

INDIRA GANDHI UNIVERSITY

Meerpur-Rewari, Haryana (122502)

(A State University Established under Haryana Act No.29 of 2013)

(Recognized u/s 12(B) & 2(f) of UGC Act, 1956)



SCHEME OF EXAMINATION & SYLLABI

in accordance with National Education Policy-2020

for

Undergraduate Programme

in

Bachelor of Computer Applications

(Effective from Academic Session: 2026-27)

DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF ENGINEERING & TECHNOLOGY

www.igu.ac.in

VISION AND MISSION OF THE UNIVERSITY

VISION

To be a globally renowned university, recognized for excellence in teaching, innovative research and welfare of the society, imbibing the spirit of “*Vasudhaiv kutumbkam*”.

MISSION

- To introduce and implement innovation in teaching and learning process matching up the global standards to strengthen academic delivery through curriculum design, teaching pedagogy and usage of ICT.
- To develop a mechanism that attracts talented, qualified and experienced faculty from across the globe for pursuing their academic and research careers at the University.
- To offer academic programmes at UG, PG, Doctoral, Post-Doctoral levels which are learner-centric, industry focused and adhere to outcome based international models.
- To create an ambiance that is conducive for undertaking sponsored research, innovation and consultancy services to a wide spectrum of societal and industrial requirements while encouraging interdisciplinary approach of learning, team work and research.
- To establish state of art centres of excellence in frontier areas of research and design innovation through industry collaboration to innovate and incubate the products and services.
- To establish smart campus and promote e-governance activities in the university for the digitally empowered society and knowledge economy.
- To provide a hygienic, modern, environment friendly and vivacious campus attuned to the urgent needs of Green Technology.
- To consider and implement norms, metrics, standards, procedures and benchmarks for assessing and improving the quality in every aspect of University system and achieve quality certifications by National and International bodies.
- To make society self-reliant by organizing various programmes including literacy, gender sensitization, health awareness and dissemination of information about livelihood generation.

VISION AND MISSION OF THE DEPARTMENT

VISION

To train students to be highly effective instructors, researchers, developers and contributors to IT companies globally. Be regarded as a prestigious centre of scholarly achievement worldwide.

MISSION

1. To foster advanced research and the best education in the IT domain.
2. To create skilled employees for businesses and industries based on the latest IT technologies like artificial intelligence, data science and IoT etc.
3. To offer a learning environment that is centred on the needs of the students to help in their overall development.

ABOUT THE PROGRAMME

The Bachelor of Computer Applications (BCA) Programme aims to provide students with comprehensive knowledge and practical skills in Computer Science and Applications. It is designed to prepare students for professional careers in the IT industry, higher education, research, and entrepreneurship. The programme equips students with the technical expertise, analytical abilities, and problem-solving skills required to meet the demands of the rapidly evolving technological world.

The Programme introduces students to the fundamental and emerging areas of Computer Science through a combination of theoretical knowledge and practical exposure. It provides students with modern computer courses, programming skills, and interdisciplinary learning opportunities. The choice-based curriculum is designed to develop logical thinking, scientific temperament, creativity, and an understanding of contemporary technological developments.

The programme includes a balanced combination of Core Courses, Discipline-Centric Elective Courses, Open Elective Courses, Foundation Courses, Skill Enhancement Courses, Internship/Training, and Project Work in alignment with the objectives of NEP-2020. The courses are structured to cover the complete spectrum of computer applications, beginning with basic computing concepts and progressing toward advanced and industry-relevant technologies.

Through the BCA programme, students gain knowledge in a wide range of areas such as programming languages, database management systems, computer networks, operating systems, web technologies, software engineering, data structures, cloud computing, cybersecurity, artificial intelligence, machine learning, and Internet of Things (IoT), along with related interdisciplinary subjects. The Learning Outcome-based Curriculum Framework in Computer Science promotes flexibility and innovation in curriculum design, teaching-learning methods, and assessment procedures.

The outcome-based approach emphasizes practical problem-solving, computational thinking, software development, and collaborative learning. The framework enables students to develop programming proficiency, understand computing systems, and apply technology-based solutions to real-world problems while fostering innovation and employability skills.

BCA is an undergraduate programme of 4 years (8 semesters) under NEP structure, where applicable. The programme generally includes theory courses, laboratory work, internships, and project-based learning. Each semester consists of a balanced mix of subjects and practical components designed to provide both academic knowledge and hands-on experience in computer applications.

