Apeejay Institute of Management and Engineering
Technical Campus, Jalandhar

Affiliated to I.K.Gujral Punjab Technical University(IKG-PTU), Kapurthala

Study Scheme & Syllabus of

Bachelor of Computer Applications

School of Information Technology

Scheme & Syllabus of

Bachelor of Computer Applications

(BCA)

Batch 2021 onwards

For

University Main Campus, Constituent Campuses and Affiliated colleges

Department of Academics

IK Gujral Punjab Technical University

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Bachelors of Computer Applications (BCA):
It is a Under Graduate (UG) Programme of 3 years duration (6 semesters)

Eligibility: All those candidates who have passed the 10+2 or its equivalent examination in any stream conducted by a recognized Board / University / Council.

Or

Those candidates who have passed their Matriculation examination **AND** have also passed three year Diploma in any Trade from Punjab State Board of Technical Education & Industrial Training, Chandigarh or such Examination from any other recognized State Board of Technical Education, or Sant Longowal Institute of Engineering & Technology, Longowal.

BCA (Lateral Entry): It is a Under Graduate (UG) Programme of 2 years duration (4 semesters)
Eligibility: All those candidates who have passed Matriculation examination **AND** have also passed 3 Year Diploma in any Trade from Punjab State Board of Technical Education & Industrial Training, Chandigarh or such Examination from any other recognized State Board of Technical Education, or Sant Longowal Institute of Engineering & Technology, Longowal.

Or

10+2 with 1 year Diploma in Computer Application / IT (or equivalent) from a recognized University with Mathematics as course at 10+2 or DIT / DCA level.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

PROGRAM OUTCOMES (POs)

Program: BCA

1. **Basic knowledge:** An ability to apply knowledge of basic mathematics, science and domain knowledge to solve the computational problems.

2. **Discipline knowledge**: An ability to apply discipline –specific knowledge to solve core and/or applied computational problems.

3. **Experiments and practice:** An ability to plan and perform experiments and practices and to use the results to solve computational problems.

4. **Tools Usage**: Apply appropriate technologies and tools with an understanding of limitations.

5. **Profession and society**: Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional practice.

6. **Environment and sustainability**: Understand the impact of the computational solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

7. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional practice.

8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

9. **Communication:** An ability to communicate effectively.

10. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological changes.

I. K. Gujral Punjab Technical University
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First Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1901	Core Theory	Mathematics	3	1	0	40	60	100	4
UGCA1902	Core Theory	Fundamentals of Computer and IT	3	1	0	40	60	100	4
UGCA1903	Core Theory	Problem Solving using C	3	1	0	40	60	100	4
UGCA1904	Practical/Laboratory	Workshop on Desktop Publishing	0	0	4	60	40	100	2
UGCA1905	Core Practical/Laboratory	Problem Solving using C Laboratory	0	0	4	60	40	100	2
UGCA1906	Core Practical/Laboratory	Fundamentals of Computer and IT Laboratory	0	0	4	60	40	100	2
BTHU103/18	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1
BTHU104/18	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1
HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	3	0	0	40	60	100	3
HVPE102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	25	--**	25	1
BMPD102-18		Mentoring and Professional Development	0	0	1	25	--**	25	1
	TOTAL		**13**	**3**	**16**	**460**	**440**	**900**	**25**

The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only. **(See guidelines at the last page of this file)

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Second Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1907	Core Theory	Fundamentals of Statistics	3	1	0	40	60	100	4
UGCA1908	Core Theory	Computer System Architecture	3	1	0	40	60	100	4
UGCA1909	Core Theory	Object Oriented Programming using C++	3	1	0	40	60	100	4
UGCA1910	Core Practical/Laboratory	Object Oriented Programming using C++ Laboratory	0	0	4	60	40	100	2
UGCA1911	Core Practical/Laboratory	Fundamentals of Statistics Laboratory	0	0	4	60	40	100	2
UGCA1912	Core Practical/Laboratory	Computer System Architecture Laboratory	0	0	4	60	40	100	2
EVS102-18	Ability Enhancement Compulsory Course (AECC) -III	Environmental Studies	2	0	0	40	60	100	2
BMPD202-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**11**	**3**	**13**	**365**	**360**	**725**	**21**

