



RANI DURGA VATI VISWA VIDYALAYA, JABALPUR

Bachelor of Computer Applications (BCA)

Scheme of Examination as per Choice Based Credit System
(New Education Policy-2020)



BCA First Semester										
Course Code / S. No.	Subject Name	Periods Per Week			Credits	Maximum Marks Theory Slot		Maximum Marks Practical Slot		Total Marks
		L	T	P		End Sem. Exam (External)	Tests (Two) /Assignment (Internal)	End Sem. Practical Performance / Viva	Practical Record / Presentation	
BCA-101	Computer Fundamental organization & architecture	3	1	-	4	60	40	-	-	100
BCA-102	Programming using C	3	1	-	4	60	40	-	-	100
BCA-103-EL	Elective -I	3	1	-	4	60	40	-	-	100
BCA-104	Hindi	3	1	-	2	30	20	-	-	50
BCA-105	English	3	1	-	2	30	20	-	-	50
BCAL-106	Computer Lab-I(Computer Fundamental organization & Architecture)	-	-	4	2	-	-	60	40	100
BCAL-107	Computer Lab-II (Programming using C)	-	-	4	2	-	-	60	40	100
Skill-I	Skill Development	-	-	-	2	-	-	-	-	-
CVV	Comprehensive Viva-Voce	-	-	-	4 *(Virtual)	-	-	-	-	-
TOTAL		15	-	8	22+4	240	160	120	80	600

* L: Lecture, T: Tutorial, P: Practical, 1 Credit=1 hr. (Theory), 1 Credit=2 hrs. (Practical)

BCA Second Semester										
Course Code / S. No.	Subject Name	Periods Per Week			Credits	Maximum Marks Theory Slot		Maximum Marks Practical Slot		Total Marks
		L	T	P		End Sem. Exam (External)	Tests (Two) /Assignment (Internal)	End Sem. Practical Performance / Viva	Practical Record / Presentation	
BCA-201	Programming methodology using data structure	3	1	-	4	60	40	-	-	100
BCA-202	Operating System	3	1	-	4	60	40	-	-	100
BCA-203-EL	Elective-II	3	1	-	4	60	40	-	-	100
BCA-204	Yoga	3	1	-	2	30	20	-	-	50
BCA-205	EVS	3	1	-	2	30	20	-	-	50
BCAL-206	Computer Lab-I (Programming methodology using data structure)	-	-	4	2	-	-	60	40	100
BCAL-207	Computer Lab-II (Operating System)	-	-	4	2	-	-	60	40	100
SKILL-II	Skill Development	-	-	-	2	-	-	-	-	-
CVV	Comprehensive Viva-Voce	-	-	-	4 *(Virtual)	-	-	-	-	-
	TOTAL	15	-	8	22+4	240	160	120	80	600

* L: Lecture, T: Tutorial, P: Practical, 1 Credit=1 hr. (Theory), 1 Credit=2 hrs. (Practical)

List of Elective Courses Identified- Computer Science (CS) and Non Computer Science (NCS)

Elective: I

Course Code	Subject Name
BCA-103- EL-1	Computational Mathematics
BCA-103- EL-2	Discrete Mathematics

Elective: II

Course Code	Subject Name
BCA-203- EL-1	Numerical Methods
BCA-203- EL-2	Probability and Statistics

Bachelor of Computer Applications (BCA)

Examination Pattern

- ✓ End semester examination will contain three sections as A, B & C.
- ✓ Section-A will be of objective type
- ✓ Section- B will have short answers
- ✓ Section- C will consist of long answers.
- ✓ Marks distribution for all sections will be as follows:

Section- A 1*10 = 10 marks

Section- B 4*5 = 20 marks

Section- C 6*5 = 30 marks

----- Total
= 60 marks

PART A: Introduction			
Program: Certificate		Class: B.C.A.	Semester: 1st
Session: 2021-22			
Subject: Computer Applications			
1.	Course Code	BCA - 101	
2.	Course Title	Computer Fundamentals, Organization and Architecture	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Major	
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.	
5.	Course Learning Outcomes (CLO)	<p>After the completion of this course, a successful student will be able to do the following:</p> <ol style="list-style-type: none"> 1. Understand the basic structure, operation and characteristics of digital computer. 2. Be able to design simple combinational digital circuits based on given parameters. 3. Familiarity with working of arithmetic and logic unit. 4. Know about hierarchical memory system including cache memories and virtual memory. 5. Know the contributions of Indians in the field of computer architecture and related technologies. 	
6.	Credit Value	Theory – 4 Credits Practical - 2 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lectures (in hours per week): 3 Hrs. per week			
Total No. of Lectures: 60 Hrs.			
Module	Topics		No. of Lectures
I	<p>Fundamentals of computers: Definition, Characteristics, capabilities and limitations, Types of Computers: Analog, Digital, Micro, Mini, Mainframe & Super Computers, Generations of Computers, Server.</p> <p>Smart Systems: definition, characteristics and applications. Definition of Embedded system, GIS, GPS, Cloud Computing, Concept of hardware, software and firmware.</p> <p>Use of computers in e-governance and various public domains and services.</p> <p>Block diagram of computer and its functional units.</p>		8
II	<p>Input devices - keyboard, scanner, mouse, light pen, bar code reader, OMR, OCR, MICR, track ball, joystick, touch screen camera, mic etc.</p> <p>Output devices: monitors – classification of monitors based on technology -CRT & flat panel, LCD,LED monitors, speakers, printers – dot matrix printer, ink jet printer, laser printer, 3D Printers, Wi-Fi enabled printers, plotters and their types , LCD/LED projectors.</p> <p>Computer memory and its types, Storage devices: Magnetic tapes,</p>		10

	Floppy Disks, Hard Disks, Compact Disc – CD-ROM, CD-RW, VCD, DVD, DVD-RW, usb drives, Blue Ray Disc, SD/MMC Memory cards.	
III	<p>Fundamentals of Digital Electronics: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes.</p> <p>Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design problems.</p> <p>Combinational Circuits- Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders</p> <p>Sequential Circuits - Flip - Flops, Registers, Counters.</p>	10
IV	<p>Basic Computer Organization: Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts</p> <p>Instruction formats, Addressing modes, Instruction codes, Machine language, Assembly language.</p> <p>Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations.</p>	10
V	<p>Processor and Control Unit: Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, Introductory concept of RISC, CISC, advantages and disadvantages of both.</p> <p>Pipelining – concept of pipelining, introduction to Pipelined data path and control – Handling Data hazards & Control hazards.</p>	10
VI	<p>Memory and I/O Systems - Peripheral Devices, I/O Interface, Data Transfer Schemes - Program Control, Interrupt, DMA Transfer. I/O Processor.</p> <p>Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.</p>	10
VII	<p>Indian contribution to the field – Contributions of reputed scientists of Indian origin - like - Dr. Vinod Dham – Father of Intel Pentium Processor, Dr. Ajay Bhat – Co-Inventor of USB Technology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar - architect of India's national initiative in supercomputing, and many others.</p> <p>Parallel Computing projects of India – PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.</p>	2

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

1. M.Morris Mano, “Computer System Architecture”, PHI.
2. Heuring Jordan , “Computer System Design & Architecture” (A.W.L.)

Reference Books:

3. William Stalling, “Computer Organization & Architecture”, Pearson Education Asia.
4. V. Carl Hamacher , “Computer Organization”, TMH
5. Tannenbaum, “Structured Computer Organization”, PHI.
6. Er. Rajiv Chopra, “Computer Architecture”, Revised 3rdEdition, S. Chand & Company Pvt. Ltd

Suggestive digital platform web links

<https://www.youtube.com/watch?v=4TzMyXmzL8M><https://nptel.ac.in/courses/106/106/106106166/><https://nptel.ac.in/courses/106/106/106106134/>

Suggested equivalent online courses

<https://nptel.ac.in/courses/106/105/106105163/>**PART D: Assessment and Evaluation**

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:	External Assessment: University Exam (UE) : 60 Marks Time : 03.00 Hours
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Assessment and presentation of assignment	10 Marks	Section (A): Ten MCQ Questions	01 x 10 = 10 Marks
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Class Test I (Objective Questions)	10 Marks
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Class Test II (Descriptive Questions)	10 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 04 = 20 Marks
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Class Test III (Based on solving circuit design problems)	10 Marks	Section (C): Five Long Questions (500 Words Each)	06 x 05 = 30 Marks
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Total	40 Marks	Total	60 Marks
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Any remarks/suggestions:

