`JSS COLLEGE FOR WOMEN (Autonomous)

Saraswathipuram Mysore-9

NATIONAL EDUCATION POLICY - 2020 (NEP-2020)

Model Curriculum Structure for Bachelor of Computer Applications (BCA) Programme (Basic and Honours degree),

2021-22 onwards

DEPARTMENT OF COMPUTER SCIENCE

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 after successful 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 in design 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 BDSCourses, 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

The objectives of the Programme are:

1. The primary objective of this program is to provide a foundation of computing principles and business practices for effectively using/managing information systems and enterprise software
2. It helps students analyze the requirements for system development and exposes students to business software and information systems
3. This course provides students with options to specialize in legacy application software, system software or mobile applications
4. To produce outstanding IT professionals who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem-solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

Program Outcomes: **BCA** (3 Years) **Degree**

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 analyze 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 modeling, 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.

Additional Program Outcomes: **BCA Degree** (Hons)

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 project development
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 existing problems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
5. The ability to work independently on a substantial software project and as an effective team member.

I-C. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka

Bachelor of Computer Applications (Basic/Hons.) with Computer Applications as core subject

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),		Skill Enhancement Courses (SEC)			Total Credits
					Skill based credits (L+T+P)	Value based (Credits) (L+T+P)		
I	DSC-1 (3+2) DSC-2 (3+2) DSC-3 (3)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)		SEC-1:Digital Fluency (2) (1+0+2)	Health & Wellness and Yoga (2) (0+0+4)		26
II	DSC-4 (3+2) DSC-5 (3+2) DSC-6 (3)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)	Environmental Studies (3)		NCC/NSS/R&R(S&G) / Cultural (2) (0+0+4)		27
Exit option with Certificate in Computer Applications (50 credits)								
III	DSC-7 (3+2) DSC-8 (3+2) DSC-9 (3)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs each)		SEC-2: Artificial Intelligence (2) (1+0+2)	NCC/NSS/R&R(S&G) / Cultural (2) (0+0+4)		26
IV	DSC-10 (3+2) DSC-11 (3+2) DSC-12 (3)	Constitution of India (2)	L1-4(3), L2-4(3) (4 hrs each)		SEC-3: Financial Investment and Awareness (2) (1+0+2)	NCC/NSS/R&R(S&G) / Cultural (2) (0+0+4)		26
Exit option with Diploma in Computer Applications (100 credits)								
V	DSC-13 (4+2) DSC-14 (4+2) DSC-15 (4)	DSE-1 (3) Vocational-1 (3)			SEC-4: Cyber Security(3) (3+0+0)			25
VI	DSC-16 (4+2) DSC-17 (4+2) DSC-18 (4)	DSE-2 (3) Vocational-2 (3)			SEC-4: Internship(2)			24
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (142 credits)								

Model Curriculum for BCA

Sem	DS Core Courses	Hour / Week		DS Elective Courses	Hous/ Week
		Theory	Lab		
1	i. Fundamentals of Computers ii. Programming in C iii.Mathematical Foundation/ Accountancy iv. LAB: Information Technology v. LAB: C Programming	3 3 3	 4 4		
2	i. Discrete Mathematical Structures ii. Data Structures using C iii. Object Oriented Concepts using JAVA iv. LAB: Data Structure v. LAB: JAVA Lab	3 3 3	 4 4		
3	i. Data Base Management Systems ii. C# and DOT NET Technologies iii. Computer Networks iv. LAB: DBMS v. LAB: C# and DOT NET Technologies	3 3 3	 4 4		
4	i. Python Programming ii. Computer Multimedia and Animation iii. Operating Systems Concepts iv. LAB: Multimedia and Animation v. LAB: Python programming	3 3 3	 4 4		
5	i. Internet Technologies ii. Statistical Computing and R Programming iii. Software Engineering iv. LAB: R Programming v. LAB: JAVA Script, HTML and CSS vi. Vocational 1	3 3 3 3	 4 4 	CAE: Any one from below (a) Cyber Law and Cyber Security (b) Cloud Computing (c) Business Intelligence	3 3 3
6	i. Artificial Intelligence and Applications ii. PHP and MySQL iii. Object Oriented Analysis and Design iv. LAB: PHP and MySQL v. PROJECT: vi. Vocational 2	3 3 3 3	 4 4 	CAE: Any one from below (a) Fundamentals of Data Science (b) Mobile Application Development (c) Embedded Systems	 3 3 3
7	i. Analysis and Design of Algorithms ii. Data Mining and Knowledge Management iii. LAB: Algorithms iv. LAB: Data Mining and Knowledge Management v. Vocational 3	3 3 3	 4 4 	CAE: Any one from below (a) Data Compression (b) IoT (c) Data Analytics Research Methodology	 3 3 3 3
8	i. Automata Theory and Compiler Design ii. Cryptography and Network Security iii. Compiler Lab iv. LAB: Project v. Vocational 4	3 3 3	 4 12 	CAE: Any one from below (a) Open-Source Programming (b) Storage Area Networks (c) Pattern Recognition (d) Machine Learning	3 3 3 3

TABLE I: COURSE STRUCTURE FOR BCA.

Semester	Course Code	Title of the Paper	Credit	Total Credit of OE, Languages, CAE, Voc, AECC, SEC	Total Credit
	GRA 210	Fundamentals of Computers	3		
	GRA 220	Programming in C	3		
	GRA 230(a)/(b)	Mathematical Foundation/ Accountancy	3	12	25
	GRA 210P	LAB: Information Technology	2		
I	GRA 220P	LAB: C Programming	2		
	GRB 210	Data Structures using C	3		
	GRB 220	Object Oriented Concepts using JAVA	3		
	GRB 230	Discrete Mathematical Structures	3	12	25
	GRB 210P	LAB: Data Structure	2		
II	GRB 220P	LAB: JAVA	2		
	GRC 210	Data Base Management Systems	3		
	GRC 220	C# and DOT NET Technologies	3		
	GRC 230	Computer Networks	3	12	25
	GRC 210P	LAB: DBMS	2		
III	GRC 220P	LAB: C# and DOT NET Technologies	2		
	GRD 210	Python Programming	3		
	GRD 220	Computer Multimedia and Animation	3		
	GRD 230	Operating System Concepts	3	12	25
	GRD 210P	LAB: Python programming	2		
IV	GRD 220P	LAB: Multimedia and Animation	2		
	GRE 210	Design and analysis of Algorithm	4		
	GRE 220	Statistical Computing and R Programming	4	02	22
	GRE 230	Software Engineering	4		
	GRE 210P	LAB: Design and analysis of Algorithm	2		
V	GRE 220P	LAB: R Programming	2		
	GRF 210	PHP and MySQL	3		
	GRF 220	Artificial Intelligence and Applications	3		
	GRF 230	Object Oriented Analysis and Design	3	02	21
	GRF 210P	LAB: PHP and MySQL	2		
VI	GRF 240P	Project Work	2		
	CAC19	Analysis and Design of Algorithms	3		
	CAC20	Data Mining and Knowledge Management	3		
	CAC19P	LAB: Algorithms	2	9	21
	CAC20P	LAB: Data Mining	2		
VII	CAI01	Internship	2		
	CAC21	Automata Theory and Compiler Design	3		
	CAC22	Cryptography and Network Security	3		
	CAC21P	LAB: Compiler Lab	2	6	20
VIII	CAP02	Project Work	6		

TABLE II: CS COURSE DETAILS FOR BCA

Course-Type	Course Code as referred above	Compulsory / Elective	List of compulsory courses and list of option of elective courses. (A suggestive list)
CA	GRA210, GRA220, GRA230(a)/(b), GRB210, GRB220, GRB230, GRC210, GRC220, GRC230, GRD210, GRD220, GRD230, GRE210, GRE220, GRE230, GRF210, GRF220, GRF230	Compulsory	As Mentioned in Table I
CA E	CAE-1A	Elective	Cyber Law and Cyber Security OR Business Intelligence OR Fundamentals of Data Science
	CAE-2A	Elective	Fundamentals of Data Science OR Mobile Application Development OR Embedded Systems
	CAE-3A	Elective	Data Compression OR Internet of Things (IoT) OR Data Analytics
	CAE-4A	Elective	Open-source Programming OR Storage Area Networks OR Pattern Recognition OR Machine Learning
Vocational	Vocational -1	Elective	DTP, CAD and Multimedia OR Hardware and Server Maintenance OR Web Content Management Systems OR Computer Networking OR Health Care Technologies OR Digital Marketing OR Office Automation
	Vocational -2	Elective	
	Vocational -3	Elective	
	Vocational -4	Elective	
SEC	SEC 1	Compulsory	Health & Wellness/ Social & Emotional Learning
	SEC 2	Compulsory	Sports/NCC/NSS etc
	SEC 3	Compulsory	Ethics & Self Awareness
	SEC 4	Compulsory	Professional Communication
AECC	AECC1	Compulsory	Environmental Studies
	AECC2	Compulsory	Constitution of India
Language 1	L1-1, L1-2, L1-3, L1-4	Compulsory	Kannada/Functional Kannada
Language 2	L2-1, L2-2, L2-3, L4-4	Elective	English/Hindi/French/ Additional English/ etc.