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Third Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1913	Core Theory	Computer Networks	3	1	0	40	60	100	4
UGCA1914	Core Theory	Programming in Python	3	1	0	40	60	100	4
UGCA1915	Core Theory	Data Structures	3	1	0	40	60	100	4
UGCA1916	Core Practical/Laboratory	Computer Networks Laboratory	0	0	4	60	40	100	2
UGCA1917	Core Practical/Laboratory	Programming in Python Laboratory	0	0	4	60	40	100	2
UGCA1918	Core Practical/Laboratory	Data Structures Laboratory	0	0	4	60	40	100	2
UGCA1919	Skill Enhancement Course-I	PC Assembly & Troubleshooting	3	0	0	40	60	100	3
UGCA1920	Skill Enhancement Course- Laboratory	PC Assembly & Troubleshooting Laboratory	0	0	2	30	20	50	1
BMPD302-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**3**	**15**	**395**	**380**	**775**	**23**

I. K. Gujral Punjab Technical University
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Fourth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1921	Core Theory	Software Engineering	3	1	0	40	60	100	4
UGCA1922	Core Theory	Database Management Systems	3	1	0	40	60	100	4
UGCA1923	Core Theory	Operating Systems	3	1	0	40	60	100	4
UGCA1924	Core Practical/Laboratory	Software Engineering Laboratory	0	0	4	60	40	100	2
UGCA1925	Core Practical/Laboratory	Database Management Systems Laboratory	0	0	4	60	40	100	2
UGCA1926	Core Practical/Laboratory	Operating Systems Laboratory	0	0	4	60	40	100	2
UGCA1927	Skill Enhancement Course-II	Web Designing	3	0	0	40	60	100	3
UGCA1928	Skill Enhancement Course- Laboratory	Web Designing Laboratory	0	0	2	30	20	50	1
BMPD402-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**03**	**15**	**395**	**380**	**775**	**23**

Students will undergo 4 weeks Institutional Summer Training* after 4th semester. Examination will be conducted along with 5th semester practical.

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Fifth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1929	Skill Enhancement Course-III	Programming in PHP	3	0	0	40	60	100	3
UGCA1930	Skill Enhancement Course-Laboratory	Programming in PHP Laboratory	0	0	2	30	20	50	1
	Open Elective-I		3	1	0	40	60	100	4
	Elective-I		3	1	0	40	60	100	4
	Elective-II		3	1	0	40	60	100	4
	Elective-I Laboratory		0	0	4	60	40	100	2
	Elective-II Laboratory		0	0	4	60	40	100	2
	Project	Minor Project	0	0	2	60	40	100	1
	Institutional Summer Training*		0	0	2	60	40	100	1
BMPD502-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**03**	**15**	**455**	**420**	**875**	**23**

Elective -I	
Course Code	Course Title
UGCA1931	Data Warehouse and Mining
UGCA1932	Programming in Java
UGCA1933	Internet of Things

Elective -II	
Course Code	Course Title
UGCA1934	Computer Graphics
UGCA1935	Linux Operating System
UGCA1936	Cloud Computing

Elective-I Laboratory	
Course Code	Course Title
UGCA1937	Data Warehouse and Mining Laboratory
UGCA1938	Programming in Java Laboratory
UGCA1939	Internet of Things Laboratory

Elective-II Laboratory	
Course Code	Course Title
UGCA1940	Computer Graphics Laboratory
UGCA1941	Linux Operating System Laboratory
UGCA1942	Cloud Computing Laboratory