PART A: Introduction			
Program: Certificate		Class: B.C.A	Semester: 1st
Session: 2021-22			
Subject: Computer Applications			
1.	Course Code		
2.	Course Title	Computer Fundamentals and Architecture Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Core Course	
4.	Pre-Requisite (if any)	Nil	
5.	Course Learning Outcomes(CLO)	After the completion of this course, a successful student will be able to do the following: <ol style="list-style-type: none"> 1. Realization of the basic logic and universal gates. 2. Verify the behavior of logic gates using truth tables. 3. Implement Binary-to -Gray, Gray-to -Binary code conversions. 4. Design half and full adder circuit using basic gates. 5. Design and construct flip flops and verify the excitation tables. 	
6.	Credit Value	Practical - 2 Credits	
7.	Total Marks	Max.Marks: 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lab. Practicals (in hours per week): 2 Hrs. per week			
Total No. of Labs: 60 Hrs.			
	Suggestive list of Practicals		No. of Labs.
	<ol style="list-style-type: none"> 1. Verification and interpretation of truth table for AND, OR, NOT gates 2. Verification and interpretation of truth table for NAND, NOR gates 3. Verification and interpretation of truth table for Ex-OR, Ex-NOR gates 4. Study of half adder using XOR and NAND gates and verification of its operation 5. Study of full adder using XOR and NAND gates and verification of its operation 6. Study of half subtractor and verification of its operation 7. Study of full subtractor and verification of its operation 8. Realization of logic functions with the help of NAND -Universal Gates 9. Realization of logic functions with the help of NOR -Universal Gates 10. Verify the truth table of RS flip-flops using NAND and NOR gates 11. Verify the truth table of JK flip-flops using NAND and NOR gates 12. Verify the truth table of T and D flip-flops using NAND and NOR gates 13. Implementation of 4x1 multiplexer using logic gates 14. Implementation of 1x4 demultiplexer using logic gates 		60 Hrs.

	15. Verify Gray to Binary conversion using NAND gates only 16. Verify Gray to Binary conversion using NAND gates only	
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PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

- M.Morris Mano, “Computer System Architecture”, PHI.
- Heuring Jordan , “Computer System Design & Architecture” (A.W.L.)

Reference Books:

- William Stalling, “Computer Organization & Architecture”, Pearson Education Asia.
- V. Carl Hamacher , “Computer Organization”, TMH
- Tannenbaum, “Structured Computer Organization”, PHI .

Suggestive digital platform web links

<https://de-iitr.vlabs.ac.in/>

Suggested equivalent online courses

<https://nptel.ac.in/courses/106/105/106105163/>

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks		External Assessment: University Exam (UE): 60 Marks Time : 03.00 Hours	
Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	10 Marks	Practical record file	10 Marks
Viva	10 Marks	Viva voce practical	20 Marks
Lab Test from practical list	10 Marks	Table works/ Exercise Assigned (02) in practical exam	10 Marks
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	10 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	20 Marks
Total <i>Excursion/ Lab visits/ Industrial Training is compulsory</i>	40 Marks	Total	60 Marks

PART A: Introduction			
Program: Certificate	Class: B.C.A.	Semester : 1st	Session: 2021-22
Subject: Computer Application			
1.	Course Code	BCA-102	
2.	Course Title	C Programming	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Minor	
4.	Pre-Requisite (if any)		
5.	Course Learning Outcomes (CLO)	<p>After the completion of this course, a student shall be able to do the following:</p> <ol style="list-style-type: none"> 1. Identify situations where computational methods and computers would be useful. 2. Given a computational problem, identify and abstract the programming task involved. 3. Approach the programming tasks using techniques learned and write pseudo-code. 4. Choose the right data representation formats based on the requirements of the problem. 5. Use the comparisons and limitations of the various programming constructs and 6. choose the right one for the task in hand. 7. Write the program on a computer, edit, compile, debug, correct, recompile and run it. 8. Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task. 	
6.	Credit Value	Theory - 4 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lectures (in hours per week): 2 Lectures per week			
Total No. of Lectures: 60 Hrs.			
Module	Topics		No. of Lectures
I	<p>INTRODUCTION OF C LANGUAGE: Features of C ,Portability, History ,Structure of C language , Keyword, Identifiers ,Constraint. C LANGUAGE IDE'S: What is IDE's Type of IDE's , Turbo C++,Dev C++,C-Free , DATA TYPES , Basic Data Types ,Primitive Data types ,Type Casting & Type Conversion ,OPERATORS ,Unary Operator ,Binary Operator , Ternary Operator , Order of Evaluation.</p>		6
II	<p>SELECTION STATEMENTS: Simple if & If-else, Nested if , If-else if ,Break , continue and goto statement ,Switch case statement. ITERATION STATEMENTS : While , For , Do-While , Nested loop statement. ARRAYS: Introduction to an Array, Need of Array, Types of Array, Working with 1-D Array , Working with 2-D & Multi-Dimensional Array. STRING: MANIPULATION, Declaring and Initializing String , Char array manipulation,Use of <string.h>,String library function , String formatted specifiers, multiple String</p>		12
III	<p>FUNCTIONS: Introduction to Function , Classification of function</p>		12

	,Function prototype Declaring function, calling function, Function , with array , Function with string, Recursive functions STORAGE CLASS: Needs of storage class?, Types of Storage class, PREPROSESSOR: What is pre-processor , Type of Pre-processor , #define , #undef ,Macros , #include directive, header files , Condition compilation, #pragma, #error etc...	12
IV	DYNAMIC MEMORY ALLOCATION Memory management, Types of memory allocation,Allocation (malloc, calloc, realloc),De- Allocation(free) COMMAND LINE ARGUMENTS : What is a command line argument? POINTERS: Introduction to Pointer , Operation on Pointer , Pointer to Pointer , Pointer to Array , Array to Pointer , Void Pointer, Call by Value and Call by Address , Passing pointer to functions, Pointer to function .	12
V	STRUCTER, UNION AND ENUM : Introduction to structure , Declaring structure , Structure with array , Structure with function , Nested of structure , Introduction to Union, Difference between structure and union , Enumeration, typedef, function that return Structure & Union. FILES: Introduction,File Input, Output operation , Random access file , Error handling, Basic Concepts of Graphics,	12
PART C: Learning Resources		
Textbooks, Reference Books, Other Resources		
Suggested Readings		
Textbooks: <ul style="list-style-type: none"> • D. Ravichandran, programming New Age International, 1996. • E. Balaguruswamy, Tata McGraw Hill Pub. Reference Books: <ul style="list-style-type: none"> • Y.Kanitkar, Let us C. BPB Publication, 4th Ed. 2002. • Rajiv Dharaskar, Hidden Treasure of C, BPB Publication, 1995. • Shridhar B. Dandin, Programming – Pragma Publication (Hindi Medium) .		
Suggestive digital platform web links		
https://www.cprogramming.com/ https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial/index.html https://www.codewithharry.com/videos/c-tutorial-in-hindi-with-notes		
Suggested equivalent online courses		
https://nptel.ac.in/courses/106/105/106105171/		
PART D: Assessment and Evaluation		
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) : 60 Marks Time : 03.00 Hours
Assessment and presentation of assignment	10 Marks	Section (A) : Three Very Short Questions (50 Words Each) OR Nine MCQ Questions
Class Test I (Objective Questions)	10 Marks	
		01 x 10 = 10 Marks

Class Test II (Descriptive Questions)	10 Marks	Section (B) : Four Short Questions (200 Words Each)	04 x 05 = 20 Marks
Class Test III (Based on OS commands using scripting)	10 Marks	Section (C): Five Long Questions (500 Words Each)	05 x 06 = 30 Marks
Total	40 Marks	Total	60 Marks
Any remarks/suggestions:			

PART A: Introduction			
Program: Degree	Class: BCA.	Semester: 1st	Session: 2023-24
Subject: Computer Application			
1.	Course Code		
2.	Course Title	C Programming Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Lab	
4.	Pre-Requisite (if any)	This course can be adopted as an elective by the students of Computer Application.	
5.	Course Learning Outcomes (CLO)	After the completion of this course, a student shall be able to: <ul style="list-style-type: none"> • Basic Concepts of programming • Build Logic • Knowledge of problem solving skills 	
6.	Credit Value	Theory - 4 Credits Practical – 2 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 33
PART B: Content of the Course			
No. of Lab. Practicals (in hours per week): 1 Lab. per week			
Total No. of Lab.: 30 Hrs.			
Suggestive List of Practicals			No. of Labs.
C Programming: <ul style="list-style-type: none"> • Write a program to check given year is leap or not • Write a program to find maximum from given three number without using logical operator. • Write a program to find area of a circle, rectangle, and square using switch-case. • Write a program whether a given number is prime or not. • Write a program to input 10 numbers add it and find its average. • Write a program to generate even/odd series from 1 to 100. • Write a program to generate a series $1+1/1!+2/2!+3/3!+-----+n/n!$ • Prepare a program for finding the root of a Quadratic Equation. • Write a program to create a pyramid structure 			30