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SARASWATHIPURAM MYSURU-570009

NEP Syllabus - BCA. for 2021-22 onwards

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th IA		Pr IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th	Pr		
I	I	GRA 210	Fundamentals of Computers	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRA 220	Programming in C	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRA 230 (a)/(b)	Mathematical Foundation/ Accountancy	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRA 210P	LAB: Information Technology	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRA 220P	LAB:C Programming	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRA 240 SEC-1	Digital Fluency	1	0	2	1	0	1	05	05	10	05	25	-	1 hours	50
	II	GRB210	Data Structures using C	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRB220	Object Oriented Concepts using JAVA	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRB230	Discrete Mathematical Structures	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRB210P	LAB: Data Structure	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRB220P	LAB: JAVA	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th IA		Pr IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th	Pr		
II	III	GRC 210	Data Base Management Systems	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRC 220	C# and DOT NET Technologies	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRC230	Computer Networks	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRC 210P	LAB: DBMS	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRC220P	LAB: C# and DOT NET Technologies	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRC 250 SEC-2	SEC-2 Artificial Intelligence	1	0	2	1	0	1	5	5	10	5	25	-	1 Hours	50
	IV	GRD 210	Python Programming	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRD 220	Computer Multimedia and Animation	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRD 230	Operating System Concepts	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRD210P	LAB: Python programming	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRD 220P	LAB: Multimedia and Animation	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50

Year	Sem	Corse Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th IA		Pr IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th	Pr		
III	V	GRE 210	Design and Analysis of Algorithm	4	0	0	4	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRE 220	Statistical Computing and R Programming	4	0	0	4	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRE 230	Software Engineering	4	0	0	4	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRE 210P	LAB: Design and Analysis of Algorithm	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRE 220P	LAB: R Programming	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRE 240 Elective-1	Cloud Computing OR Business Intelligence	3	0	0	3	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRE250 VOC-1	Vocational 1:Digital Marketing	3	0	0	3	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRE300 SEC-3	SEC-3 Cyber Security/ Employability	2	0	2	2	0	1	20	20	-	-	60	-	$2^1/_2$ Hours	100
	VI	GRF210	Artificial Intelligence and Applications	4	0	0	4	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRF210P	Artificial Intelligence Lab	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRF220	PHP and MySQL	4	0	0	4	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRF220P	LAB: PHP and MySQL	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRF230P	LAB: Project Work	0	0	8	0	0	4	-	-	20	20	-	60	3 Hours	100
		GRF240 Elective-2	Fundamentals of Data Science OR Mobile Application Development	3	0	0	3	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRF250 VOC-2	Vocational-2: Web Content Management System	3	0	0	3	0	0	20	20	-	-	60	-	$2^1/_2$ Hours	100
		GRF300	Internship	2	0	2	2	0	1	20	20	-	-	60	-	$2^1/_2$ Hours	100

Year	Sem	Corse Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th IA		Pr IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th	Pr		
IV	VII	CAC19	Analysis and Design of Algorithms	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAC20	Data Mining and Knowledge Management	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAC19P	LAB: Algorithms	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		CAC20P	LAB: Data Mining	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		CAE-3A	Data Compression OR IoT OR Data Analytics	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAI01	Internship	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		VOC	Vocational-3	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
	VIII	CAC21	Automata Theory and Compiler Design	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAC22	Cryptography and Network Security	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAC21P	LAB: Compiler Lab	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		CAE-4A	Open-source Programming OR Storage Area Networks OR Pattern Recognition OR Machine Learning	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAP02	Project Work	0	0	12	0	0	6	-	-	20	20	-	60	3 Hours	100
		VOC	Vocational-4	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100

Model Course Content for BCA

BCA Semester: I

DSC-1 Course Code: GRA 210	**Course Title:** Fundamentals of Computers
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks:60	Exam Duration: 2 $^1/_2$ hours

Course Outcomes (COs):

• Introduction to computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers

• Operating systems, functions of operating systems, classification of operating systems, kernel, shell, basics of Unix, shell programming, booting

• Databases, why databases are used, users, SQL, data types in SQL, introduction of queries - select, alter, update, delete, truncate, using where, and or in not in

• Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching

• Web Programming basics, introduction of HTML and CSS programming

• Introduction of computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers.

Course Content

Content	**Hours**
Unit - 1	
Fundamentals of Computers: 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. **Introduction to computers:** Characteristics of computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Super computers.	14
Unit-2	
Anatomy of Computer: Introduction, Functions & Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works. Program execution with illustrative examples. Introduction to microcontrollers. **Operating System Fundamentals :** Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands, Microkernel Based Operating System, Booting.	14

Unit-3	
Introduction to Database Management Systems: Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL **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, HTML5, CSS	14

Text Books:

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication

2. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman & Hall/CRC,

Reference:

1. J. Glenn Brook shear," Computer Science: An Overview", Addision-Wesley, Twelfth Edition,

2. R.G. Dromey, "How to solve it by Computer", PHI,

Course Code: **GRA 210P**	**Course Title: Information Technology Lab**
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03 hours

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.

4. LAN and Wi-Fi Basics.

5. Operating System Installation – Windows OS, UNIX/LINUX, Dual Booting.

6. 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,

7. System Configuration – BIOS Settings, Registry Editor, MS Config, Task Manager, System Maintenance, Third-party System Maintenance Tools (Similar to CCleaner and Jv16 PowerTools …)

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.

NOTE: In addition to the ones listed above, universities can include other activities so as for the student to become proficient in using personal computers for multiple purposes for which modern computers can be put to use.

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 Lab Examination

Assessment Criteria		**Marks**
Activity – 1 from Part A	Write up on the activity/ task	5
	Demonstration of the activity/ task	5
Activity-2 from Part B	Write up on the activity/ task	5
	Demonstration of the activity/ task	5
Viva Voice based on Lab Activities		05
Total		**25**

BCA Semester I

DSC-2 Course Code: GRA 220	Course Title: Programming in C
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 2 $^1/_2$ hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Course Content

Content	Hours
Unit - 1	
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 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.	14
Unit - 2	
Control Structures: Decision making Statements - S*imple 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. **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.	14
Unit - 3	
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;	14

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.	

