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

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 BCA courses, in outcome-based curriculum framework, help students learn solving problems, accomplishing IT tasks, and expressing creativity, both individually and collaboratively. The proposed framework will help Students learn programming techniques and the syntax of one or more programming languages.

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

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

- To develop an understanding and knowledge of the basic theory of Computer Science and Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation
- To develop the ability to use this knowledge to analyse new situations in the application domain
- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems
- To learn skills and tools like mathematics, statistics and electronics to find the solution, interpret the results and make predictions for the future developments
- To formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate

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	CA C-1 (3+2) CA C-2 (3+2) CA C-3 (3)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)		SEC-1:Digital Fluency (2) (1+0+2)	Physical Education for fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	26
II	CA C-4 (3+2) CA C-5 (3+2) CA C-6 (3)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)	Environmental Studies (2)		Physical Education – Yoga (1) (0+0+2)	NCC/NSS/R&R(S&G) / Cultural (1) (0+0+2)	26
Exit option with Certificate in Computer Applications (50 credits)								
III	CA C-7 (3+2) CA C-8 (3+2) CA C-9 (3)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs each)		SEC-2: Artificial Intelligence (2) (1+0+2)	Physical Education-Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	26
IV	CA C-10 (3+2) CA C-11 (3+2) CA C-12 (3)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs each)	Constitution of India (2)		Physical Education - Games (1) (0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	26
Exit option with Diploma in Computer Applications (100 credits)								
V	CA C-13 (3+2) CA C-14 (3+2) CA C-15 (3)	CA E-1 (3) Vocational-1 (3)			SEC-3: Cyber Security(2) (1+0+2)			23
VI	CA C-16 (3+2) CA C-17 (3+2) CA C-18 (3)	CA E-2 (3) Vocational-2 (3)			SEC-4: Professional Communication (3)			23
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (142 credits)								
VII	CA C-19(3+2) CA C-20(3+2) Internship (2)	CA E-3 (3) Vocational-3 (3) Res. Methodology (3)						21
VIII	CA C-21 (3+2) CA C-22 (3)	CA E-4 (3) Vocational-4 (3) Research Project(6)*						20
Award of Bachelor of Computer Applications Honours Degree, BCA (Hons.) Degree (183 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 Communication and 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 Communication and 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	Internet Technologies	3		
	GRE 220	Statistical Computing and R Programming	3	9	22
	GRE 230	Software Engineering	3		
	GRE 210P	LAB: JAVA Script, HTML and CSS	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	8	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	9	21
	CAC19P	LAB: Algorithms	2		
	CAC20P	LAB: Data Mining	2		
VII	CAI01	Internship	2		
	CAC21	Automata Theory and Compiler Design	3		
	CAC22	Cryptography and Network Security	3	6	20
	CAC21P	LAB: Compiler Lab	2		
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.

JSS COLLEGE FOR WOMEN (AUTONOMOUS)
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	GRB 210	Data Structures using C	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRB 220	Object Oriented Concepts using JAVA	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRB 230	Discrete Mathematical Structures	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRB 210P	LAB: Data Structure	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		GRB 220P	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 Communication and 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	Internet Technologies	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRE 220	Statistical Computing and R Programming	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRE 230	Software Engineering	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		GRE 210P	LAB: JAVA Script, HTML and CSS	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	Cyber Law and Cyber Security OR Business Intelligence OR Fundamentals of Data Science	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		VOC-1	Vocational 1	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		SEC-3	SEC-3 Cyber Law and Security	1	0	2	1	0	1	5	5	10	5	25	-	1 Hours	50
	VI	CAC16	PHP and MySQL	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAC17	Artificial Intelligence and Applications	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		CAC18	Object Oriented Analysis and Design	3	0	0	0	0	0	20	20	-	-	60	-	2 Hours	100
		CAC16P	LAB: PHP and MySQL	0	0	4	0	0	2	-	-	10	15	-	25	3 Hours	50
		CA-P1	LAB: Project Work	0	0	4	0	0	2	-	-	20	20	-	60	3 Hours	100
		CAE-2A	Fundamentals of Data Science OR Mobile Application Development OR Embedded Systems	3	0	0	3	0	0	20	20	-	-	60	-	2 Hours	100
		VOC-2	Vocational-2	3	0	0	3	0	0	20	20	-	-	60	-	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

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: 02

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: 10
Exam Marks: 40	Exam Duration: 04

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

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: 02

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

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

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: 02

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

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: 03

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

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: 02 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 $_nC_r$, 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

Course Code: GRB 220	**Course Title: Object Oriented Programming with JAVA**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 02 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

Course Code: GRB 230	**Course Title: Discrete Mathematical Structures**
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 02 Hours

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.

Question Paper Pattern: BCA

Part A

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.