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Sixth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1943	Skill Enhancement Course-IV	Android Programming	3	0	0	40	60	100	3
UGCA1944	Skill Enhancement Course-Laboratory	Android Programming Laboratory	0	0	2	30	20	50	1
	Open Elective-II		3	1	0	40	60	100	4
	Elective-III		3	1	0	40	60	100	4
	Elective-IV		3	1	0	40	60	100	4
	Elective-III Laboratory		0	0	4	60	40	100	2
	Elective-IV Laboratory		0	0	4	60	40	100	2
	Project	Major Project	0	0	4	120	80	200	4
BMPD602-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**10**	**03**	**15**	**455**	**485**	**875**	**25**

Elective -III	
Course Code	**Course Title**
UGCA1945	Artificial Intelligence
UGCA1946	R Programming
UGCA1947	Digital Marketing

Elective -IV	
Course Code	**Course Title**
UGCA1948	Information Security
UGCA1949	Cyber Laws & IPR
UGCA1950	Machine Learning

Elective -III	
Course Code	**Course Title**
UGCA1951	Artificial Intelligence Laboratory
UGCA1952	R Programming Laboratory
UGCA1953	Digital Marketing Laboratory

Elective -IV	
Course Code	**Course Title**
UGCA1954	Information Security Laboratory
UGCA1955	Cyber Laws & IPR Laboratory
UGCA1956	Machine Learning Laboratory

Open Electives	
Course Code	**Course Title**
UGCA1902	Fundamentals of Computer and IT
UGCA1903	Problem Solving using C
UGCA1909	Object Oriented Programming using C++
UGCA1913	Computer Networks
UGCA1922	Database Management Systems
UGCA1957	Software Project Management

***The above list of Open Elective Courses is particularly designed to offer to other disciplines such as Physics, Chemistry, Mathematics, Management or any other area of expertise in their Under-Graduate Programs.**

***In case Open Elective-I and Open Elective-II are not offered by any other discipline/branch in the Institute/College, then student may opt Open Elective courses from given lists of Elective courses (Theory only).**

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1901
Course Name: Mathematics

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status: core/elective:** Core

Prerequisite: Student must have the knowledge of Basic Mathematics.
Co requisite: NA.
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.
Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Define various mathematical notions.
CO2	Explain different terms used in basic mathematics.
CO3	Illustrate various operations and formulas used to solve mathematical problems.
CO4	Organize data in various models.
CO5	Prepare solutions for various real life problems.

Detailed contents	Contact hours
Unit-I Set Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set) Universal Sets, Complement of a Set. [CO1][CO2]	12 hours
Unit-II Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.[CO3]	10 hours
Unit -III Matrices Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Null Matrix, Comparable Matrix, Equal Matrix), Scalar Multiplication,	12 hours

Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix. [CO4]	
Unit-IV Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities in A.P, Arithmetic Means, Geometric Progression, Geometric Mean. [C05]	10 hours

Text Books:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, Mc Graw Hill, 6th Edition.
2. College Mathematics, Schaum's Series, TMH.

Reference Books:

1. Elementary Mathematics, Dr. RD Sharma
2. Comprehensive Mathematics, Parmanand Gupta
3. Elements of Mathematics, ML Bhargava

E Books/ Online learning material

1. www.see.leeds.ac.uk/geo-maths/basic_maths.pdf
2. www.britannica.com/science/matrix-mathematics
3. www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-edition-schaums-e6841453.html

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Course Code: UGCA1902
Course Name: Fundamentals of Computer and IT

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify of input and output devices of Computers

CO2	Utilize the functioning of various components of computer system
CO3	Define the role of Operating system
CO4	Prepare documents using word processing, Spreadsheet and Presentation Graphics Software's.
CO5	Highlight the Internet safety, legally, and other issues.