Text Books:

1. C: The Complete Reference, By Herbert Schildt.
2. C Programming Language, By Brain W. Kernighan
3. Kernighan & Ritchie: The C Programming Language (PHI)

Reference Books:

1. P. K. Sinha & Priti Sinha: Computer Fundamentals (BPB)
2. E. Balaguruswamy: Programming in ANSI C (TMH)
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
4. V. Rajaraman: Programming in C (PHI – EEE)
5. S. Byron Gottfried: Programming with C (TMH)
6. Yashwant Kanitkar: Let us C
7. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: GRA 220P	**Course Title: C Programming Lab**
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks:25
Exam Marks: 25	Exam Duration: 03 hours

Programming Lab

Part A:

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 check for prime
5. Program to generate n primes
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 else-if ladder)
9. Program to find the roots of quadratic equation (demonstration of switch Case statement)
10. Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
11. Program to remove Duplicate Element in a single dimensional Array
12. Program to perform addition and subtraction of Matrices

Part B:

1. Program to find the length of a string without using built in function
2. Program to demonstrate string functions.
3. Program to demonstrate pointers in C
4. Program to check a number for prime by defining isprime( ) function
5. Program to read, display and to find the trace of a square matrix
6. Program to read, display and add two m x n matrices using functions
7. Program to read, display and multiply two m x n matrices using functions

8. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Program to Reverse a String using Pointer
10. Program to Swap Two Numbers using Pointers
11. Program to demonstrate student structure to read & display records of n students.
12. 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	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on Lab Activities		05
Total		**25**

BCA Semester I

DSC-3 Course Code: GRA 230(a)	**Course Title:** Mathematical Foundation
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 2 $^{1}/_{2}$ hours

Course Outcomes (COs):

- Study and solve problems related to connectives, predicates and quantifiers under different situations.
- Develop basic knowledge of matrices and to solve equations using Cramer's rule.
- Know the concept of Eigen values.
- To develop the knowledge about derivatives and know various applications of differentiation.
- Understand the basic concepts of Mathematical reasoning, set and functions

Content	**Hours**
Unit - 1	
Basic concepts of set theory: Mathematical logic introduction-statements Connectives-negation, conjunction, disjunction- statement formulas and truth tables- conditional and bi Conditional statements- tautology contradiction-equivalence of formulas-duality law-Predicates and Quantifiers, Arguments.	14
Unit - 2	
Operations on sets: power set- Venn diagram Cartesian product-relations - functions- types of functions - composition of functions. **Matrix algebra:** Introduction-Types of matrices-matrix operations- transpose of a matrix -determinant of matrix - inverse of a matrix- Cramer's rule	14
Unit - 3	
Matrix: finding rank of a matrix - normal form-echelon form cayley Hamilton theorem-Eigen values **Differential calculus:** Functions and limits - Simple Differentiation of Algebraic Functions – Evaluation of First and Second Order Derivatives – Maxima and Minima	14

Text Books:

P. R. Vittal-Business Mathematics and Statistics, Margham Publications, Chennai,

Reference Books:

B. S. Vatsa-Discrete Mathematics –New Age International Limited Publishers, New Delhi

DSC-3 Course Code: GRA 230(b)	**Course Title:** Accountancy
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 2 $^1/_2$ hours

Course Outcomes (COs):

- Study and understand Accounting, systems of Book, Branches of accounting advantage and limitations
- Know the concept of accounting, financial accounting process and Journalization
- Maintenance different account book and reconciliations
- Preparations of different bills, and trial balance.
- Understand the basic concepts of Mathematical reasoning, set and functions

Content	**Hours**
Unit - 1	
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 **Accounting Concepts and Convention:** Meaning, need and classification, accounting standards meaning, need and classification of Indian accounting standards. Accounting principles V/s accounting standard	14
Unit - 2	
Financial Accounting Process: Classification of accounting transactions and accounts, rules of debit and credit as per Double Entry System. Journalization and Ledger posting. **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.	14
Unit - 3	
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.	14

Text Books:

1. S. Ramesh, B.S. Chandrashekar, A Text Book of Accountancy.
2. V.A. Patil and J.S. Korihalli, Book – keeping and accounting, (R. Chand and Co. Delhi).
3. R. S. Singhal, Principles of Accountancy, (Nageen Prakash pvt. Lit. Meerut).
4. M. B. Kadkol, Book – Keeping and Accountancy, (Renuka Prakashan, Hubil)
5. Vithal, Sharma:Accounting for Management, Macmillan Publishers, Mumbai.

Reference Books:

1. B.S. Raman, Accountancy, (United Publishers, Mangalore).
2. Tulsian, Accouning and Finacial Management – I: Financial Accounting – Person Education.

BCA Semester: II

DSC-4 Course Code: GRB 210	**Course Title: Data Structures using C**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 2 $^{1}/_{2}$ Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

Course Content

Content	**Hours**
Unit - 1	
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.* Algorithm Specification, Performance Analysis, Performance Measurement Recursion: Definition; Types of recursions; Recursion Technique Examples - GCD, Binomial coefficient $_{n}C_{r}$, Towers of Hanoi; Comparison between iterative and recursive functions. **Arrays:** Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory;	14
Unit - 2	
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; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices. **Linked list**: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly liked list, Header liked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection,	14

Unit - 3	
Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; 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; **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, inorder and postorder traversal;	14

Text Books

1. Ellis Horowitz and Sartaj Sahni: Fundamentals of Data Structures

References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Kottur: Data Structure Using C
5. Padma Reddy: Data Structure Using C
6. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007))

Course Code: GRB 210P	**Course Title: Data Structures Lab**
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03 Hours

Programming Lab

Part A:

1. Program to find GCD using recursive function
2. Program to display Pascal Triangle using binomial function
3. Program to generate n Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi.
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 search an element using linear search technique
8. Program to search an element using binary search technique
9. Program to sort the given list using bubble sort technique.
10. Program to sort the given list using selection sort technique.

Part B:

1. Program to sort the given list using insertion sort technique.
2. Program to sort the given list using merge sort technique.
3. Program to sort the given list using quick sort technique.
4. Program to implement Stack. (Using Linked List)
5. Program to implement simple queue. (Using Linked List)
6. Program to implement Circular Queue. (Using Linked List)
7. Program to implement Search an Element in linear linked list.
8. Program to implement Doubly linked list
9. Program to display traversal of a tree.

Evaluation Scheme for Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
Total		**25**

BCA Semester II

DSC-5 Course Code: GRB 220	**Course Title: Object Oriented Concepts using JAVA**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: $2^1/_2$ Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the features of Java and the architecture of JVM
- Write, compile, and execute Java programs that may include basic data types and control flow constructs and how type casting is done
- Identify classes, objects, members of a class and relationships among them needed for a specific problem and demonstrate the concepts of polymorphism and inheritance
- 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
- Write, compile, execute Java programs that include GUIs and event driven programming and also programs based on files

Course Content

Content	**Hours**
Unit - 1	
Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Arrays in java. **Objects and Classes:** Basics of objects and classes in java, Constructors, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, this reference.	14
Unit - 2	
Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java. **Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box,	14
Unit - 3	
Applets: Applet and its life cycle, Exceptional handling mechanism. **I/O programming:** Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. **Multithreading in java:** Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally.	14

Text Books

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited.
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall

3. Object Oriented Programming with Java : Somashekara, M.T., Guru, D.S., Manjunatha, K.S

Reference Books:

1. Java 2 - The Complete Reference – McGraw Hill publication.
2. Java - The Complete Reference, 7th Edition, By Herbert Schildt– McGraw Hill publication.

Course Code: GRB 220 **P**	**Course Title:** JAVA Lab
Course Credits: 02	Hours/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Implement Object Oriented programming concept using basic syntaxes of control Structures
- Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
- Demonstrates how to achieve reusability using inheritance
- Demonstrate understanding and use of interfaces, packages, different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
- Identify and describe common user interface components to design GUI in Java using Applet & AWT along with response to events

Practice Lab

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.

Programming Lab

PART A: 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 add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.

4. 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 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.

5. 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.

6. Program

a. To find the area and circumference of the circle by accepting the radius from the user.

b. To accept a number and find whether the number is Prime or not

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 pass 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. In a college first year class are having the following attributes Name of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class

9. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class

10. Program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.

11. Create a package 'student. Fulltime. BCA 'in your current working directory

a. Create a default class student in the above package with the following attributes: Name, age, sex.

b. Have methods for storing as well as displaying

PART B: Exception Handling & GUI Programming

1. Program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.

2. Program to handle Null Pointer Exception and use the "finally" method to display a message to the user.

3. Program which create and displays a message on the window

4. Program to draw several shapes in the created window

5. Program to create an applet and draw grid lines

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 similar details of mother also appear.