INTAKE IN THE PROGRAMME

As per institution

MINIMUM ELIGIBILITY CRITERIA

The candidate must have completed the Senior Secondary Examination (10+2) with at least 45% marks.

For SC/ST: The candidate must have passed the Senior Secondary Examination (10+2) with at least 42.75% aggregate from the Haryana Board of School Education

PASSING CRITERIA

Minimum 40% marks in (Theory as well as Sessional separately)

ELIGIBILITY FOR EXAMINATION

75% Attendance in each subject

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To have fundamental as well as advanced knowledge of the Information Technologies.
PEO2	To provide professional services to IT industries, research organisations in the domain of super specialisation.
PEO3	To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.

PROGRAMME LEARNING OBJECTIVES (PLOs)

PLO1	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.
PLO2	Capability to ask relevant/ appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis.
PLO3	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.
PLO4	Capability of applying knowledge to solve scientific and other problems.
PLO5	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, multidisciplinary settings.
PLO6	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PLO7	Ability to use and learn techniques, skills and modern tools for scientific practices.
PLO8	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PLO9	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.
PLO10	Capability to identify and apply ethical issues related to one's work; avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work.

PLO11	Ability to demonstrate knowledge and understanding of the latest IT technologies and apply these to manage projects.
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Scheme of Examination for Undergraduate Programme

Subject	BCA
Total number of Semesters	08
Total Marks	4500
Total Credit	180
Scheme	Scheme - D

Curriculum Framework - UG - Scheme - D

*L: Lecture, T: Tutorial, P: Practical, Th: Theory

Semester	Course Type	Course Code	Nomenclature of the Course	Theory (Th)/ Practical (P)	Credit	Contact hours per week (L+T+P=Total)	Internal Assessment Marks (Th+P=Total)	End Term Examination Marks (Th+P=Total)	Total Marks	Exam Hours Theory, Practical
1	CC-A1	26 L4.5-BCA- 101	Problem Solving through C	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-B1	26 L4.5-BCA- 102	Foundations of Computer Science	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-C1	26 L4.5-BCA- 103	Logical Organization of Computer	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-M1	26 L4.5-BCA- 104	Mathematical Foundations for Computer Science-I	2T / 0P	2	2+0+0=2	15+0=15	35+0=35	50	2 Hours
	MDC-1				3	from available pool of MDC				
	AEC-1				2	from available pool of AEC				
	SEC-1				3	from available pool of SEC				
	VAC-1				2	from available pool of VAC				
	Total				24	26+	185	415	600	
2	CC-A2	26 L4.5-BCA- 201	Object Oriented Programming using C++	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-B2	26 L4.5-BCA- 202	Introduction to Web Technologies	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-C2	26 L4.5-BCA- 203	Concepts of Operating Systems	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-M2	26 L4.5-BCA- 204	Mathematical Foundations for Computer Science-II	2T / 0P	2	2+0+0=2	15+0=15	35+0=35	50	2 Hours
	MDC-2				3	from available pool of MDC				
	AEC-2				2	from available pool of AEC				
	SEC-2				3	from available pool of SEC				
	VAC-2				2	from available pool of VAC				
	Total				24	26+	185	415	600	
UG Certificate in COMPUTER APPLICATIONS (MAJOR SUBJECT) of 48 Credits will be Awarded in Case of Exit (after 2nd Semester) after completing Internship (4-6 weeks) of 4 Credits										

Curriculum Framework - UG - Scheme - D

Semester	Course Type	Course Code	Nomenclature of the Course	Theory (Th)/ Practical (P)	Credit	Contact hours per week (L+T+P=Total)	Internal Assessment Marks (Th+P=Total)	End Term Examination Marks (Th+P=Total)	Total Marks	Exam Hours Theory, Practical
3	CC-A3	26 L5.0-BCA- 301	Java OOP Foundations	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-B3	26 L5.0-BCA- 302	Network Infrastructure and Data Communication Technologies	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-C3	26 L5.0-BCA- 303	Data Base Technologies	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-M3	26 L5.0-BCA- 304	Basics of Data Science Using Excel	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	MDC-3				3	from available pool of MDC				
	AEC-3				2	from available pool of AEC				
	SEC-3				3	from available pool of SEC				
	Total				24	27+	185	415	600	
4	CC-A4	26 L5.0-BCA- 401	Data Structures and Applications	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-B4	26 L5.0-BCA- 402	Management Information System	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-C4	26 L5.0-BCA- 403	Computer Graphics	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-M4(V)				4	from available pool of Minor/ Minor (Vocational)				
	AEC-4				2	from available pool of AEC				
	VAC-3				2	from available pool of VAC				
	Total				20	22+	150	350	500	
UG Diploma in COMPUTER APPLICATIONS (MAJOR SUBJECT) of 92 Credits will be Awarded in Case of Exit (after 4th Semester) after completing Internship (4-6 weeks) of 4 Credits										