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. [CO1] **Functional Units of Computer System:** CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors. **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. [CO2] **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. [CO2] **Data Representation:** Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.	12
Unit-II **Concept of Computing, Types of Languages:** Machine, assembly and High level Language; Operating system as user interface, utility programs. [CO3] **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors. [CO4]	10
Unit-III **Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. [CO4] **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	10

Unit-IV **Electronic Payment System:** Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority. [CO5] Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT)	12

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Computer Fundamentals, A. Goel, 2010, Pearson Education.
3. Fundamentals of Computers, P. K.Sinha & P. Sinha, 2007, BPB Publishers.
4. IT Tools, R.K. Jain, Khanna Publishing House
5. "Introduction to Information Technology", Satish Jain, Ambrish Rai & Shashi Singh, Paperback Edition, BPB Publications, 2014.

Reference Books:

1. "Introduction to Computers", Peter Norton
2. Computers Today, D. H. Sanders, McGraw Hill.
3. "Computers", Larry long & Nancy long, Twelfth edition, Prentice Hall.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning

E Books/ Online learning material

1. www.sakshat.ac.in
2. https://swayam.gov.in/course/4067-computer-fundamentals

Course Code: UGCA1903
Course Name: Problem Solving using C

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs

Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Express the logical flow used in Programming.
CO2	Design algorithms for solving various real life problems
CO3	Implement programs using C.
CO4	Choose the right data type and statements for programs.
CO5	Explain various concepts of C programming language.

Detailed Contents	Contact hours
Unit-I **Logic Development:** Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants. [CO1] **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions. [CO2]	11
Unit-II **Data Input and Output:** formatted & unformatted input output. **Control Statements:** While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements. [CO3]	10
Unit-III **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. [CO4] **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays.	11

Strings: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables. [CO3]	
Unit-IV **Structures & Unions:** Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions. **Pointers:** Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays **File Handling:** File Operations, Processing a Data File [CO5]	12

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill.
2. Programming in C, Third Edition, Stephen G Kochan, Pearson.
3. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication.

Reference Books:

1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

Course Code: UGCA1904
Course Name: Workshop on Desktop Publishing

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours**: 4 hours per week
Internal max. marks: 60	**Theory/Practical**: Practical
External max. marks: 40	**Duration of end semester examinations (ESE):** 3hrs
Total marks: 100	**Elective status**: Core

Prerequisite: Students must have basic understanding of designing/ Painting tools.
Co requisite: Printing & Publishing tools.

Additional material required in ESE: Softcopy & Hardcopy of the exercises are to be maintained during the practical labs and to be submitted during the End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course outcomes
CO1	Outline the characteristics of desktop publishing tools.
CO2	Identify the right components for designing documents.
CO3	Apply knowledge in designing various documents.
CO4	Prepare different types of graphic related documents.
CO5	Express the messages through graphical content

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Design and print a *Title Page* of a Magazine/Book.
2.	Prepare multiple designs for a *Flex* by using different Tools.
3.	Prepare NSS *Certificates* for appreciation using logos of University, College & NSS unit.
4.	Prepare 5 different Designing of *Business Cards*.
5.	Prepare *Envelops* displaying full address of the company by inserting graphical symbol/ logos of company.
6.	Design and Print *Invoices* for three companies.
7.	Prepare and print *News Letter Layouts* for any five activities of your college/ university.
8.	Prepare *Invitation Cards* for cultural meet held in your college.
9.	Design and print *Brochures* to advertise a "Blood Donation Camp" in your college.
10.	Design *Logos* of your college, University & Govt. of Punjab also display these logos on black background as water mark.
11.	Design, Print and Publish 5 motivations Playcards.
12.	Design & Print assignment book of minimum 20 Pages an any Topic.
13.	Design & Print any five most important activities of your college in a collage.
14.	Design & Print Question Paper of any Subject.
15.	Assemble all the latest news cutting of your activities on a 10 X 8 size flex.