7. Create a frame which displays your personal details with respect to a button click

8. Create a simple applet which reveals the personal information of yours.

9. Program to move different shapes according to the arrow key pressed.

10. Program to create a window when we press M or m the window displays Good Morning, A or a the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night

11. Demonstrate the various mouse handling events using suitable example.

12. 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 Lab Examination

Assessment Criteria		**Marks**
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on **Object Oriented Programming with JAVA**		05
Total		**25**

BCA Semester II

DSC-6 Course Code: GRB230	**Course Title: Discrete Mathematical Structures**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 2 $^1/_2$ hrs

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- To understand the basic concepts of Mathematical reasoning, set and functions.
- To understand various counting techniques and principle of inclusion and exclusions.
- Understand the concepts of various types of relations, partial ordering and
- equivalence relations.
- Apply the concepts of generating functions to solve the recurrence relations.
- Familiarize the fundamental concepts of graph theory and shortest path algorithm

Course Content

Content	**Hours**
Unit - 1	
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.	14
Unit - 2	
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. **Induction and Recursion**: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Corrections.	14
Unit - 3	
Relation: Properties of relation, Composition of relation, Closer operation on relation, Equivalence relation and partition. Operation on relation, Representing relation. **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.	14

Text Book:

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012.

References:

2. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003.
3. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI 1986.
4. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
5. Discrete Mathematical Structures, Trembley and Manobar.

BCA: Semester III

DSC-7 Course code: GRC210	Course Title: Database Management Systems
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
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.

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. **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.	14
2	**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 **Relational Algebra:** Basic Relational Algebra operations. Set theoretical operations on relations. JOIN operations Aggregate Functions and Grouping. Nested Sub Queries-Views.	14
3	**Data Normalization:** Anomalies in relational database design. Decomposition. Functional dependencies – Axioms, minima and maxima cover. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form. **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.	14

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, 3 rd Edition, McGraw Hill, 2002

Course code: GRC 210P	Course Title: DBMS Lab
Total Contact Hours: 52	Hours/week : 04
Formative Assessment Marks: 25	Course Credits: 02
Exam Marks: 25	Duration of Exam: 03 Hours

Course Outcomes (COs):

Student would be able to create tables, execute queries

- Execute a single line query and group functions.
- Execute DDL Commands.
- Execute DML Commands
- Execute DCL and TCL Commands. 5. Implement the Nested Queries.
- Implement Join operations in SQL
- Create views for a particular table
- Implement Locks for a particular table

Activity 1:

Database: Student (DDL, DML Statements)

Table: Student

Name	**RegNo**	**Class**		**Major**
Smith	17	1		CS
Brown	8	2		CS

Table: Course

CourseName	**CourseNumber**	**CreditHours**	**Department**
Introduction to Computer Science	CS1310	4	CS
Data Structure	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database Management Systems	CS3380	3	CS

Table: Section

Section_Identifier	CourseNumber	Year	Instructor
85	MATH2410	98	King
92	CS1310	98	Andreson
102	CS3320	99	Knuth
112	MATH2410	99	Chang
119	CS1310	99	Andreson
135	CS3380	99	Stone

Table: Grade_Report

RegNo	Section_Identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

Create Tables using create statement
Insert rows to individual tables using insert statement
Alter table section add new field section and update the records
Delete brown's grade report
Drop the table section

Activity 2: (Select clause, Arithmetic Operators)
Database: Employee
Create Following tables and insert tuples with suitable constraints
Table: Employee

Emp_Id	First_Name	Last_Name	Hire_Date	Address	City
1001	George	Smith	11-May-06	83 first street	Paris
1002	Mary	Jones	25-Feb-08	842 Vine Ave	Losantiville
1012	Sam	Tones	12-Sep-05	33 Elm St.	Paris
1015	Peter	Thompson	19-Dec-06	11 Red Road	Paris
1016	Sarath	Sharma	22-Aug-07	440 MG Road	New Delhi
1020	Monika	Gupta	07-Jun-08	9 Bandra	Mumbai

Table: Empsalary

Emp_Id	Salary	Benefits	Designation
1001	10000	3000	Manager
1002	8000	1200	Salesman
1012	20000	5000	Director
1015	6500	1300	Clerk
1016	6000	1000	Clerk
1020	8000	1200	Salesman

Write queries for the following

1. To display FIRSTNAME, LASTNAME, ADDRESS AND CITY of all employees living in PARIS.
2. To display the content of employee table in descending order of FIRSTNAME
3. Select FIRSTNAME and SALARY of salesman
4. To display the FIRSTNAME, LASTNAME, AND TOTAL SALARY of all employees from the table EMPLOYEE and EMPSALARY. Where TOTAL SALARY is calculated as SALARY+BENEFITS

5. List the Names of employees, who are more than 1 year old in the organization
6. Count number of distinct DESINGATION from EMPSALARY
7. List the employees whose names have exactly 6 characters
8. Add new column PHONE_NO to EMPLOYEE and update the records
9. List employee names, who have joined before 15-Jun-08 and after 16-Jun-07
10. Generate Salary slip with Name, Salary, Benefits, HRA-50%, DA-30%, PF-12%, Calculate gross. Order the result in descending order of the gross.

Activity 3: (Logical, Relational Operators)

Database: Library

Create Following **tables** and insert **tuples** with suitable constraints

Table: Books

Book_Id	Book_Name	Author_Name	Publishers	Price	Type	Quantity
C0001	The Klone and I	Lata Kappor	EPP	355	Novel	5
F0001	The Tears	William Hopkins	First Publ	650	Fiction	20
T0001	My First C++	Brain & Brooke	ERP	350	Text	10
T0002	C++ Brainwork‟s	A.W.Rossaine	TDH	350	Text	15
F0002	Thunderbolts	Ana Roberts	First Publ.	750	Fiction	50

Table: Issued

Book_ID	Quantity_issued
T0001	4
C0001	5
F0001	2
T0002	5
F0002	8

Write queries for the following

1. To show Book name, Author name and price of books of **First Publ**. publisher
2. Display Book id, Book name and publisher of books having quantity more than 8 and price less than 500
3. Select Book id, book name, author name of books which is published by other than ERP publishers and price between 300 to 700
4. Generate a Bill with Book_id, Book_name, Publisher, Price, Quantity, 4% of VAT "Total"
5. Display book details with book id‟s C0001, F0001, T0002, F0002 (Hint: use IN operator)
6. Display Book list other than, type Novel and Fiction
7. Display book details with author name starts with letter „A‟
8. Display book details with author name starts with letter „T‟ and ends with „S‟
9. Select Book_Id, Book_Name, Author Name , Quantity Issued where Books.Books_Id = Issued.Book_Id

10. List the book_name, Author_name, Price. In ascending order of Book_name and then on descending order of price

Activity 4: (Date Functions)
Database: Lab
Create Following **table** and insert **tuples** with suitable constraints
Table: Equipment_Details

No.	ItemName	Costperitem	Quantity	Dateofpurchase	Warranty	Operational
1	Computer	30000	9	21/5/07	2	7
2	Printer	5000	3	21/5/06	4	2
3	Scanner	8000	1	29/8/08	3	1
4	Camera	7000	2	13/6/05	1	2
5	UPS	15000	5	21/5/08	1	4
6	Hub	8000	1	31/10/08	2	1
7	Plotter	25000	2	11/1/09	2	2

(Use date functions and aggregate functions)

1. To select the ItemName purchase after 31/10/07
2. Extend the warranty of each item by 6 months
3. Display ItemName , Dateof purchase and number of months between purchase date and present date
4. To list the ItemName in ascending order of the date of purchase where quantity is more than 3.
5. To count the number, average of costperitem of items purchased before 1/1/08
6. To display the minimum warranty , maximum warranty period
7. To Display the day of the date , month , year of purchase in characters
8. To round of the warranty period to month and year format.
9. To display the next Sunday from the date "07-JUN-96"
10. To list the ItemName, which are within the warranty period till present date

Activity 5: (Numeric, character functions)
Use Functions for the following

1. Find the mod of 165,16
2. Find Square Root of 5000
3. Truncate the value 128.3285 to 2 and -1 decimal places
4. Round the value 92.7683 to 2 and -1 decimal places
5. Convert the string „Department" to uppercase and lowercase
6. Display your address convert the first character of each word to uppercase and rest are in lowercase
7. Combine your first name and last name under the title Full name
8. A) Take a string length maximum of 15 displays your name to the left. The remaining space should be filled with „*"
9. Take a string length maximum of 20 displays your name to the right. The remaining space should be filled with „#"
10. Find the length of the string „JSS College, Mysore"
11. Display substring „BASE" from „DATABASE"
12. Display the position of the first occurrence of character „o" in Position and Length