Curriculum Framework - UG - Scheme - D

Semester	Course Type	Course Code	Nomenclature of the Course	Theory (Th)/ Practical (P)	Credit	Contact hours per week (L+T+P=Total)	Internal Assessment Marks (Th+P=Total)	End Term Examination Marks (Th+P=Total)	Total Marks	Exam Hours Theory, Practical
5	CC-A5	26 L5.5-BCA- 501	Software Engineering	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-B5	26 L5.5-BCA- 502	Front-end and Back-end Development	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-C5	26 L5.5-BCA- 503	Linux and Shell programming	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-M5(V)				4	from available pool of Minor/ Minor (Vocational)				
	Internship	-	*Internship		4				100	-
	Total				20	18+	120	280	500	
4 credits of summer internship (earned post-semester 2 or 4) will be taken into account in the 5th semester for 3rd-year UG students who did not take an exit option.										
6	CC-A6	26 L5.5-BCA- 601	Programming using Python	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-B6	26 L5.5-BCA- 602	Advanced Web Development	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 2 Hours(P)
	CC-C6	26 L5.5-BCA- 603	Artificial Intelligence	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-M6(V)				4	from available pool of Minor/ Minor (Vocational)				
	CC-M7(V)				4	from available pool of Minor/ Minor (Vocational)				
	Total				20	22+	150	350	500	
Bachelor of COMPUTER APPLICATIONS with Major in Degree of 132 Credits will be Awarded in Case of Exit (after 6th Semester)										

Curriculum Framework - UG - Scheme - D

Semester	Course Type	Course Code	Nomenclature of the Course	Theory (Th)/ Practical (P)	Credit	Contact hours per week (L+T+P=Total)	Internal Assessment Marks (Th+P=Total)	End Term Examination Marks (Th+P=Total)	Total Marks	Exam Hours Theory, Practical
7	CC-H1	26 L6.0-BCA- 701	E-Commerce	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-H2	26 L6.0-BCA- 702	Software Testing	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-H3	26 L6.0-BCA- 703	Data Mining and Warehousing	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	DSE-H1 (pick any one)	26 L6.0-BCA- 704	No SQL Databases	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
		26 L6.0-BCA- 705	Cyber Security							
	PC-H1	26 L6.0-BCA- 706	Practicum (Practical Based on 26 L6.0-BCA- 703-704/Case Study Report Based on 26 L6.0-BCA-705)	0T / 4P	4	0+0+8=8	0+30=30	0+70=70	100	4 Hours
	CC-HM1				4	from available pool of Minor/ Minor (Vocational)				
Total					24	28+	180	420	600	
8	CC-H4	26 L6.0-BCA- 801	Design & Analysis of Algorithms	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-H5	26 L6.0-BCA- 802	Software Project Management	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-H6	26 L6.0-BCA- 803	Emerging Trends in Information Security	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	DSE-H2 (pick any one)	26 L6.0-BCA- 804	Big Data	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
		26 L6.0-BCA- 805	Machine Learning							
	PC-H2	26 L6.0-BCA- 806	Practicum (Practical Based on 26 L6.0-BCA- 801,804,805/Case Study Report Based on 26 L6.0-BCA-803)	0T / 4P	4	0+0+8=8	0+30=30	0+70=70	100	4 Hours
	CC-HM2	26 L6.0-BCA- 807	Internet of Things	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 3 Hours(P)
Total					24	28+	180	420	600	
OR										