* ** *** **** *****	ABCDE ABCD ABC AB A	1 12 123 1234 12345	***** 0000 *** 00 *	1 10 101 1010 10101
1 01 101 0101 10101	1 22 333 4444 55555	A AB ABC AB A	ABCDEDCBA ABCD DCBA ABC CBA AB BA A A	1 121 12321 1234321 123454321
***** ***** ***** ***** *****	1 2 3 4 5 2 3 4 5 1 3 4 5 1 2 4 5 1 2 3 5 1 2 3 4	5 4 3 2 1 4 3 2 1 3 2 1 2 1 1	***** **** *** ** *	1 2 3 4 5 1 5 1 5 1 5 1 2 3 4 5

- Write a program to reverse a string.
- Write a program to find whether a given string is PALINDROME or not.
- Write a program to change the case of string.
- WAP to print Fibonacci series
- Write a program to generate series $1+1/2!+1/3!+\dots+1/n!$
- WAP to find length of string without using built in function.
- Write a program for call by value and call by reference.
- Write a recursive program to calculate factorial of a given number.
- Write a program to print sum of two matrices.
- Write a program to demonstrate different storage
- Program to calculate the sum of n numbers entered by the user by using malloc/callock function.
- Write a program to demonstrate concept of command line argument.
- Write a program to demonstrate concept of structure.
- Write a program to demonstrate concept of union.
- Write a program to demonstrate concept of file handling.
- Write a program to draw Line, Circle, Rectangle by using built in function.

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:			
<ul style="list-style-type: none"> • D. Ravichandran, programming New Age International, 1996. • E. Balaguruswamy, Tata McGraw Hill Pub. • Computer Fundamentals and Programming in C by R.Thareja. 			
Suggestive digital platform web links			
https://codeforwin.org/ http://learn-c.org/			
Suggested equivalent online courses			
https://nptel.ac.in/courses/106/105/106105171/ https://www.youtube.com/watch?v=OHCMfsNpqCc			
PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks		External Assessment: University Exam (UE) : 60 Marks Time : 02.00 Hours	
Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	10 Marks	Practical record file	10 Marks
Viva	10 Marks	Viva voce practical	20 Marks
Lab Test from practical list	10 Marks	Table works/ Exercise Assigned (02) in practical exam	10 Marks
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	10 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	20 Marks
Total	40 Marks	Total	60 Marks
<i>Excursion/ Lab visits/ Industrial Training is compulsory</i>			

PART A: Introduction			
Program: Certificate		Class: BCA	Semester: 1st
Session: 2021-22			
Subject: Computer Applications			
1.	Course Code	BCA-103-EL-1	
2.	Course Title	Computational Mathematics	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Open Elective	
4.	Pre-Requisite (if any)	Students must have basic analytical aptitude.	
5.	Course Learning Outcomes (CLO)	On successful completion of the course the students shall be able to: <ol style="list-style-type: none"> 1. Implement trigonometric solutions for measurements in real world scenarios 2. Implement matrices and simultaneous equations to solve complex problems 3. Use statistical tools efficiently 4. Use Mathematical Logic and predicate calculus for solving problems 5. Apply the concepts of set theory for finding solutions to set related problems 	
6.	Credit Value	Theory - 6 Credits	
7.	Total Marks	Max. Marks: 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lectures (in hours per week): 3 lectures Per week			
Total No. of Lectures: 90 Hrs.(120 lectures)			
Unit	Topics		No. of Lectures
I	Trigonometry: Angles & their Measurement, Values of Trigonometric Ratios, Height and Distances. Elementary Matrices and types of matrices.		25
II	Equations: Simultaneous linear equations, Methods of Solving Simultaneous equations, Quadratic equations.		25
III	Statistics: Frequency Distribution, Measure of Central Tendency: Mean, Mode, Median, Measures of variation: Mean deviation Standard Deviation,		15
IV	Mathematical Logic: Statements and notations, Connectives: Negation, Conjunction, And Disjunction. Statement formulas and truth tables. Tautologies, Tautological implications, contradiction contingency		25
V	Set Theory: Basic concepts of set theory, notation, inclusion and equality of sets, the power set, types of sets, operations on set, Venn diagrams.		30

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Text Books:

1. Business Mathematics S.M.SHUKLA, SahityaBhawan Publications.
2. Business Mathematics D C Agrawal, SreeSaiPrakashan.
3. DiscreteStructure ,5/E, D.C Agrawal,S Chand Publishing.
4. A text book of Discrete Mathematics,9/E ,Sarkar S.K, S.Chand New Delhi,2016

Reference Books:

1. Fundamental of Statistics ELHANCE&ELHANCE,KitabMahalPublication.
2. Mathematical Statistics,8/E RAY and .SHARMA,Ram Prasad and Sons.
3. Business Mathematics, J,K Singh,Himalaya Publishing House 2017
4. Business Mathematics, 9/E, Sancheti and Kapoor ,Sultan Chand & Sons ,2014
5. Discrete Mathematics structures with application to computer science”, Indian Edition, J. P. Tremblay, R Manohar,McGraw Hill Education 2017
6. “Discrete Mathematical”,2/E,J.K Sharma, Macmillan publication, 2005

Suggestive digital platform web links

<https://byjus.com/maths/trigonometry/>

<https://www.skillsyouneed.com/num/trigonometry.html>

<https://www.mathsisfun.com/algebra/trigonometry.html>

<https://www.mbacrystalball.com/blog/2015/10/09/set-theory-tutorial/>

<https://plato.stanford.edu/entries/set-theory/basic-set-theory.html>

Suggested equivalent online courses

S.No.	Course Title	Duration	Provider
1	Algebra and Trigonometry	15 weeks	Swayam
2	Mathematics	8 weeks	Mitopen Courseware

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) :60 Marks Time :03.00 Hours	
Assessment and presentation of assignment	10 Marks	Section (A) : Ten Very Short Questions (50 Words Each) OR Nine MCQ Questions	01 x 10 = 10 Marks
Class Test I (Objective Questions)	10 Marks		
Class Test II (Descriptive Questions)	10 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 04 = 20 Marks
Class Test III (Objective and Descriptive)	10 Marks	Section (C): Five Long Questions (500 Words	06 x 05 = 30 Marks

Questions)		Each)	
Total	40 Marks	Total	60 Marks
Any remarks/suggestions:			

आधार पाठ्यक्रम : प्रथम प्रश्न पत्र – हिन्दी भाषा

(भाग अ) परिचय			
कार्यक्रम : यूजी लेवल प्रमाण-पत्र	कक्षा :बी.सी.ए.. प्रथम	वर्ष : 2021	सत्र 2021-22
विषय	आधार पाठ्यक्रम		
1.	कोर्स कोड	BCA-104	
2.	कोर्स का शीर्षक	भाषा और संस्कृति	
3.	कोर्स का प्रकार	आधार पाठ्यक्रम	
4.	कोर्स अपेक्षित	कक्षा 12वीं उत्तीर्ण किसी भी विषय समूह से	
5.	कोर्स अधिगम उपलब्धि (लर्निंग आउटकम) (CLO)	<ol style="list-style-type: none"> 1. उत्कृष्ट साहित्यिक पाठों के अध्ययन से रूचि का विकास करना। 2. सांस्कृतिक चेतना और राष्ट्रीय भावना का विकास करना। 3. भाषा-ज्ञान 4. सामान्य शब्दावली और विशेष शब्दावली के अध्ययन द्वारा भाषा एवं संस्कृति बोध का विकास करना 5. विशिष्ट शब्दावली (बीज शब्द/की वर्ड) से परिचित करवाते हुए बोध के स्तर को विकसित करना। 6. प्रतियोगी परीक्षाओं हेतु तैयार करना। 	
6.	क्रेडिट मान	02 क्रेडिट	
7.	कुल अंक	50 अंक	
8.	उत्तीर्ण अंक	17 अंक	

(भाग बी) कोर्स सामग्री		
व्याख्यान की कुल संख्या : वर्ष में अधिगम 15 घण्टे		
यूनिट	विषय	व्याख्यान की संख्या
इकाई – एक	<ol style="list-style-type: none"> 1. मैथिलीशरण गुप्त परिचय पाठ : मातृभूमि (कविता) 2. प्रेमचन्द परिचय पाठ : शतरंज के खिलाड़ी (कहानी) 3. व्यंग्य शरद जोशी – जीप पर सवार इल्लियाँ 	5 घण्टे
इकाई – दो	<ol style="list-style-type: none"> 1. वैचारिक-भारतीय भाषाओं में राम 2. आचार्य रामचन्द्र शुक्ल : परिचय पाठ : उत्साह (भावमूलक निबन्ध) 3. रामधारी सिंह दिनकर : परिचय पाठ : भारत एक है (संस्कृति) 4. आदिशंकराचार्य – जीवन व दर्शन 	
इकाई – तीन	<ol style="list-style-type: none"> 1. पर्यायवाची शब्द; विलोम शब्द; अनेक शब्द के लिए एक शब्द (हिन्दी व्याकरण) 	