13. Replace string Database with Data type
14. Display the ASCII value of „ „ (Space)
15. Display the Character equivalent of 42

Activity 6:

Database: Subject

Create Following **table** and insert **tuples** with suitable constraints

Table - Physics

Regno	Name	Year	Combination
AJ00325	Ashwin	First	PCM
AJ00225	Swaroop	Second	PMCs
AJ00385	Sarika	Third	PME
AJ00388	Hamsa	First	PMCs

Table – Computer Science

Regno	Name	Year	Combination
AJ00225	Swaroop	Second	PMCs
AJ00296	Tajas	Second	BCA
AJ00112	Geetha	First	BCA
AJ00388	Hamsa	First	PMCs

1. Select all students from physics and Computer Science
2. Select student common in physics and Computer Science
3. Display all student details those are studying in second year
4. Display student those who are studying both physics and computer science in second year
5. Display the students studying only physics
6. Display the students studying only Computer Science
7. select all student having PMCs combination
8. select all student having BDSCombination
9. select all student studying in Third year
10. Rename table Computer Science to CS

Activity 7: (views)

Database: Railway Reservation System

Create Following **table** and insert **tuples** with suitable constraints

Table: Train Details

Train_No	Train_Name	Start_Place	Destination
RJD16	Rajdhani Express	Bangalore	Mumbai
UDE04	Udhyan Express	Chennai	Hyderabad
KKE55	Karnataka Express	Bangalore	Chennai
CSE3	Shivaji Express	Coimbatore	Bangalore
JNS8	Janashatabdi	Bangalore	Salem

Table: Availability

Train_No	Class	Start_Place	Destination	No_of_seats
RJD16	Sleeper Class	Bangalore	Mumbai	15
UDE04	First Class	Chennai	Hyderabad	22

KKE55	First Class AC	Bangalore	Chennai	15
CSE3	Second Class	Coimbatore	Bangalore	8
JNS8	Sleeper Class	Bangalore	Salem	18

1. Create view **sleeper** to display train no, start place, destination which have sleeper class and perform the following
    a. insert new record
    b. update destination="Manglore" where train no="RJD16"
    c. delete a record which have train no="KKE55"
2. Create view **details** to display train no, train name, class
3. Create view **total_seats** to display train number, start place, use count function to no of seats , group by start place and perform the following
    a. insert new record
    b. update start place="Hubli" where train no="JNS8"
    c. delete last row of the view
4. Rename view sleeper to class
5. Delete view details

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester III

DSC-8 Course code: GRC 220	Course Title: C# and .Net Technologies
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^{1}/_{2}$ hrs
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#.

Unit	Description	Hours
1	**Introduction to C#:** Understanding C# environment Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Decision making and branching, Decision making and looping, Methods in C#, Handling Arrays, Manipulating Strings. Structures, Enumerations.	14
2	**OOPS with C#:** Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading Delegates, Events, Errors and Exceptions. multithreading in C#	14
3	**Windows Forms:** Control class, Standard controls and components (check box, radio button, comboBox, ListBox, Checked List Box, Label, Listview, picture box, textbox, rich text box, panel, flow layout panel and table lay out panel, tool strip, menu strip. **ADO .NET Connectivity:** Introduction to ADO.NET, ADO vs ADO.NET. Architecture: Data reader, Data adopter, Accessing Data with ADO.NET. Programming Web Applications with Web Forms. ASP .NET applications with ADO.NET	14

References:

1. 1."Programming in C#", E. Balagurusamy, 4th Edition, Tata McGraw-Hill, 2017.
2. 2.“Visual Basic.NET”, Shirish Chavan, 3rd Edition, Pearson Education, 2009.
3. 3.“ASP.NET and VB.NET Web Programming”, Matt J. Crouch, Edition 2012.
4. 4."Computing with C# and the .NET Framework", Arthur Gittleman, 2nd Edition, Jones & Bartlett Publishers, 2011

Course code: GRC 220P	Course Title: C# and .Net Technologies Lab
Total Contact Hours: 52	Hours/week : 04
Formative Assessment Marks: 25	Course Credits: 02
Exam Marks: 25	Duration of Exam: 03 Hours

Practical:

1. Develop a C# .NET console application to demonstrate the conditional statements.
2. Develop a C# .NET console application to demonstrate the control statements.
3. Console application to achieve multiple inheritances using interface
4. Console application to create user defined exception
5. Demonstrate Multithreaded Programming in C#.NET
6. Develop Windows application for Employee Pay-roll transactions in C#.NET
7. Design a calculator using windows application
8. Design a window application using check box and option button
9. Design a window application using list box and combo box
10. Design a window application using picture box.
11. Design a window application for edit menu and change the size of the font using menu strip and tool strip
12. design a window application to Display Content in a Multitabbed User Interface
13. Develop a Windows application with database connectivity for core-banking transactions
14. Develop a web application in C#.NET for dynamic Login Processing
15. Design a web application for online ticket booking using click event.

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester III

DSC-9 Course code: GRC 230	Course Title: Computer Networks
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^{1}/_{2}$ hrs
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.

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. **The Physical Layer:** Transmission Media – Twisted pair, coaxial cable, optical fiber, radio transmission, microwaves and infrared transmission, Switching – message switching, Multiplexing.	14
2	**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 **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.	14
3	**The Transport Layer, Presentation Layer and Application Layer:** Elements of Transport service, Elements of Transport, protocols, Internet transport protocols (TCP & UDP), Presentation Layer – Introduction, protocol, Application Layer DNS, Electronic Mailing, and World Wide Web.	14

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

BCA Semester IV

DSC-10 Course code: GRD 210	Course Title: Python Programming
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
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.

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. **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.	14
2	**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. **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 on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods **File Handling:** File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator.	14

3	**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. **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.	14

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

Course code: GRD210P	Course Title: Python Programming Lab
Total Contact Hours: 52	Hours/week : 04
Formative Assessment Marks: 25	Course Credits: 02
Exam Marks: 25	Duration of Exam: 03 Hours

Programs for Practical Component:

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 DataFramefrom Excel sheet using Pandas and Perform Operations on DataFrames

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester IV

DSC-11 Course code: GRD220	Course Title: Computer Multimedia and Animation
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^{1}/_{2}$ hrs
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.

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. Introduction to Animation: Definition, The Start and End States, Interpolation, Animations in HTML.	14
2	CSS Animations, Creating a Simple Animation, CSS Animation Property, Keyframes, Declaring Multiple Animations, Wrap-up. CSS Transitions, Adding a Transition, Transitions in Detail, The Longhand Properties, Longhand Properties vs. Shorthand Properties, Working with Multiple Transitions. 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.	14
3	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, 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.	14

References:

1. The Complete Reference HTML and CSS, 5th Edition, Thomas A Powell, 2017
2. Animation in HTML, CSS, and JavaScript, Kirupa Chinnathambi, 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/

Course code: GRD 220P	Course Title: Multimedia Animation L ab
Total Contact Hours: 52	Course Credits: 02
Formative Assessment Marks: 25	Duration of SEE/Exam: 03 Hours
Summative Assessment Marks: 25	

List of Lab programs

Part-A

1. Write an HTML program tocreate and display navigations menus using list tags and anchor tag
2. Write an HTML program to display Multi-mediadata (text, images, audios, videos, gifs, etc) on a webpage
3. Write an HTML program to create student Registrations form on submitting the form check whether fields are empty or not using JavaScript. If any fields are empty display an error message
4. Write an HTML program to create bio-data(CV or Resume) and to change the following CSS properties
   Font, Text, Background,
5. Write an HTML program to create div and apply the following CSS properties on created div
   Margin, Padding, Border, Box shadow
6. Write an HTML program to create a box and using CSS transform and transition properties move the box to the center of the web page on loading web-page
7. Write an HTML program to create a circle and create an animation of bouncing of the circle for 10 sec
8. Write an HTML program to create page loading animations

Part-B

1. Write an HTML program to draw line, polyline and rectangle and fill rectangle with red color using svg tag.
2. Write an HTML program to draw star and multiple circle and with different color using svg tag
1. Write an HTML program to create logo with linear gradient properties using svg tag.
2. Write an HTML program to draw Square and Rectangle using canvas tag and JavaScript
3. Write an HTML program to draw bezier curve using canvas tag and JavaScript
4. Write an HTML Program to import an external image into a canvas and then to draw on that image
5. Write an HTML program to draw a rectangle box using canvas and to change background color to red, scale of the rectangle to 2 on move-over (hover)properties.
6. Write an html program to draw a circle using canvas and to apply the rotations animations on loading the page

Evaluation Scheme for Lab Examination:

Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester IV

DSC-12 Course code: GRD230	Course Title: Operating System Concepts
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
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.