Semester	Course Type	Course Code	Nomenclature of the Course	Theory (Th)/ Practical (P)	Credit	Contact hours per week (L+T+P=Total)	Internal Assessment Marks (Th+P=Total)	End Term Examination Marks (Th+P=Total)	Total Marks	Exam Hours Theory, Practical
8	CC-H4	26 L6.0-BCA- 801	Design & Analysis of Algorithms	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	CC-H5	26 L6.0-BCA- 802	Software Project Management	4T / 0P	4	4+0+0=4	30+0=30	70+0=70	100	3 Hours
	PROJECT/DIS SERTATION	26 L6.0-BCA- 808	Dissertation	0T / 12P	12	0+0+24=24	0	300	300	0 Hours
	CC-HM2	26 L6.0-BCA- 807	Internet of Things	3T / 1P	4	3+0+2=5	25+5=30	50+20=70	100	3 Hours(Th), 3 Hours(P)
	Total				24	36+	90	510	600	
Bachelor of COMPUTER APPLICATIONS (Hons.) / (Hons. with Research) in Major Degree of 180 Credits will be Awarded (after 8th Semester)										

Semester I

Part A–Introduction			
Name of the Programme	BCA		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Problem Solving through C		
Course Code	26 L4.5-BCA-101		
Course Type	CC-A1 (Core Course)		
Course Level	100-199		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ -learn the basics of C program, data types and input/output statements. CLO ₂ -understand different types of operators, Their hierarchies and control statements of C. CLO ₃ -implement programs using arrays and strings. CLO ₄ -get familiar with advanced concepts like structures, union etc. in C language.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u> The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u> Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Unit	Topics		Contact Hours/ CLOs
I	Overview of C: History, Importance, Structure of C Program, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant. Input/output: Formatted I/O Function-, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putch(), putchar(), puts(). Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy; Arithmetic Expressions, Evaluation of Arithmetic Expression,		15/CLO ₁

II	Type Casting and Conversion. Decision making with if statement, if else statement, nested if statement, else-if ladder, switch and break statement, goto statement, Looping Statements: for, while, and do while loop, jumps in loops. Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation. Functions: definition, prototype, function call, passing arguments to a function: call by value; call by reference, recursive functions.	15/CLO ₂			
III	Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate etc., Search for a Substring. Pointers in C: Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays. User defined data types: Structures - Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; difference between Structure and Union.	15/CLO ₃			
Practical	Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: - To read radius of a circle and to find area and circumference - To read three numbers and find the biggest of three - To check whether the number is prime or not - To read a number, find the sum of the digits, reverse the number and check it for palindrome - To read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers - To read percentage of marks and to display appropriate message (Demonstration of else-if ladder) - To find the roots of quadratic equation - To read marks scored by n students and find the average of marks (Demonstration of single dimensional array) - To remove Duplicate Element in a single dimensional Array - To perform addition and subtraction of Matrices - To find factorial of a number and generate Fibonacci series - To remove Duplicate Element in a single dimensional Array - To find the length of a string without using built in function - To demonstrate string functions - To read, display and add two m x n matrices using functions - To read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters - To Swap Two Numbers using Pointers - To demonstrate student structure to read & display records of n students - To demonstrate the difference between structure & union.	30/CLO ₄			
	Contact Hours	75			
Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20
• Class Participation:	5	0	Lab record	NA	05
• Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
• Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
• Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources	
Recommended Books/e-resources/LMS: - Gottfried, Byron S., Programming with C, Tata McGraw Hill. - Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill. - Jeri R. Hanly& Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley. - Yashwant Kanetker, Let us C, BPB. - Rajaraman, V., Computer Programming in C, PHI. - Yashwant Kanetker, Working with C, BPB.	

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	75

Part A–Introduction			
Name of the Programme	BCA		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Foundations of Computer Science		
Course Code	26 L4.5-BCA-102		
Course Type	CC-B1 (Core Course)		
Course Level	100-199		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ -understand the basics of computer CLO ₂ -learn about I/O devices and operating systems CLO ₃ -understand internet and its services CLO ₄ -learn about the threats and security concepts on computers		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u> The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units. <u>Instructions for Practical Examiner</u> Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Unit	Topics		Contact Hours/ CLOs
I	Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of computers in Various Fields. Types of Software: System software, Application software, Utility Software, Shareware, Freeware, Firmware, Free Software. Memory Systems: Concept of bit, byte, word, nibble, storage locations and addresses, measuring units of storage capacity, access time, concept of memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM. Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory.		15/CLO ₁