	2. संधि और उसके प्रकार (हिन्दी व्याकरण) 3. बीज शब्द – धर्म, अद्वैत, भाषा, अवधारणा, उदारीकरण।	
सर्च करे :		
मैथिलीशरण गुप्त	मैथिलीशरण गुप्त की कविता मातृभूमि	
प्रेमचंद	प्रेमचंद शतरंज के खिलाड़ी	
रामधारी सिंह दिनकर	भारत एक है रामधारी सिंह दिनकर	
आचार्य रामचन्द्र शुक्ल	उत्साह निबन्ध रामचन्द्र शुक्ल	
स्वामी विवेकानन्द धर्म क्या है	शिकागो व्याख्यान	
अद्वैत		
भाषा विकास		
भाषा परिभाषा		
अवधारणा का अर्थ एवं परिभाषा		
उदारीकरण की विशेषता		
पर्यायावाची शब्द		
विलोम शब्द		
अनेक शब्द के लिए एक शब्द		
संधि		

(भाग सी)

अनुशासित अध्ययन संसाधन

पाठ्य पुस्तकें, सन्दर्भ पुस्तकें, अन्य संसाधन

1. प्रेमचन्द – मानसरोवर, खण्ड – 3
2. आचार्य रामचन्द्र शुक्ल – चिन्तामणि, भाग 1
3. डॉ. वासुदेव नन्दन प्रसाद : आधुनिक हिन्दी व्याकरण और रचना, भारती भवन, ठाकुर बाड़ी रोड, पटना, बिहार
4. डॉ. राजेश्वर चतुर्वेदी, हिन्दी व्याकरण – उपकार प्रकाशन, आगरा, उ.प्र.
5. हिन्दी ज्ञान कोश
6. इन्टर नेट सामग्री – टैग में उल्लेखित

(भाग डी)

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 15 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:	External Assessment: University Exam (UE) :35 Marks Time :03.00 Hours		
Class Test I (Objective Questions)	5 Marks	Section (A) : Five MCQ Questions	01 x 05 = 5 Marks
Class Test II (Descriptive Questions)	5 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 02 = 10 Marks
Class Test III (Objective and Descriptive Questions)	5 Marks	Section (C): Four Long Questions (500 Words Each)	05 x 04 = 20 Marks
Total	15 Marks	Total	35 Marks

Part A - Introduction			
Program: UG Level	Class: BCA	Semester: 1st	Session 2021-22
Subject : Foundation Course (English)			
1	Course Code	BCA -105	
2	Course Title	English Language And Indian Culture	
3	Course Type (Core Course/Elective/ Generic Elective/ Vocational)	Foundation Course	
4	Prerequisite (if any)	To study this course, a student should have basic knowledge of English language. This course will be studied by all the students of UG level under the Foundation Course category.	
5	Course Learning Outcome (CLO)	Through this course the students will be able to : <ol style="list-style-type: none"> 1. Prepare for various competitive exams by developing their English language competence. 2. Promote their comprehension skills by being exposed to a variety of texts and their interpretations. 3. Build and enhance their vocabulary. 4. Develop their communication skills by strengthening grammar and usages. 5. Inculcate values which make them aware of national heritage and environmental issues, making them responsible citizens. 	
6	Credit Value	02 Credit	
7	Total Marks	Max Marks : 50	Min Passing Marks: 17

Part B: Content of the Course		
Total No. of Lectures/Tutorials/Practical (in hours per week) Total No. of Lectures =3		
Unit	Topic	No. of Lectures
I	Reading, Writing and Interpretation Skills : <ol style="list-style-type: none"> 1. Where The Mind is Without Fear – Rabindranath Tagore [Key Word : Patriotism] 2. National Education – M.K. Gandhi [Key Word : Edification] 3. The Axe – R.K. Narayan [Key Word : Environment] 4. The Wonder That Was India – A.L. Basham (an excerpt) [Key Word : Indianness] 5. Prefare to the Mahabharta C. Rajagopalachari [Key Word : Indian Mythology] 	05
II	Comprehension Skills : Unseen Passage followed by Multiple choice questions.	05
III	Basic Language Skills : <ol style="list-style-type: none"> 1. Vocabulary Building : Suffix, Prefix, Synonyms, Antonyms, Homophones, Homonyms and One-word substitution. 2. Basic Grammar : Noun, Pronoun, Adjective, Verb, Adverb, Prepositions, Articles, Time and Tense 	05

Part - C – Learning Resources	
Text Books, Reference Books, Other resources	
Suggested Reading :	
<ul style="list-style-type: none"> • Essential English Grammar – Raymone¹ Murphy, Cambridge University Press. • Practical English Grammar Exercises 1 – A.J. Thomson & A.V. Martinet, Oxford India. • Practical English Usage – Michael Swan, Oxford • English Grammar in Use – Raymond Murphy, Cambridge University Press. 	

PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 15 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) : 35 Marks Time :03.00 Hours	
Class Test I (Objective Questions)	5 Marks	Section (A) : Five MCQ Questions	01 x 05 = 5 Marks
Class Test II (Descriptive Questions)	5 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 02 = 10 Marks
Class Test III (Objective and Descriptive Questions)	5 Marks	Section (C): Four Long Questions (500 Words Each)	05 x 04 = 20 Marks
Total	15 Marks	Total	35 Marks
Any remarks/suggestions:			

Part A Introduction			
Program: Certificate Course		Class: BCA	Semester: 1 st
Subject:Computer Applications			
1	Course Code	BCA 103-EL-2	
2	Course Title	Probability and Statistics	
3	Course Type	Open Elective	
4	Pre-requisite (if any)		
5	Course Learning Outcomes (CLO)	<p>This course will enable the students to:</p> <ol style="list-style-type: none"> 1. Describe and calculate the mean deviation, standard deviation, range, quartiles and percentiles. 2. Understand and use the terminology of probability. 3. Determine whether two events are mutually exclusive and independent. 4. Calculate probabilities using the addition and multiplication rules. 5. Recognize and understand discrete and continuous probability distribution functions, binomial, uniform and exponential probability distribution. 6. Calculate and interpret the correlation coefficient. 7. Understand the basic concepts of linear regression and correlation. 8. Interpret the Student's t probability distribution, chi-square goodness-of-fit, F and Z test. 	
6	Credit Value	Theory: 6Credit	
7	Total Marks	Max. Marks: 25 + 75	Min. Passing Marks:

Part B - Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week		
Total Lectures: 90 hours		
Unit	Topics	No. of Lectures
I	Theory of Probability - I: Event and Sample space, Probability of an event, Addition and multiplication theorem of probability, Inverse probability, Baye's theorem. Continuous probability.	18
II	Theory of Probability - II: Probability density function and its applications, Standard deviation of various continuous probability distributions, Mathematical expectation, Expectation of sum and product of random variables.	18
III	Dispersion and Distribution: Measures of dispersion: Range and interquartile range, Mean deviation and Standard deviation, Moments, Skewness and kurtosis. Moment generating function. Theoretical distribution: Binomial, Poisson, Rectangular, Exponential.	18

IV	Curve fitting and Correlation: Methods of least squares, Curve fitting, Correlation and regression, Partial and multiple correlations (up to three variables only)	18
V	Sampling: Sampling of large samples, Null and alternative hypothesis, Errors of first and second kinds, Level of significance and critical region, Tests of significance based on chi-square (χ^2), t, F and Z distribution.	18
Keywords/Tags: Probability, Dispersion, Moment generating function, Theoretical distribution, Curve fitting, Correlation, Regression, Sampling.		
Remark: Scientific calculator will be allowed during examination.		