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; **CPU Scheduling**: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling; Multiprocessor Scheduling; Real-Time CPU Scheduling.	14
2	**Multithreaded Programming**: Introduction to Threads; Types of Threads; Multithreading- Definition, Advantages; Multithreading Models; Thread Libraries; Threading Issues. **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.	14
3	**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. **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	14

References:

1. Operating System Concepts, Silberschatz‟ et al., 10thEdition, 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.

BCA: Semester V

DSC-13 Course code: GRE210	Course Title: Design and Analysis of Algorithm
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):
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 and 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

Unit	Contents	52 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, Bestcase and Average-case efficiencies. Asymptotic Notations and Basic Efficiency classes, Informal Introduction, O-notation, Ω-notation, θ-notation,	13
Unit 2	Mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms. 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	13
Unit 3	Decrease-and-Conquer: Introduction, Insertion Sort, Topological Sorting Divide-and-Conquer: Introduction, Merge Sort, Quick Sort, Binary Search, Binary Tree traversals and related properties.	13
Unit 4	Greedy Technique: Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Lower-Bound Arguments, Decision Trees, P Problems, NP Problems, NPComplete Problems, Challenges of Numerical Algorithms.	13

References:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009, Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)
5. 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 code: GRE210P	Course Title: Design and Analysis of Algorithm Lab
Total Contact Hours: 52-4hrs/week	Course Credits: 02
Formative Assessment Marks: 25	Duration of SEE/Exam: 03 Hours
Summative Assessment Marks: 25	

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 program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
4. Write a program to perform Knapsack Problem using Greedy Solution
5. Write program to implement the DFS and 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. Ex: Quick sort algorithm for sorting list of integers in ascending order.
8. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.
9. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort.
10. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort.
11. Write C program that accepts the vertices and edges for a graph and stores it as an adjacency matrix.
12. Implement function to print In-Degree, Out-Degree and to display that adjacency matrix.
13. Write program to implement backtracking algorithm for solving problems like N queens.
14. Write a program to implement the backtracking algorithm for the sum of subsets problem
15. Write program to implement greedy algorithm for job sequencing with deadlines.
16. Write program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
17. Write a program that implements Prim's algorithm to generate minimum cost spanning Tree.
18. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree.

Evaluation Scheme for Lab Examination: Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester V

DSC-14 Course code: GRE220	Course Title: Statistical Computing & R Programming
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

- Explore fundamentals of statistical analysis in R environment.
- Describe key terminologies, concepts and techniques employed in Statistical Analysis. Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
- Understand, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

Unit	Contents	52 Hrs
Unit 1	Introduction of the language, numeric, arithmetic, assignment, and vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Basic Plotting. Reading and writing files, Programming, Calling Functions, Conditions and Loops: stand- alone statement with illustrations in exercise 10.1,stacking statements, coding loops	13
Unit 2	Writing Functions, Exceptions, Timings, and Visibility. Statistics And Probability, basic data visualisation, probability, common probability distributions: common probability mass functions, bernoulli, binomial, poisson distributions, common probability density functions, uniform, normal, student's t-Distribution.	13
Unit 3	Statistical testing and modelling, sampling distributions, hypothesis testing, components of hypothesis test, testing means, testing proportions, testing categorical variables, errors and power, Analysis of variance.	13
Unit 4	Simple linear regression, multiple linear regression, 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.	13

References:

1. Tilman M. Davies, "The book of R: A first course in programming and ststistics", San Francisco, 2016.
2. Vishwas R. Pawgi, "Statistical computing using R software", Nirali prakashan publisher, e1 edition, 2022.

https://www.youtube.com/watch?v=KlsYCECWEWE
https://www.geeksforgeeks.org/r-tutorial/
https://www.tutorialspoint.com/r/index.htm

Course code: GRE220P	Course Title: R Programming Lab

Total Contact Hours: 52-4hrs/week	Course Credits: 02
Formative Assessment Marks: 25	Duration of SEE/Exam: 03 Hours
Summative Assessment Marks: 25	

Overview

The following program problematic comprises of R programming basics and application of several Statistical Techniques using it. The module aims to provide exposure in terms of Statistical Analysis, Hypothesis Testing, Regression and Correlation using R programming language.

Learning Objectives

The objective of this Laboratory to make students exercise the fundamentals of statistical analysis in R environment. They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics. Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.

Course Outcomes:

- Install, Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames. Explore fundamentals of statistical analysis in R environment.
- Describe key terminologies, concepts and techniques employed in Statistical Analysis.
- Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
- Understand, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

1. Write a R program for different types of data structures in R.
2. Write a R program that include variables, constants and data types.
3. Write a R program that include different operators, control structures, default values for arguments, returning complex objects.
4. Write a R program for quick sort implementation, binary search tree.
5. Write a R program for calculating cumulative sums, and products minima maxima and calculus.
6. Write a R program for finding stationary distribution of markanov chains.
7. Write a R program that include linear algebra operations on vectors and matrices.
8. Write a R program for any visual representation of an object with creating graphs using graphic functions: Plot(),Hist(),Linechart(),Pie(),Boxplot(),Scatterplots().
9. Write a R program for with any dataset containing data frame objects, indexing and subsetting data frames, and employ manipulating and analysing data.
10. Write a program to create an application of Linear Regression in multivariate context for predictive purpose.

Evaluation Scheme for Lab Examination: Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester V

DSC-15 Course code: GRE230	Course Title: Software Engineering
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

- How to apply the software engineering lifecycle by demonstrating competence in Communication, planning, analysis, design, construction, and deployment
- An ability to work in one or more significant application domains
- Work as an individual and as part of a multidisciplinary team to develop and deliver quality Software
- Demonstrate an understanding of and apply current theories, models and techniques that provide a basis for the software lifecycle
- Demonstrate an ability to use the techniques and tools necessary for engineering practice

Unit	Contents	52 Hrs
Unit 1	**OVERVIEW:** Introduction; Software engineering ethics; Software process models; Process activities; Coping with change; Agile software development: Agile methods; Plan- driven and agile development. **REQUIREMENTS ENGINEERING:** Functional and non-functional requirements; Software requirements document; Requirement's specification; Requirements engineering processes; Requirement's elicitation and analysis; Requirement's validation; Requirements management	13
Unit 2	**SYSTEM MODELING:** Context models; Interaction models- Use case modeling, Sequence diagrams; Structural models- Class diagrams, Generalization, Aggregation; Behavioral models- Data-driven modeling, Event-driven modeling; Model-driven engineering.	13
Unit 3	**ARCHITECTURAL DESIGN:** Architectural design decisions; Architectural views; Architectural patterns- Layered architecture, Repository architecture, Client–server architecture Pipe and filter architecture.	13
Unit 4	**DESIGN AND IMPLEMENTATION**: Object-oriented design using the UML- System context and interactions, Architectural design, Object class identification, Design models, Interface specification; Design patterns; Implementation issues. **SOFTWARE TESTING:** Development testing- Unit testing, Choosing unit test cases, Component testing, System testing. Test-driven development; Release testing; User testing- Alpha, Beta, Acceptance testing.	13

Text Book:

Ian Somerville, "Software Engineering" 8th Edition, Pearson Education, 2009.