II	I/O Devices: I/O Ports of a Desk Top Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touch pad and track ball, joystick, magnetic stripes, scanner, digital camera, and microphone Output Devices: speaker, monitor, printers: classification, laser, ink jet, dot-matrix. Plotter. Introduction to Operating System: Definition, Functions, Features of Operating System, Icon, Folder, File, Start Button, Task Bar, Status Buttons, Folders, Shortcuts, Recycle Bin, Desktop, My Computer, My Documents, Windows Explorer, Control Panel.	15/CLO ₂			
III	The Internet: Introduction to networks and internet, history, Internet, Intranet & Extranet, Working of Internet, Modes of Connecting to Internet. Electronic Mail: Introduction, advantages and disadvantages, User Ids, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines. Threats: Physical & non-physical threats, Virus, Worm, Trojan, Spyware, Keyloggers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking. Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-Repudiation, Security Mechanisms, Security Awareness, Security Policy, anti-virus software & Firewalls, backup & recovery.	15/CLO ₃			
Practical	Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: MS-Office: • Starting with basics of MS-Office • Understand basics of MS-Word, Excel, Power point Internet and E-mail: • Using Internet for various tasks • Creating and using e-mail. Security: • Understanding various threats • How to be safe from virus threats Various software to get safe from virus attacks.	30/CLO ₄			
	Contact Hours	75			
Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20
• Class Participation:	5	0	Lab record	NA	05
• Seminar/presentation/ assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
• Seminar/Demonstration/Vi va-voce/Lab records etc.:	NA	5	Written Examination	50	NA
• Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
• Sinha, P.K. & Sinha, Priti, Computer Fundamentals, BPB. • Dromey, R.G., How to Solve it By Computer, PHI. • Norton, Peter, Introduction to Computer, McGraw-Hill. • Leon, Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World. • Rajaraman, V., Fundamentals of Computers, PHI.					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	75

Part A-Introduction			
Name of Programme	BCA		
Semester	I		
Nature of Course/Course Composition	Theory		
Name of the Course	Logical Organization of Computer		
Course Code	26 L4.5-BCA-103		
Course Type	CC-C1 (Core Course)		
Course Level	100-199		
Pre-requisite for the course(if any)	Basic Knowledge of Mathematics (10th Level)		
Course Learning Outcomes (CLOs ₁) After completing this course, the learner will be able to:	CLO ₁ -understand number systems, error detecting correcting code and representations of numbers in a computer system. CLO ₂ -understand computer arithmetic and Boolean algebra and simplification of Boolean expressions. CLO ₃ -understand working of logic gates and design various combinational circuits using these logic gates. CLO ₄ -understand working of different types of flip-flops and design different types of registers.		
	Theory	Practical	Total
Credits	4	0	4
Teaching hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B-Contents of the Course			
<u>Instructions for Paper- Setter:</u> The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics		Contact Hours/ CLOs
I	Number Systems: Binary, Octal, Hexadecimal etc. Conversions from one number system to another, BCD Number System. BCD Codes: Natural Binary Code, Weighted Code, Self Complimenting Code, Cyclic Code. Error Detecting and Correcting Codes. Character representations: ASCII, EBCDIC and Unicode. Number Representations: Integer numbers - sign-magnitude, 1's & 2's complement representation. Real Numbers normalized floating point representations.		15/CLO ₁
II	Binary Arithmetic: Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division using 1's and 2's Complement representations, Addition and subtraction with BCD representations. Boolean Algebra: Boolean Algebra Postulates, basic Boolean Theorems, Boolean Expressions, Boolean Functions, Truth Tables, Canonical Representation of Boolean Expressions: SOP and POS, Simplification of Boolean Expressions using Boolean Postulates & Theorems, Karnaugh-Maps (upto four variables), Handling Don't Care conditions.		15/CLO ₂

III	Logic Gates: Basic Logic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR etc. Their symbols, truth tables and Boolean expressions. Combinational Circuits: Design Procedures, Half Adder, Full Adder, Half Subtractor, Full Subtracor, Multiplexers, Demultiplexers, Decoder, Encoder, Comparators, Code Converters.	15/CLO ₃
IV	Sequential Circuits: Basic Flip- Flops and their working. Synchronous and Asynchronous Flip –Flops, Triggering of Flip- Flops, Clocked RS, D Type, JK, T type and Master-Slave Flip-Flops. State Table, State Diagram and State Equations. Flip-flops characteristics & Excitation Tables, Sequential Circuits.	15/CLO ₄
	Total Contact Hours	60
Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment /quiz/class test etc.:	10	
• Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
• M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd.		
• V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall.		
• Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.		
• Nicholas Carter, Schaum’s Outlines Computer Architecture, Tata McGraw-Hill.		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	2	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	3	2	3	3
CLO ₃	3	3	3	3	3	3	3	2	3	3	2
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	60