Part C - Learning Resources	
Text Books, Reference Books, Other Resources	
Suggested Readings:	
Text Books:	
1. H. C. Saxena and J. N. Kapoor: Mathematical Statistics, S. Chand and Company, 2010.	
2. E. Rukmangadachari: Probability and Statistics, Pearson Education India; First edition, 2012.	
3. मध्य प्रदेश हिन्दी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें।	
Reference Books:	
1. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh: An Introduction to Probability and Statistics, Wiley; 3rd edition, 2015.	
2. S. C. Gupta and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2014.	
Suggested Digital Platforms Web links:	
https://www.highereducation.mp.gov.in/?page=xhzIQmpZwkylQo2b%2Fy5G7w%3D%3D	
Suggested Equivalent online courses:	
https://nptel.ac.in/courses/111106112/	
https://nptel.ac.in/courses/111105090/	
https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/313	
https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/327	

PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) :60 Marks Time :03.00 Hours	
Assessment and presentation of assignment	10 Marks	Section (A) : Ten Very Short Questions (50	01 x 10 = 10 Marks

Class Test I (Objective Questions)	10 Marks	Words Each) OR Nine MCQ Questions	
Class Test II (Descriptive Questions)	10 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 04 = 20 Marks
Class Test III (Objective and Descriptive Questions)	10 Marks	Section (C): Five Long Questions (500 Words Each)	06 x 05 = 30 Marks
Total	40 Marks	Total	60 Marks
Any remarks/suggestions:			

BCA SECOND SEMESTER

PART A: Introduction			
Program: Certificate		Class: B.C.A.	Semester: 2nd
Session: 2021-22			
Subject: Computer Applications			
1.	Course Code	BCA-201	
2.	Course Title	Programming Methodology & Data Structures	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Major	
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.	
5.	Course Learning Outcomes(CLO)	<p>After the completion of this course, a successful student will be able to do the following:</p> <ol style="list-style-type: none"> 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles. 6. Have knowledge of complexity of basic operations like insert, delete, search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 9. Assess efficiency tradeoffs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting. 11. Know the contributions of Indians in the field of programming and data structures. 	
6.	Credit Value	Theory – 4 Credits Practical – 2 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lectures (in hours per week): 3 Hrs. per week			
Total No. of Lectures: 60 Hrs.			

Module	Topics	No. of Lectures
I	<p>Introduction to Programming - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies.</p> <p>Basics of C++: A Brief History of C++, Application of C++, Compiling & Linking, Tokens, Keywords, Identifiers & Constants , Basic Data Types, User-Defined Data Types, Symbolic Constant, Type Compatibility, Reference Variables, Operator in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator.</p> <p>Functions In C++: The Main Function, Function Prototyping, Call by Reference Call by Address, Call by Value, Return by Reference, Inline Function, Default Arguments, Constant Arguments, Function Overloading, Function with Array.</p>	8
II	<p>Classes & Objects: A Sample C++ Program with class, Defining Member Functions, Making an Outside Function Inline, Nesting of Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member Functions, Array of Objects, Object as Function Arguments, Friend Functions, Virtual functions, Returning Objects, Constant member functions, Pointer to Members, Local Classes.</p> <p>Constructor & Destructor: Constructor,Parameterized Constructor, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor and Destructor.</p>	10
III	<p>Inheritance: Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes.Operator Overloading & Type Conversion, Polymorphism, Pointers, Pointers with Arrays C++, Streams, C++ Stream Classes, Unformatted I/O Operation, Formatted I/O Operation, Managing Output with Manipulators, Exception Handling.</p>	8
IV	<p>Data Structure: Basic concepts, Linear and Non-Linear data structures</p> <p>Algorithm Specification:Introduction, Recursive algorithms, Data Abstraction, Performance analysis.</p> <p>Arrays: Representation of single, two-dimensional arrays, triangular arrays, sparse matrices-array and linked representations.</p> <p>Stacks: Operations, Array and Linked Implementations, Applications-Infix to Postfix Conversion, Infix to Prefix Conversion,Postfix Expression Evaluation, Recursion Implementation.</p> <p>Queues: Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.</p>	12
V	<p>Linked Lists:Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly</p>	10

	<p>Linked Lists- Operations, Doubly Circular Linked List, Header Linked List</p> <p>Trees: Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees.</p> <p>Heap: Definition, Insertion, Deletion.</p>	
VI	<p>Graphs: Graph ADT, Graph Representations, Graph Traversals, Searching.</p> <p>Hashing: Introduction, Hash tables, Hash functions, Overflow Handling.</p> <p>Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison of Sorting Methods,</p> <p>Search Trees: Binary Search Trees, AVL Trees- Definition and Examples.</p>	10
VII	<p>Indian Contribution to the field: Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new programming languages, open source languages, Dr. SartajSahni – computer scientist - pioneer of data structures, Other relevant contributors and contributions.</p>	2

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

- J. R. Hanly and E. B. Koffman, “Problem Solving and Program Design in C”, Pearson, 2015
- E. Balguruswamy, "C++ ", TMH Publication ISBN O-07-462038-X
- Herbert Schildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7

Reference Books:

- R. Lafore, 'Object Oriented Programming C++'
- N. Dale and C. Weems, “Programming and problem solving with C++: brief edition”, Jones & Bartlett Learning.
- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- SartajSahani, “Data Structures, Algorithms and Applications with C++”, McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, “Data Structure using C++”, Second edition, Cengage Learning.
- M. A. Weiss, “Data structures and Algorithm Analysis in C”, 2nd edition, Pearson.
- Lipschutz, “Schaum’s outline series Data structures”, Tata McGraw-Hill

Suggestive digital platform web links

<https://www.youtube.com/watch?v=BCIS40yzssA>
<https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en>
<https://www.youtube.com/watch?v=Umm1ZQ5ltZw>

Suggested equivalent online courses

S.No.	Online Course	Duration	Platform
1	Programming in C++ https://nptel.ac.in/courses/106/105/106105151/	8 weeks	NPTEL
2	Beginning C++ Programming - From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-plus-	Self paced	Udemy

	programming/		

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) : 60 Marks Time : 03.00 Hours	
Assessment and presentation of assignment	10 Marks	Section (A) : Ten MCQ Questions	01 x 10 = 10 Marks
Class Test I (Objective Questions)	10 Marks		
Class Test II (Descriptive Questions)	10 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 04 = 20 Marks
Class Test III (Based on solving programming problems)	10 Marks	Section (C): Five Long Questions (500 Words Each)	06 x 05 = 30 Marks
Total	40 Marks	Total	60 Marks

Any remarks/suggestions: **Focus of the course/teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.**

PART A: Introduction			
Program: Certificate		Class: B.C.A.	Semester: 2nd
Session: 2021-22			
Subject: Computer Applications			
1.	Course Code		
2.	Course Title	Programming Methodology Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Core Course	
4.	Pre-Requisite (if any)	To study this course, a student must have basic logical and analytical skills.	
5.	Course Learning Outcomes(CLO)	<p>After the completion of this course, a successful student will be able to do the following:</p> <ol style="list-style-type: none"> 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Possess ability to choose a data structure to suitably model any data used in computer applications. 6. Implement and know the applications of algorithms for searching and sorting etc. 	
6.	Credit Value	Practical – 2 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lab Practicals (in hours per week): 2 hours per week			
Total No. of Lab.: 60 Hrs.			
	Suggestive list of Practicals		No. of Labs.
	<p>Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following :</p> <ol style="list-style-type: none"> 1. Write a program to swap the contents of two variables. 2. Write a program for finding the roots of a Quadratic Equation. 3. Write a program to find area of a circle, rectangle, square using switch case. 4. Write a program to print table of any number. 5. Write a program to print Fibonacci series. 6. Write a program to find factorial of a given number using recursion. 7. Write a program to convert decimal (integer) number into 		60

	<p>equivalent binary number.</p> <ol style="list-style-type: none"> 8. Write a program to check given string is palindrome or not. 9. Write a program to print digits of entered number in reverse order. 10. Write a program to print sum of two matrices. 11. Write a program to print multiplication of two matrices. 12. Write a program to generate even/odd series from 1 to 100. 13. Write a program whether a given number is prime or not. 14. Write a program for call by value and call by reference. 15. Write a program to create a pyramid structure <pre> 1 12 123 1234 </pre> 16. Write a program to check entered number is Armstrong or not. 17. Write a program to input N numbers and find their average. 18. Write a program to find the area and volume of a rectangular box using constructor. 19. Write a program to design a class time with hours, minutes and seconds as data members. Use a data function to perform the addition of two time objects in hours, minutes and seconds. 20. Write a program to implement single inheritance. 21. Write a program to find largest element from an array. 22. Write a program to implement push and pop operations on a stack using array. 23. Write a program to perform insert and delete operations on a queue using array. 24. Write a program for Linear search. 25. Write a program for Binary search. 26. Write a program for Bubble sort. 27. Write a program for Selection sort. 28. Write a program for Quick sort. 29. Write a program for Insertion sort. 30. Write a program to implement linked list. 	
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PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

- J. R. Hanly and E. B. Koffman, “Problem Solving and Program Design in C”, Pearson, 2015
- E. Balguruswamy, "C++ ", TMH Publication ISBN O-07-462038-X
- Herbert Schildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7

Reference Books:

- R. Lafore, 'Object Oriented Programming C++'
- N. Dale and C. Weems, “Programming and problem solving with C++: brief edition”, Jones & Bartlett Learning.

- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- SartajSahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
- M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
- Lipschutz, "Schaum's outline series Data structures", Tata McGraw-Hill

Suggestive digital platform web links

<https://www.youtube.com/watch?v=BCIS40yzssA>
<https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en>
<https://www.youtube.com/watch?v=Umm1ZQ5ltZw>

Suggested equivalent online courses

S.No.	Online Course	Duration	Platform
1	Programming in C++ https://nptel.ac.in/courses/106/105/106105151/	8 weeks	NPTEL
2	Beginning C++ Programming - From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-plus-programming/	Self paced	Udemy

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks	External Assessment: University Exam (UE) : 60 Marks Time : 02.00 Hours
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Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	10 Marks	Practical record file	10 Marks
Viva	10 Marks	Viva voce practical	20 Marks
Lab Test from practical list	10 Marks	Table works/ Exercise Assigned (02) in practical exam	10 Marks
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	10 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	20 Marks
Total <i>Excursion/ Lab visits/ Industrial Training is compulsory</i>	40 Marks	Total	60 Marks

PART A: Introduction			
Program: Certificate	Class: B.C.A.	Semester: 2nd	Session: 2021-22
Subject: Computer Application			
1.	Course Code	BCA-202	
2.	Course Title	Operating System	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Minor	
4.	Pre-Requisite (if any)		
5.	Course Learning Outcomes (CLO)	<p>After the completion of this course, a student shall be able to do the following:</p> <ol style="list-style-type: none"> 1. Describe the importance of computer system resources and the role of operating system in their management policies and algorithms. 2. Specify objectives of modern operating systems and describe how operating systems have evolved over time. 3. Understand various process management concepts and can compare various scheduling techniques, synchronization, and deadlocks. 4. Describe the concepts of multithreading and memory management techniques. 5. Identify the best suited memory management technique for any process. 6. Describe various file operations, file allocation methods and disk space management. 7. To understand and identify potential threats to operating systems and the security features design to guard against them. 8. Learn to operate the Linux system, along with its administration and Shell programming 9. Getting to know the Android OS and its application framework. 	
6.	Credit Value	Theory - 4 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lectures (in hours per week): 2 Lectures per week			
Total No. of Lectures: 60 Hrs.			
Module	Topics		No. of Lectures
I	<p>Introduction to Operating System: What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems; Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems. Some prevalent operating systems – Windows, UNIX/Linux, Android, MacOS, Blackberry OS, Symbian, Bada etc.</p>		6
II	<p>Process Management: Process Concepts, Process states & Process Control Block. Process Scheduling: Scheduling Criteria, Scheduling Algorithms (Preemptive & Non- Preemptive) – FCFS, SJF, SRTN, RR, Priority,</p>		12

	Multiple-Processor, Real-Time, Multilevel Queue and Multilevel Feedback Queue Scheduling. Deadlock - Definition, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock. Deadlock Handling Approaches: Prevention, Avoidance, Detection and Recovery.	
III	Memory Management: Introduction, Address Binding, Logical versus Physical Address Space, Swapping, Contiguous & Non-Contiguous Allocation, Fragmentation (Internal & External), Compaction, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms. File Management: Concept of File System(File Attributes, Operations, Types), Functions of File System, Types of File System, Access Methods (Sequential, Direct & other methods), Directory Structure (Single-Level, Two-Level, Tree-Structured, Acyclic-Graph, General Graph), Allocation Methods (Contiguous, Linked, Indexed)	12
IV	Disk Management: Structure, Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK), Swap Space Management, Disk Reliability, Recovery. Security: Security Threats, Security policy mechanism, Protection, Trusted Systems, Authentication and Internal Access Authorization, Windows Security.	12
V	LINUX: Introduction, History and features of Linux, advantages, hardware requirements for installation, Linux architecture, file system of Linux - boot block, super block, inode table, data blocks. Linux standard directories, Linux kernel, Partitioning the hard drive for Linux, installing the Linux system, system - startup and shut-down process, init and run levels. Process, Swap, Partition, fdisk, checking disk free spaces. Difference between CLI OS & GUI OS, Windows v/s Linux, Importance of Linux Kernel, Files and Directories. Concept of Open Source Software.	
VI	Indian contribution to the field – the BOSS operating system, open source softwares, growth of LINUX, Aryabhatt Linux, contributions of innovators – RajenSheth, Sunder Pichai etc.	2

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

- A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications.
- A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education.
- Operating System by Peterson
- Linux by Sumitabh Das

Reference Books:

- G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education.
- W. Stallings, Operating Systems, Internals & Design Principles, 8th Edition, Pearson Education.
- M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill.
- Operating System design and Concepts by Milan Milenkovic.

Suggestive digital platform web links

- <https://web.iitd.ac.in/~minati/MTL458.html>
<https://www.cse.iitb.ac.in/~mythili/os/>

<https://www.youtube.com/watch?v=aCJ3YgoolHQ>

Suggested equivalent online courses

<https://nptel.ac.in/courses/106/102/106102132/>

PART D: Assessment and Evaluation

Internal Assessment : Continuous
Comprehensive Evaluation (CCE) : **40 Marks**
Shall be based on allotted assignments and Class
Tests. The marks shall be as follows:

External Assessment: University Exam (UE) : **60
Marks**

Time : **03.00 Hours**

Assessment and presentation
of assignment

10 Marks

Section (A) : TEN MCQ
Questions

01 x 10 = 10 Marks

Class Test I (**Objective
Questions**)

10 Marks

Class Test II (**Descriptive
Questions**)

10 Marks

Section (B) : Five Short
Questions (200 Words
Each)

05 x 04 = 20 Marks

Class Test III (**Based on OS
commands using scripting**)

10 Marks

Section (C): Five Long
Questions (500 Words
Each)

05 x 06 = 30 Marks

Total

40 Marks

Total

60 Marks

Any remarks/suggestions:

PART A: Introduction			
Program: Degree	Class: BCA	Semester: 2nd	Session: 2021-22
Subject: Computer Application			
1.	Course Code		
2.	Course Title	Operating System Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Discipline Specific Elective	
4.	Pre-Requisite (if any)	This course can be opted as an elective by the students of Computer Science.	
5.	Course Learning Outcomes (CLO)	After the completion of this course, a student shall be able to: <ul style="list-style-type: none"> • Operate the Linux system. • Do administration • Do Shell programming 	
6.	Credit Value	Theory - 4 Credits Practical – 2 Credits	
7.	Total Marks	Max. Marks : 40+60	Min. Passing Marks: 35
PART B: Content of the Course			
No. of Lab. Practicals (in hours per week): 2 Lab. per week			
Total No. of Lab.: 60 Hrs.			
	Suggestive List of Practicals		No. of Labs.
	Linux: a) Linux Directory Commands: pwd, mkdir, rm -rf, ls, cd, cd / , cd ~ b) Linux File Commands: touch, cat, cat >, cat >>, rm , cp, mv, rename c) Linux Permission Commands: su, id, useradd, passwd, groupadd, chmod, groupdel, chown, chgrp d) Linux File Content & Filter Commands: head, tail, tac, more, less, grep, cat, cut, grep, comm, sed, tee, tr, uniq, wc, od, sort, diff. e) Linux Utility Commands: find, bc, locate, date, cal, sleep, time, df, mount, exit, clear, gzip, gunzip. f) Linux Networking Commands: ip, ssh, mail, ping, host g) Edit Crontab file: to wall message on system on particular time automatically. h) Vi editor: Create file, edit, save and quit. Highlighting the searched term within a file. cut, yank, undo.		60
PART C: Learning Resources			
Textbooks, Reference Books, Other Resources			
Suggested Readings			
Textbooks:			
<ul style="list-style-type: none"> • Linux by Sumitabh Das • Linux Bible 			
Suggestive digital platform web links			
https://web.iitd.ac.in/~minati/MTL458.html https://www.cse.iitb.ac.in/~mythili/os/ https://www.youtube.com/watch?v=aCJ3YgoolHQ			

Suggested equivalent online courses			
https://nptel.ac.in/courses/106/102/106102132/			
https://www.youtube.com/watch?v=OHCMfsNpqCc			
PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks		External Assessment: University Exam (UE) : 60 Marks Time : 03.00 Hours	
Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	10 Marks	Practical record file	10 Marks
Viva	10 Marks	Viva voce practical	20 Marks
Lab Test from practical list	10 Marks	Table works/ Exercise Assigned (02) in practical exam	10 Marks
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	10 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	20 Marks
Total	40 Marks	Total	60 Marks
<i>Excursion/ Lab visits/ Industrial Training is compulsory</i>			