Reference Books:

1. Waman S Jawadekar, "Software Engineering Principles and Practice", Tata McGrawHill, 2004.
2. Roger S. Pressman, "A Practitioners Approach",7th Edition, McGraw-Hill, 2007.
3. P Jalote, "An Integrated Approach to software Engineering", Narosa Publication.

BCA: Semester V

DSE-E1 Course code: GRE240	Course Title: Cloud Computing
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
Summative Assessment Marks: 60	

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

- 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.
- Apply the fundamental concepts in data center to understand the trade-offs in power, efficiency and cost.
- Identify resource management fundamentals like resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
- Analyse various cloud programming models and apply them to solve problems on the cloud

Unit	**Contents**	**42 Hrs**
Unit 1	**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. **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.	14
Unit 2	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. **Cloud Application Programming and the Aneka Platform:** Aneka Cloud Application Platform- Framework Overview, Anatomy of the Aneka Container; Building Aneka Clouds (Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode); Cloud Programming and Management- Aneka SDK (Application Model and Service Model); Management Tools (Infrastructure, Platform and Application management).	14
Unit 3	**Cloud Platforms in Industry:** Amazon Web Services- Compute Services, Storage Services, Communication Services, Additional	14

	Services; Google AppEngine- Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations; Microsoft Azure- Azure Core Concepts (Compute, Storage, Core Infrastructure and Other Services), SQL Azure, Windows Azure Platform Appliance. **Cloud Applications:** Scientific Applications- Healthcare (ECG Analysis in the Cloud)	

Text Books:

- Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi: "Mastering Cloud Computing- Foundations and Applications Programming", Elsevier, 2013
- Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
- K Chandrashekaran: "Essentials of Cloud Computing", CRC Press, 2015
- Derrick Rountree, Ileana Castrillo: "The Basics of Cloud Computing", Elsevier, 2014

BCA: Semester V

DSE-E1 Course code: GRE240	Course Title: Business Intelligence
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

- Describe the Decision Support systems and Business Intelligence framework.
- Explore knowledge management, explain its activities, approaches, and its implementation
- Describe business intelligence, analytics, and decision support systems

Unit	Contents	42 Hrs
Unit 1	**Information Systems Support** for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics **Introduction and Definitions**, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.	14
Unit 2	**Basic Concepts of Neural Networks**, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis, Speech Analytics.	14
Unit 3	**Decision Support Systems** modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons. **Automated Decision Systems**, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, and Development of Expert Systems.	14

Text Books:

Ramesh Sharda, Dursun Delen, Efraim Turban, J.E.Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition.

Reference books

Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017 by Edward Miz

BCA: Semester V

Voc1 Course code: GRE250	Course Title: Digital Marketing
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 2 $^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

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

Unit	Contents	42 Hrs
Unit 1	**Introduction to Digital Marketing:** Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms **Digital Marketing Strategy and Planning:** Developing a digital marketing strategy, Setting goals and objectives, Budgeting, and resource allocation 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	14
Unit 2	**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 strategy and planning, 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	14
Unit 3	**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	14

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

BCA: Semester V

SEC-3 Course code: GRE260	Course Title: Cyber Security
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE Exam: $2^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):

After the successful completion of the course, the student will be able to

- Understand the concept of Cyber security and issues and challenges associated with it.
- Students, at the end of this course, should be able to understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures
- On completion of this course, students should be able to appreciate various privacy and security concerns on online social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms

Module	Contents	30 Hrs
Module-I.	Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	9
Module-II.	Cyber-crime and Cyber law: Classification of cybercrimes, Common cybercrimes- cyber-crime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cyber-crime and offences, Organisations dealing with Cybercrime and Cyber security in India, Case studies.	9
Module-III.	Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.	8
Module-IV	Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Advantage of e-commerce, Survey of popular e-commerce sites. Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act, 2007.	8

Module-V	End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	11

Text/Reference:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers
5. Fundamentals of Network Security by E. Maiwald, McGraw Hill.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

BCA: Semester VI

DSC-16 Course code: GRF210	Course Title: Artificial Intelligence and Applications
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 40	Duration of SEE Exam: $2^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

- Gain a historical perspective of AI and its foundations
- Become familiar with basic principles and strategies of AI towards problem solving
- Understand and apply approaches of inference, perception, knowledge representation, and learning.
- Understand the various applications of AI

Unit	Contents	52 Hrs
Unit 1	**Introduction**- What is Artificial Intelligence, Foundations of AI, History, AI - Past, Present and Future. Intelligent Agents-Environments- Specifying the task environment, Properties of task environments, Agent based programs-Structure of Agents, Types of agents- Simple reflex agents, Model-based reflex agents, Goal-based agents; and Utility-based agents.	13
Unit 2	**Problem Solving by Searching**-Problem-Solving Agents, Well-defined problems and solutions, examples Problems, Searching for Solutions, Uninformed Search Strategies Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Greedy best-first search, A* Search, AO* search Informed (Heuristic) Search Strategies, Heuristic Functions	13
Unit 3	**Knowledge Representation** - Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic-Syntax and Semantics of First-Order Logic, Using First-Order Logic, Unification and Lifting Forward Chaining, Backward Chaining	13
Unit4	**Learning**– Forms of Learning, Supervised Learning, Machine Learning - Decision Trees, Regression and Classification with Linear Models, Artificial Neural Networks, Support Vector Machines **Applications of AI** - Natural Language Processing, Text Classification, and Information Retrieval, Speech Recognition, Image processing and computer vision, Robotics	13

Text Books:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003
2. Tom Mitchell, "Machine Learning", 1st Edition, McGraw-Hill,2017
3. Elaine Rich, Kevin Knight, Shivashankar B Nair:
4. Artificial Intelligence, Tata McGraw Hill 3rd edition, 2013

Course code: GRF210P	Course Title: Artificial Intelligence Lab
Total Contact Hours: 52-4hrs/week	Course Credits: 02
Formative Assessment Marks: 25	Duration of SEE/Exam: 03 Hours
Summative Assessment Marks: 25	

Course Outcomes:

- Identify and apply Artificial Intelligence concepts to solve real world problems.
- Develop learning programs for supervised learning models.
- Design and develop solutions for informed and uninformed search problems in AI.

Programs:

1. Write a program to implement breadth first search using python.
2. Write a program to implement depth first search using python.
3. Write a program to implement 8-puzzle problem using python
4. Write a program to implement n-queens problem using python.
5. Write a program to implement alpha-beta pruning using python.
6. Write a program to implement forward chaining algorithm.
7. Write a program to implement backward chaining algorithm.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the Iris data set. Print both correct and wrong predictions.
9. Train a random sample data using linear regression model and plot the graph
10. Implement the naïve Bayesian classifier for a sample training data set stored as a .csv file. Compute the accuracy of the classifier, considering few test data sets.
11. Demonstrate the working of SVM classifier for a suitable data set(e.g., Iris dataset)
12. Build a sample binary image classification model (cat and dog)

Evaluation Scheme for Lab Examination

Note: The programs can be implemented using Jupyter notebook IDE with scikit-learn library or native Phyton IDLE with required packages.

Packages can be downloaded and installed separately without any internet connection.