Part A-Introduction			
Name of Programme	BCA		
Semester	I		
Nature of Course/Course Composition	Theory		
Name of the Course	Mathematical Foundations for Computer Science-I		
Course Code	26 L4.5-BCA-104		
Course Type	CC-M1(Minor)		
Course Level	100-199		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO₁-Gain the knowledge of set theory, types of sets and operations on sets. Understand various concepts of matrices and determinants, and acquire the cognitive skills to apply different operations on matrices and determinants. CLO₂-Have the knowledge of the basic concepts of complex numbers and acquire skills to solve linear quadratic equations. CLO₃-Understand the concept of differentiation CLO₄-Attain the skills to make use of the learnt concepts of Introductory Mathematics in multidisciplinary learning contexts and to know their applications		
	Theory	Practical	Total
Credits	2	0	2
Teaching hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Duration (in Hours)	02	0	
Part B-Contents of the Course			
<u>Instructions for Paper- Setter:</u> The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 07 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			
Unit	Topics		Contact Hours/ CLOs

I	Sets: Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Practical applications of set theory. Relations And Functions: Properties of Relations, Equivalence Relation, Partial Order Relation. Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions. Trigonometry: Introduction, Measurement of angles, trigonometric functions, relation between trigonometric functions, signs of trigonometric functions, trigonometric functions of standard angles. Basic of inverse trigonometry. Limits & Continuity: Limit at a Point, properties of limit, computation of limits of various types of functions, Continuity of a function at a point, Continuity over an interval.	15/CLO ₁
II	Differentiation: Derivative of a function, Derivatives of sum, differences, product & quotient of functions, Derivatives of polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions, Logarithmic Differentiation, Chain rule and differentiation by substitution. Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices. Determinants: Definition, Minors, Cofactors, Properties of Determinants, Applications of determinants in finding area of triangle, Adjoint of matrix, Inverse of matrix, solving a system of linear equations using matrix method.	15/CLO ₂
	Total Contact Hours	30
Evaluation Methods		
Internal Assessment: 15 Marks		End Term Examination: 35 Marks
• Class Participation:	5	Written Examination:35
• Seminar/presentation/assignment/quiz/ class test etc.:	5	
• Mid-Term Exam:	5	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
• C. Y. Young (2021). Algebra and Trigonometry. Wiley. • S.L. Loney (2016). The Elements of Coordinate Geometry (Cartesian Coordinates) (2nd Edition). G.K. Publication Private Limited. • Seymour Lipschutz and Marc Lars Lipson (2013). Linear Algebra. (4th Edition) Schaum’s Outline Series, McGraw-Hill. • C.C. Pinter (2014). A Book of Set Theory. Dover Publications. • J. V. Dyke, J. Rogers and H. Adams (2011). Fundamentals of Mathematics (10th Edition), Brooks/Cole.		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	2	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	3	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	2
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	30
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	30

Semester II

Part A–Introduction			
Name of the Programme	BCA		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Object Oriented Programming Using C++		
Course Code	26 L4.5-BCA-201		
Course Type	CC-A2 (Core Course)		
Course Level	100-199		
Pre-requisite for the course(if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ -understand basic concepts of C++. CLO ₂ -learn operators, hierarchy and their precedence and different control structures of C++. CLO ₃ -develop programs using arrays, strings and functions. CLO ₄ -implement OOPS concepts with C++.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u> The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units. <u>Instructions for Practical Examiner</u> Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Unit	Topics		Contact Hours/ CLOs
I	Introduction to C++: About C++, Character Set, Keywords, Identifiers, Constants, Punctuators, Data Types: User Defined, Built-in, Derived Data Types, Access Modifiers. Unformatted and Formatted I/O Operations. I/O using extraction and extraction operators, Type Conversion, Type Casting. Operators in C++: Arithmetic, Relational, Logical, Bitwise, Ternary, Precedence & associativity of Operators. Control Structures: if statement, if-else statement, nested if, if-else-if ladder, switch...case statement, break and continue, goto statement, nested switch...case statement, Loops: while loop, do...while loop, for loop.		15/CLO ₁