Part A - Introduction			
Programme: UG Level Certificate	Class: BCA	Semester: 2nd	Session 2021-22
Subject : Computer Application			
1	Course Code	BCA 204	
2	Course Title	Environment Education	
3	Course Type (Core Course/Elective/ Generic Elective/ Vocational)	Foundation Course	
4	Prerequisite (if any)	Nil.	
5	Course Learning Outcome (CLO)	<ol style="list-style-type: none"> 1. To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era. 2. To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate practices and policies, and develop framework to make inform decisions. 3. To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation. 4. To develop the critical thinking for shaping strategies such as; scientific, social, economic, administrative & legal, environmental protection, conservation of biodiversity, environmental equity and sustainable development. 5. To prepare for the competitive exams. 	
6	Credit Value	02 Credit	
7	Total Marks	Max Marks : 50	Min Passing Marks: 17

Part B: Content of the Course		
Total No. of Lectures/Tutorials/Practical (01 hours per week) Total No. of Lectures = 15Hrs		
Unit	Topic	No. of Lectures

I	<p>Reading, Writing and Interpretation Skills :</p> <ul style="list-style-type: none"> • Multidisciplinary nature, Scope and Importance of Environment. • Components of Environment : Atmosphere, Hydrosphere, Lithosphere, and Biosphere. • Brief account of Natural Resources and associated problems : Land Resource, Water Resource, Energy Resource. • Concept of Sustainability and Sustainable Development <p>[Key Word : Environment, Forest, Mineral, Food, Land, Water, Energy, Sustainable Development]</p>	5 Hrs.
II	<p>Biome, Ecosystem and Biodiversity :</p> <ul style="list-style-type: none"> • Major Biomes : Tropical, Temperate, Forest, Grassland, Desert, Tundra, Wetland, Estuarine and Marine • Ecosystem : Structure function and types their Preservation & Restoration • Biodiversity and its conservation practices <p>[Key Word : Biome, Ecosystem, Biodiversity]</p>	4 Hrs.
III	<p>Environmental Pollution, Management and Social Issues :</p> <ol style="list-style-type: none"> 1. Pollution : Types, Control measures, Management and associate problems. 2. Environmental Law and Legislation : Protection and conservation Acts. 3. International Agreement & Programme 4. Environmental Movements, communication and public programme. 5. National and International organizations related to environment conservation and monitoring. 6. Role of information technology in environment and human health. <p>[Key Word : Pollution, Environment Legislation, Environmental Movement, Environmental programme and organization]</p>	6 Hrs.
	<p>Suggested activities (at least one)</p> <ol style="list-style-type: none"> 1. Visit to an area to document environmental assets : rivers/forest/flora/fauna. 2. Visit to a local polluted site Urban/Rural/Industrial/Agricultural 3. Study of simple ecosystem. 	

Part - C – Learning Resources

Text Books, Reference Books, Other resources

Suggested Reading :

- Singh; J.S., Singh S.P. and Gupta, S.R., “Ecology; Environment Science and Conservation”. S.Chand publishing, New Delhi, (2018).
- Divan, S. and Rosencranz, A., “Environmental Law and Policy in India : Cases, Material & Status “ Oxford University Press, India, (2002) 2nd Edition.
- Odum, E.P., “Fundamentals of Ecology”, Philadelphia Saundres, (1971).
- Bharucha, Erach, “Environmental studies” Universities Press India Pvt. Ltd. Hyderabad (2014) (Hindi Edition also available)
- Kaushik, Anubha, Kaushik, C.P. “Perspectives in Environmental Studies” New age International Publishers, (2018) , 6th Edition.
- Asthana, D.K. Asthana Meera, “A Textbook of Environmental Studies”, S. Chand Publishing New Delhi, (2007).
- National Digital Library (<https://ndl.iitkgp.c.in/homestudy/science>)
- Epg-pathshala (<https://epgp.inflibnet.ac.in/Home/Download>)
- NPTEL (<https://nptel.ac.in/course.html>)
- Coursera (<https://www.coursera.org/search?query=environmental+science&page=1>)
- इराक भरूचा, पर्यावरण अध्ययन, ओरियन्ट ब्लैकस्वान प्राइवेट लिमिटेड नई दिल्ली (2014)
- दयाशंकर त्रिपाठी, पर्यावरण अध्ययन, मोतीलाल बनारसीलाल पब्लिशर्स, दिल्ली (2005)
- रतन जोशी, पर्यावरण अध्ययन, साहित्य भवन पब्लिकेशन्स (2018)

Suggested Reading :

- i. The Health Effects of Climate Change (edx)
- ii. Climate Change : Financial Risks and Opportunities (edx)
- iii. Introduction to Environmental Law and Policy (coursera)
- iv. Women in environmental biology (coursera)
- v. Our Earth : It’s Climate, History, and Processes ((coursera)
- vi. Ecology, Physiology, Environmental Science (National Digital Library)

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 15 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) :35 Marks Time :03.00 Hours	
Class Test I (Objective Questions)	5 Marks	Section (A) : Five MCQ Questions	01 x 05 = 5 Marks

Class Test II (Descriptive Questions)	5 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 02 = 10 Marks
Class Test III (Objective and Descriptive Questions)	5 Marks	Section (C): Four Long Questions (500 Words Each)	05 x 04 = 20 Marks
Total	15 Marks	Total	35 Marks
Any remarks/suggestions:			

Part A - Introduction			
Programme: Certificate Course	Class: BCA	SEMESTER: 2nd	Session : 2021-22
Subject : Computer Application			
1	Course Code	BCA 205	
2	Course Title	Yoga and Meditation	
3	Course Type (Core Course/Elective/ Generic Elective/ Vocational)	Foundation Course	
4	Prerequisite (if any)	Nil	
5	Course Learning Outcome (CLO)	After studying this course, students will be able to : <ul style="list-style-type: none"> • Take care of their own Physical Mental emotional social and spiritual health. 	
6	Credit Value	Theory - 2	
7	Total Marks	Max Marks : 50	Min Passing Marks: 17

Part B: Content of the Course		
Total No. of Lectures/Tutorials/Practical (in hours per week) : 2 hourse per week Total No. of Lectures = 30 hours; L-T- : 2 – 0 – 0		
Unit	Topic	No. of Lectures
I	Introduction : 1. Yoga : Etymology, definitions, aim, objectives and misconceptions 2. Yoga : Its Origin, history and development 3. Rules and regulations to be followed by Yoga Practitioners 4. Introduction to Yoga practices 5. Shatkarma : meaning, purpose and their significance in Yoga Sadhana 6. Introductionto Yogic Loosening practices and Surya Namaskar [Key Word : History and Development of Yoga, Shatkarma, Common Yogic Practices]	10
II	Breathing Practices and Pranayama : 1. Sectional Breathing (Abdominal, Thoracic and Clavicular) 2. Yogic Deep Breathing 3. Concept of Puraka, Rechaka and Kumbhaka 4. Concept of Bandha and Mudra 5. AnulmoaViloma/NadiShodhana 6. Shitali 7. Bhramari [Key words : Sectional Breathing, Deep Breathing, Bandha & Mudra, Shitali, Bhramari]	10
III	Practices Leadingto Meditation : 1. Recitation of Pranava Mantra 2. Recitation of Hymns, in vocations and prayers 3. Anter Maun 4. Breath Meditation	05

5. Om Dhyana [Key Words : Pranav Mantra, Antermaun, Breath Meditation, Om Dhyan]	
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Part - C – Learning Resources
Text Books, Reference Books, Other resources
<p>Suggested Reading :</p> <ul style="list-style-type: none"> • Singh, S.P. & Yogi Mukesh : Foundation of Yoga, Standard Publication, New Dehi, 2010. • Swami Dharendra Brahmchari : Yogasana Vijnana, Dharendra Yoga Publication, New Delhi, 1966. • Saraswati, Swami Satyanand : Asana, Pranayama, Mudra, Bandha (APMB), Yoga Publication Trust, Munger, 2013. • H.R. Nagendra : Asana, Pranayama, Mudra, Bandha, Swami Vivekananda Yog Prakashan, Bangalore, 2002. • Ishwar Bhardwaj : Saral Yogasana, Satyam Publishing House, New Delhi, 2018. • Shri Rai Singh Chouhan : Mudra Rahasya, Bhartiya Yog Sansthan, New Delhi, 2014. • Dr. Vishwanath Prasad Sanha : Dhyana Yoga, Bhartiya Yog Sansthan, New Delhi, 1987. • Shri Deshraj : Dhyana Sadhana, Bhartiya Yog Sansthan, New Delhi, 2015. <p>Suggestive digital platforms web links :</p> <ul style="list-style-type: none"> • www.rishikeshnathyogshala.com
<p>Suggested equivalent online courses :</p> <ol style="list-style-type: none"> 1. https://sahayji.com/hathayoga-course 2. https://theyogainstitute.org/

PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 15 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) :35 Marks Time : 03.00 Hours	
Class Test I (Objective Questions)	5 Marks	Section (A) : Five MCQ Questions	01 x 05 = 5 Marks
Class Test II (Descriptive Questions)	5 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 02 = 10 Marks
Class Test III (Objective and Descriptive Questions)	5 Marks	Section (C): Four Long Questions (500 Words Each)	05 x 04 = 20 Marks

Total	15 Marks	Total	35 Marks
Any remarks/suggestions:			

Part A Introduction			
Program: Certificate Course		Class: BCA	Semester: 2 nd
Session: 2021-2022			
Subject:Computer Applications			
1	Course Code	BCA 203 EL-1	
2	Course Title	Numerical Methods	
3	Course Type	Open Elective	
4	Pre-requisite (if any)		
5	Course Learning Outcomes (CLO)	<p>The course will enable the students to:</p> <ol style="list-style-type: none"> 1. Understand numerical methods to find the solution of a system of linear equations. 2. Compute interpolation value for real data. 3. Findquadrature by using various numerical methods. 4. Solve system of linear equations by using various numerical techniques. 5. Obtain solutions of ordinary differential equations by using numerical methods. 	
6	Credit Value	Theory: 6Credit	
7	Total Marks	Max. Marks: 40 + 60	Min. Passing Marks: 35

Part B - Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week		
Total Lectures: 90 hours		
Unit	Topics	No. of Lectures
I	Methods for Solving Algebraic and Transcendental Equations: Bisection Method, Regula Falsi Method, Secant Method, Newton-Raphson Method, Ramanujan Method.	18
II	Interpolation: Lagrange interpolation, Finite difference operators, Interpolation formula using Differences, Gregory-Newton Forward Difference Interpolation, Gregory-Newton Backward Difference Interpolation.	18
III	Numerical Integration: Newton- Cote's formulae, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Gauss Integration.	12
IV	Methods to Solve System of Linear Equations: Direct method for solving system of linear equations: Gauss elimination, LU decomposition, Cholesky decomposition. Iterative method:Jacobi, Gauss-Seidel.	21
V	Numerical Solution of Ordinary Differential Equations: Single step methods: Picard, Taylor's series, Euler, Runge-Kutta. Multistep methods: Predictor-corrector, Modified Euler, Milne-Simpson.	21
Keywords/Tags: Algebraic and transcendental equations, Interpolation, Numerical Integration, Gauss elimination method, LU decomposition, Jacobi method, Gauss-Seidel method, Picard method, Runge-Kutta method, Predictor-corrector method, Milne-Simpson method.		

Remark: Scientific calculator will be allowed during examination.

Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. S. S. Sastry: Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited, Fifth edition, 2012.
2. E. Balagurusamy: Numerical Methods, Tata McGraw Hill Publication, 2017.
3. मध्य प्रदेश हिन्दी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें।

Reference Books:

1. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999.
2. Saxena H. C.: Finite Differences & Numerical Analysis, S Chand, 2010.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://www.highereducation.mp.gov.in/?page=xhzIQmpZwkylQo2b%2Fy5G7w%3D%3D>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111106101/>

<https://nptel.ac.in/courses/111107105/>

<https://nptel.ac.in/courses/111107107/>

https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_pg/1476

PART D: Assessment and Evaluation

Internal Assessment :		External Assessment: University Exam (UE) :60 Marks	
Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		Time :03.00 Hours	
Assessment and presentation of assignment	10 Marks	Section (A) : Ten Very Short Questions (50 Words Each) OR Nine MCQ Questions	01 x 10 = 10 Marks
Class Test I (Objective Questions)	10 Marks		
Class Test II (Descriptive Questions)	10 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 04 = 20 Marks

Class Test III (Objective and Descriptive Questions)	10 Marks	Section (C): Five Long Questions (500 Words Each)	06 x 05 = 30 Marks
Total	40 Marks	Total	60 Marks
Any remarks/suggestions:			

Part A Introduction			
Program: Certificate Course		Class: BCA	Semester: 2 nd
Session: 2021-2022			
Subject: Computer Applications			
1	Course Code	BCA 203 EL-2	
2	Course Title	Discrete Mathematics	
3	Course Type	Open Elective	
4	Pre-requisite (if any)		
5	Course Learning Outcomes (CLO)	<p>The course will enable the students:</p> <ol style="list-style-type: none"> 1. Apply the Boolean algebra, switching circuits and their applications. 2. Minimize the Boolean Function using Karnaugh Map. 3. Understand the lattices and their types. 4. Graphs, their types and its applications in study of shortest path algorithms. 5. Test whether two given graphs are isomorphic. 6. Understand the Eulerian and Hamiltonian graphs. 7. Represent graphs using adjacency and incidence matrices. 8. Understand the discrete numeric functions, generating functions and Recurrence Relations. 	
6	Credit Value	Theory: 6Credit	
7	Total Marks	Max. Marks: 40 + 60	Min. Passing Marks: 35

Part B - Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week		
Total Lectures: 90 hours		
Unit	Topics	No. of Lectures
I	<p>Relations: Binary, Inverse, Composite and Equivalence relation, Equivalence classes and its properties, Partition of a set, Partial order relation, Partially ordered and Totally ordered sets, Hasse diagram.</p> <p>Lattices: Definition and examples, Dual, bounded, distributive and complemented lattices.</p>	18
II	<p>Boolean Algebra:Definition and properties, Switching circuits and its applications, Logic gates and circuits.</p> <p>Boolean functions: Disjunctive and conjunctive normal forms, Bool's expansion theorem, Minimize the Boolean function using Karnaugh Map.</p>	18
III	<p>Graphs:Definition and types of graphs, Subgraphs, Walk, path and circuit, Connected and disconnected graphs, Euler graph, Hamiltonian path and circuit, Dijkstra's Algorithm for shortest paths in weighted graph.</p>	18

IV	<p>Trees: Definition and its properties, Rooted, Binary and Spanning tree Rank and nullity of a graph, Kruskal's and Prim's Algorithm, Cut-set and its properties, Fundamental Circuit and Cut-Set, Planar graphs.</p> <p>Matrix representation of graphs: Incidence, Adjacency, Circuit, Cut-Set, Path.</p>	18
V	<p>Discrete numeric and generating functions: Operations on numeric functions, Asymptotic behavior of numeric functions, Generating functions.</p> <p>Recurrence relations and recursive algorithms: Recurrence relations, Linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Solution by the method of generating functions.</p>	18
<p>Keywords/Tags: Relation, Hasse diagram, Lattices, Boolean Algebra, Boolean function, Graph and Subgraph, Path and circuit, Tree, Spanning tree, Cut-set, Matrix representation of graph, Discrete numeric function, Generating function, Recurrence relation, Recursive algorithm.</p>		

Part C - Learning Resources	
Text Books, Reference Books, Other Resources	
<p>Suggested Readings:</p> <p>Text Books:</p> <ol style="list-style-type: none"> 1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures With Applications To Computer Science, McGraw Hill Education, 1st edition, 2017. 2. C. L. Liu: Elements of Discrete Mathematics, McGraw Hill Education, 4th edition, 2017. 3. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India Learning Private Limited, 1979. 4. मध्य प्रदेश हिन्दी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें। <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Seymour Lipschutz and Mark Lipson: Discrete Mathematics (Schaums Outline), McGraw Hill Education, 3rd edition, 2017. 2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, Pearson Education Pt.Ltd., Indian Reprint 2003. <p>Suggested Digital Platforms Web links: https://www.highereducation.mp.gov.in/?page=xhzIQmpZwkylQo2b%2Fy5G7w%3D%3D</p> <p>Suggested Equivalent online courses: https://nptel.ac.in/courses/111106086/ https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/311</p>	

PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 40 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) : 60 Marks Time :03.00 Hours	
Assessment and presentation of assignment	10 Marks	Section (A) : Ten Very Short Questions (50 Words Each) OR Nine MCQ Questions	01 x 10 = 10 Marks
Class Test I (Objective Questions)	10 Marks		
Class Test II (Descriptive Questions)	10 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 04 = 20 Marks
Class Test III (Objective and Descriptive Questions)	10 Marks	Section (C): Five Long Questions (500 Words Each)	06 x 05 = 30 Marks
Total	40 Marks	Total	60 Marks
Any remarks/suggestions:			