Evaluation Scheme for Lab Examination

Criteria Marks	**Marks**
Writing the Program	10
Execution and Formatting	10
Viva Voce	2
Practical Record	3
Total	**25**

BCA: Semester VI

DSC-17 Course code: GRF220	Course Title: **PHP & MySQL**
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 40	Duration of SEE Exam: $2^{1}/_{2}$ hrs
Summative Assessment Marks: 60	

Course Outcomes:

- After the successful completion of the course, the student will be able to:
- Design dynamic and interactive web pages and websites.
- Run PHP scripts on the server and retrieve results.
- Handle databases like MySQL using PHP in websites

Unit	Contents	52 Hrs
Unit 1	**Introduction to PHP:** Introduction to PHP, History and Features of PHP, Installation & Configuration of PHP, Embedding PHP code in Your Web Pages, Understanding PHP, HTML and White Space, Writing Comments in PHP, Sending Data to the Web Browser, Data types in PHP, Keywords in PHP, Using Variables, Constants in PHP, Expressions in PHP, Operators in PHP.	13
Unit 2	**Programming with PHP:** Conditional statements: if, if-else, switch, The? Operator**,** Looping statements: while Loop, do-while Loop, for Loop **Arrays in PHP:** Introduction- What is Array? Creating Arrays, Accessing Array elements, Types of Arrays: Indexed v/s Associative arrays, Multidimensional arrays, Creating Array, Accessing Array, Manipulating Arrays, Displaying array, Using Array Functions, Including and Requiring Files- use of Include() and Require(), Implicit and Explicit Casting in PHP.	13
Unit 3	**Functions, and Strings in PHP:** Functions in PHP, Function definition, Creating and invoking user-defined functions, Formal parameters versus actual parameters, Function and variable scope, Recursion, Library functions, Date and Time Functions **Strings in PHP:** What is String? Creating and Declaring String, String Functions **Class &Objects in PHP:** What is Class & Object, Creating and accessing a Class &Object, Object properties, object methods, Overloading, inheritance, Constructor and Destructor	13
Unit4	**Form Handling:** Creating HTML Form, Handling HTML Form data in PHP **Database Handling Using PHP with MySQL: I**ntroduction to MySQL: Database terms, Data Types. **Accessing MySQL** –Using MySQL Client and Using php MyAdmin, MySQL Commands, Using **PHP with MySQL:** PHP MySQL Functions, Connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Updating Records with PHP	13

Textbooks:

PHP & MySQL for Dynamic Web Sites- Fourth Edition By Larry Ullman
Learning PHP, MySQL and JavaScript By Robin Nixon –O‟REILLY Publications
Programming PHP By Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre
SAMS Teach Yourself PHP in 24 hours, Author: Matt Zandstra, Sams Publishing

Course code: GRF220P	Course Title: PHP and MySQL Lab
Total Contact Hours: 52-4hrs/week	Course Credits: 02
Formative Assessment Marks: 25	Duration of SEE/Exam: 03 Hours
Summative Assessment Marks: 25	

1. Write a PHPscript to print “hello world”.
2. Write a PHPscript to find odd or even number from given number.
3. Write a PHPscript to find maximum of three numbers
4. Write a PHPscript to find maximum of three numbers
5. Write a PHPscript to find the factorial of a number
6. Write a PHPscript to check whether given number is palindrome or not
7. Write a PHP script to reverse a given number and calculate its sum
8. Write a PHP script to to generate a Fibonacci series using Recursive function
9. Write a PHP script to implement atleast seven string functions.
10. Write a PHP program to insert new item in array on any position in PHP.
11. Write a PHP script to implement constructor and destructor
12. Write a PHP script to implement form handling using get method
13. Write a PHP script to implement form handling using post method
14. Write a PHP script that receive form input by the method post to check the number is prime or not
15. Write a PHP script that receive string as a form input
16. Write a PHP script to compute addition of two matrices as a form input
17. Write a PHP script to show the functionality of date and time function
18. Write a PHP program to upload a file
19. Write a PHP script to implement database creation
20. Write a PHP script to create table
21. Develop a PHP program to design a college admission form using MYSQL database.

Evaluation Scheme for Lab Examination: Assessment Criteria	**Marks**
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

BCA: Semester VI

DSE-E2 Course code: GRF240	Course Title: Fundamentals of Data Science
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE Exam: $2^{1}/_{2}$ hrs
Summative Assessment Marks: 60	

Course Outcomes (CO s):

After the successful completion of the course, the student will be able to:

- Understand the concepts of data and pre-processing of data
- Know simple pattern recognition methods
- Understand the basic concepts of Clustering and Classification
- Know the recent trends in Data Science

Unit	Contents	42 Hrs
Unit 1	**Data Mining:** Introduction, Data Mining Definitions, Knowledge Discovery in Databases (KDD) Vs Data Mining, DBMS Vs Data Mining, DM techniques, Problems, Issues and Challenges in DM, DM applications. **Data Warehouse:** Introduction, Definition, Multidimensional Data Model, Data Cleaning, Data Integration and transformation, Data reduction, Discretization	14
Unit 2	**Mining Frequent Patterns:** Basic Concept – Frequent Item Set Mining Methods -Apriori and Frequent Pattern Growth (FPGrowth) algorithms -Mining Association Rules **Classification:** Basic Concepts, Issues, And Algorithms: Decision Tree Induction. Bayes Classification Methods	14
Unit 3	Rule-Based Classification, Lazy Learners (or Learning from your Neighbors), k Nearest Neighbor. Prediction - Accuracy- Precision and Recall **Clustering:** Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering	14

Text Books:

1. Elsevier Jiawei Han Publications and Micheline Kambar – "Data Mining Concepts and Techniques" Second Edition
2. Arun K Pujari – "Data Mining Techniques" 4th Edition, Universities Press
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.
4. K.P.Soman, Shyam Diwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI

BCA: Semester VI

DSE-E2 Course code: GRF240	Course Title: Mobile Application Development
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE Exam: $2^1/_2$ hrs
Summative Assessment Marks: 60	

Course Outcomes (CO s):

After the successful completion of the course, the student will be able to:

- Create Servlets for server-side programming Create, test and debug Android application by setting up Android development environment
- Critique mobile applications on their design pros and cons,
- Program mobile applications for the Android operating system and understand techniques for designing and developing sophisticated mobile interfaces
- Deploy applications to the Android marketplace for distribution

Unit	Contents	42 Hrs
Unit 1	**Android OS design and Features**: Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools, Building your First Android application. **Android Application Design Essentials:** Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions	14
Unit 2	**Android User Interface Design Essentials:** User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources	14
Unit 3	**Using Common Android APIs:** Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Deploying Android Application to the World.	14

Text Books:

1. Lauren Darcey and Shane Conder , "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
3. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
4. Android Application Development All in one for Dummies by Barry Burd, Edition: I
5. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
6. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012

BCA: Semester VI

Voc-2 Course code: GRF250	Course Title: Web Content Management System
Total Contact Hours: 42	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE Exam: $2^{1}/_{2}$ hrs
Summative Assessment Marks: 60	

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

- Understand content development basics
- Gain Knowledge of tools for multimedia content development for audio/ video, graphics, animations, presentations, screen casting
- Host websites and develop content for social media platforms such as wiki and blog,
- Understand e-publications and virtual reality
- Use of e-learning platform Moodle and CMS applications Drupal and Joomla

Unit	Contents	42 Hrs
Unit 1	Web Content Development and Management, Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing Web Hosting and Managing Multimedia Content, Creating and Maintaining a Wiki Site.	14
Unit 2	Presentation Software Part I, Presentation Software Part II, Screen casting Tools and Techniques, Multilingual Content Development. Planning and Developing Dynamic Web Content Sites, Website Design Using CSS Creating and Maintaining a WIKI Site, Creating and Managing a Blog Site E- Publication Concept, E- Pub Tools	14
Unit 3	Simulation and Virtual Reality Applications, Creating 2D and 3 D Animations. Introduction to Moodle, Creating a New Course and Uploading, Create and Add Assessment, Add and Enroll User and Discussion Forum, Content Management System: Joomla, Content Management System: Drupal	14

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

1. Pattern and Scheme of Examination for VI Sem BCA Project Work

- Each project can be done by a maximum of 4 students.
- The distribution of marks for Assessment is as follows:

C1	C2	C3
20	20	60

- C3 marks distribution in the final examination is as follows:
    1. Project Report: 20 marks
    2. Presentation and Demonstration: 30 marks
    3. Viva-Voce: 10 marks

2. Guidelines for Internship is as per the Model Curriculum Structure of the University of Mysore provided in the circular vide reference AC2(S)/151/2020-21 Dated 08/08/2023

Question Paper Pattern: BCA

Part A

Duration: $2^1/_2$ hours **Max. Marks: 60**

I. Answer any 5 questions out of 7 **5X2=10**

1.
2.
3.
4.
5.
6.
7.

Part B

II. Answer any 4 questions out of 6 **4X5=20**

8.
9.
10.
11.
12.
13.

Part C

III. Answer All the Questions **3X10=30**

14.

a.

or

b.

15.

a.

or

b.

16.

a.

Or

b.