II	Arrays and strings: Array definition, initialization, multidimensional arrays, Manipulation of array elements, String declaration and initialization, Manipulations, String handing functions. Functions: Declaration and Definition, return values, arguments, passing parameters by value, call by reference, call by pointer, Recursions, Inline and external linkage Functions, storage classes.	15/CLO ₂			
III	Object-Oriented Features of C++: Class and Objects, Data hiding & encapsulation, abstraction, constructors & destructors. Data Members and Member Functions, accessing class members, empty class, local class, global class, Scope Resolution Operator and its Uses, Static Data Members, Static Member Functions, Structure vs Class.	15/CLO ₃			
Practical	Practicum: Students are advised to do laboratory/practical practice by including following types of problems: • Programs for showing use of different operators • Program for array • Program for constructor and destructor • Program for structure.	30/CLO ₄			
	Contact Hours	75			
Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20
• Class Participation:	5	0	Lab record	NA	05
• Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
• Seminar/Demonstration /Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
• Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
Text Books:					
• Herbert Schildt, C++, The Complete Reference, Tata McGraw-Hill • Robert Lafore, Object Oriented Programming in C++, SAMS Publishing					
Reference Books:					
• Bjarne Stroustrup, The C++ Programming Language, Pearson Education • Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill. • Richard Johnson, An Introduction to Object-Oriented Application Development, Thomson Learning.					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	3	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	2	2
CLO ₄	3	3	2	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	75

Part A-Introduction			
Name of the Programme	BCA		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Introduction to Web Technologies		
Course Code	26 L4.5-BCA-202		
Course Type	CC-B2 (Core Course)		
Course Level	100-199		
Pre-requisite for the course(if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ -outline the idea of web and its components. CLO ₂ -understand the theoretical steps for developing a website CLO ₃ -learn the skills that will enable him/her to design simple web pages. CLO ₄ - learn CSS to specify style to web pages.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u> The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units. <u>Instructions for Practical Examiner</u> Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Unit	Topics		Contact Hours/ CLOs
I	Introduction to Internet and World Wide Web (WWW); Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers; Hypertext Transfer Protocol, URLs; Searching and Web Casting Techniques, Search Engines and Search Tools, Scripting Languages. Web Publishing: Hosting website; Internet Service Provider; Planning and designing website; Web Content Authoring, Web Graphics Design, Web Programming, Steps For Developing website, Choosing the Contents, Home Page, Domain Names, Creating a Website and Introduction to Markup Languages (HTML and DHTML).		15/CLO ₁

II	Web Development: HTML Document Features, Fundamentals HTML Elements, Creating Links; Headers; Text styles; Text Structuring; Text color and Background; Formatting text; Page layouts, Images; Ordered and Unordered lists; Inserting Graphics; Table Creation and Layouts; Frame Creation and Layouts; Working with Forms and Menus; 10(3343) Working with Radio Buttons; Check Boxes; Text Boxes.	15/CLO ₂			
III	Introduction to CSS (Cascading Style Sheets): Features, Core Syntax, Types, Style Sheets and HTML, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Positioning and other useful Style Properties; Features of CSS3.	15/CLO ₃			
Practical	Practicum: Students are advised to do laboratory/practical practice by including different types of problems base on HTML tags.	30/CLO ₄			
Contact Hours		75			
Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20
• Class Participation:	5	0	Lab record	NA	05
• Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
• Seminar/Demonstration /Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
• Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
Textbooks:					
• Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.					
• Ramesh Bangia, Multimedia and Web Technology, Firewall Media.					
Reference Books:					
• Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill					
• Wendy Willard, HTML Beginners Guide, Tata McGraw-Hill.					
• Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	2	3	3	2	3	3	3	3	2	3	3
CLO ₂	3	3	3	2	3	3	3	3	2	3	3
CLO ₃	2	3	3	2	3	3	3	2	3	3	2
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75

Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	75

Part A-Introduction			
Name of Programme	BCA		
Semester	II		
Nature of Course/Course Composition	Theory		
Name of the Course	Concepts of Operating Systems		
Course Code	26 L4.5-BCA-203		
Course Type	CC-C2 (Core Course)		
Course Level	100-199		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs ₁) After completing this course, the learner will be able to:	CLO ₁ -understand the basic concepts of operating systems and its services. CLO ₂ -understand concept of process management and scheduling. CLO ₃ -acquire knowledge of process synchronization along with deadlock handling. CLO ₄ -learn about memory management and virtual memory concepts.		
	Theory	Practical	Total
Credits	4	0	4
Teaching hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B-Contents of the Course			
Instructions for Paper- Setter:			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics		Contact Hours/ CLOs
I	Introductory Concepts: Operating System Functions and Characteristics, Historical Evolution of Operating Systems, Operating System Structure, Operating System Operations; Types of Operating System: Real time, Multiprogramming, Multiprocessing, Batch processing; Operating System Services, Operating System Interface, Methodologies for Implementation of Operating System, Service System Calls, System Programs.		15/CLO ₁
II	Process Management: Process Concepts, Operations on Processes, Process States and Process Control Block. InterProcess Communication; Multithreaded Programming: Multithreading Models, Threading Issues; CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling; Algorithm Evaluation.		15/CLO ₂
III	Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classicla Problem of Synchronization, Monitors, Atomic Transactions; Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.		15/CLO ₃

IV	Memory Management Strategies: Memory Management of Single- User and Multiuser Operating System, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing, Memory Mapped Files.	15/CLO ₄
	Total Contact Hours	60
Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/class test etc.:	10	
• Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
Text Books:		
• Silberschatz A., Galvin P.B., and Gagne G., Operating System Concepts, John Wiley & Sons. • Godbole, A.S., Operating Systems, Tata McGraw-Hill Publishing Company, New Delhi.		
REFERENCE BOOKS:		
• Deitel, H.M., Operating Systems, Addison- Wesley Publishing Company, New York. • Tanenbaum, A.S., Operating System- Design and Implementation, Prentice Hall of India, New Delhi.		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	2	3	3	2	3	3	3	3	2	3	3
CLO ₂	3	3	3	2	3	1	3	3	2	3	3
CLO ₃	3	2	3	3	3	3	3	3	3	3	2
CLO ₄	2	3	3	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	60

Part A-Introduction			
Name of Programme	BCA		
Semester	II		
Nature of Course/Course Composition	Theory		
Name of the Course	Mathematical Foundations for Computer Science-II		
Course Code	26 L4.5-BCA-204		
Course Type	CC-M2 (Minor)		
Course Level	100-199		
Pre-requisite for the course(if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ -Understand concept of algorithms CLO ₂ -Understand graph theory CLO ₃ -Understand concept of recursion CLO ₄ -In-depth understanding of number theory		
	Theory	Practical	Total
Credits	2	0	2
Teaching hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Duration (in Hours)	02	0	
Part B-Contents of the Course			
<u>Instructions for Paper- Setter:</u> The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 07 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			
Unit	Topics		Contact Hours/ CLOs
I	Basic Statistics: Measure of Central Tendency, preparing frequency distribution table, Mean, Mode, Median, Measure of Dispersion: Range, Variance and Standard Deviations, Correlation and Regression. Algorithm: Algorithms, merits and demerits, Exponentiation, How to compute fast exponentiation. Linear Search, Binary Search, "Big Oh" notation, Worst case, Advantage of logarithmic algorithms over linear algorithms, complexity. Graph Theory: Graphs, Types of graphs, degree of vertex, sub graph, isomorphic and homeomorphic graphs, Adjacent and incidence matrices, Path Circuit; Eulerian, Hamiltonian path circuit.		15/CLO ₁
II	Tree: Trees, Minimum distance trees, Minimum weight and Minimum distance spanning trees. Recursion: Recursively defined function. Merge sort, Insertion sort, Bubble sort, and Decimal to Binary Recurrence Relations: LHRR, LHRRWCCs, DCRR. Recursive procedures. Number Theory: Principle of Mathematical induction, GCD, Euclidean algorithm, Fibonacci numbers, congruences and equivalence relations, public key encryption schemes		15/CLO ₂
	Total Contact Hours		30

Evaluation Methods		
Internal Assessment: 15 Marks		End Term Examination: 35 Marks
• Class Participation:	5	Written Examination:35
• Seminar/presentation/assignment/quiz/class test etc.:	5	
• Mid-Term Exam:	5	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
Textbooks:		
• Discrete Mathematics and Structures by Satinder Bal Gupta.		
• A Textbook of Graph Theory by R. Balakrishnan and K. Ranganathan		
Reference Books:		
• Schaum's Outline of Graph Theory: Including Hundreds of Solved Problems. by V. K. Balakrishnan		
• Algorithms, 4th Edition by Robert Sedgewick and Kevin Wayne.		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	2	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	1	3	3	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	30
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Technology Development	30