Reference Books:

1. DTP Course, by Shirish Chavan published by Rapidex.
2. DTP Course Kit by Vikas Gupta published by Comdex.
3. CorelDraw 9 by David Karlins published by Techmedia.
4. Adobe Illustrator CC by Brian Wood published by Adobe Press.
5. Page Maker in Easy Steps - Scott Basham.

Software Tools:

1. Adobe Illustrator 14.
2. CorelDraw Graphics Suit.
3. GNU image manipulation program.
4. Ink Scape.
5. PhotoScape Setup.
6. PM701.

Course Code: UGCA1905
Course Name: Problem Solving using C Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks:100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course Outcomes
CO1	Select the right statement for the program.
CO2	Experiment with different input values.
CO3	Test the output with boundary conditions.
CO4	Distinguish between various control statements and data types.
CO5	Implement programs for various problems.

Instructions: Develop all programs in C programming language.

Assignments:

1.	WRITE A PROGRAM to display your name. Write another program to print message with inputted name.
2.	WRITE A PROGRAM to add two numbers.
3.	WRITE A PROGRAM to find the square of a given number.
4.	WRITE A PROGRAM to calculate the average of three real numbers.
5.	Write a program to Find ASCII Value of a Character
6.	WRITE A PROGRAM to Find the Size of int, float, double and char

7.	WRITE A PROGRAM to Compute Quotient and Remainder
8.	WRITE A PROGRAM to accept the values of two variables.
9.	WRITE A PROGRAM to find the simple interest, inputs are amount, period in years and rate of interest.
10.	Basic salary of an employee is input through the keyboard. The DA is 25% of the basic salary while the HRA is 15% of the basic salary. Provident Fund is deducted at the rate of 10% of the gross salary(BS+DA+HRA). WRITE A PROGRAM to calculate the net salary
11.	WRITE A PROGRAM to find area of a circle using PI as constant
12.	WRITE A PROGRAM to find volume of a cube using side as input from user
13.	WRITE A PROGRAM using various unformatted Input Functions
14.	WRITE A PROGRAM to find area of rectangle and print the result using unformatted output Functions
15.	WRITE A PROGRAM to find the larger of two numbers.
16.	WRITE A PROGRAM to find greater of three numbers using Nested If.
17.	WRITE A PROGRAM to find whether the given number is even or odd.
18.	WRITE A PROGRAM to Generate Multiplication Table Using for loop
19.	WRITE A PROGRAM to Generate Multiplication Table Using while loop
20.	WRITE A PROGRAM to Make a Simple Calculator Using switch...case
21.	WRITE A PROGRAM to find whether the given number is a prime number.
22.	WRITE A PROGRAM using function to find the largest of three numbers
23.	WRITE A PROGRAM using function to print first 20 numbers and its squares.
24.	WRITE A PROGRAM to find the factorial of a given number.
25.	WRITE A PROGRAM to print the sum of two matrices
26.	WRITE A PROGRAM to Find the Length of a String
27.	WRITE A PROGRAM to Copy String using strcpy()
28.	WRITE A PROGRAM to compare a string
29.	WRITE A PROGRAM to reverse a string
30.	WRITE A PROGRAM to reverse a string
31.	WRITE A PROGRAM to multiply two numbers using pointers.
32.	WRITE A PROGRAM to display address of variable using pointers
33.	WRITE A PROGRAM to show the memory occupied by Structure and Union
34.	WRITE A PROGRAM to create Student I-Card using a Structure
35.	WRITE A PROGRAM to read data from a file from a file
36.	WRITE A PROGRAM to save Employee details in a file using File Handling

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Course Code: UGCA1906
Course Name: Fundamentals of Computer and IT Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical

External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - NA-

Course Outcomes:

CO#	Course outcomes
CO1	Highlight the features of word processing, spreadsheet and presentation tools
CO2	Identify the right componets for its documents on editor, spread sheet and presentation software.
CO3	Prepare documents and apply formatting.
CO4	select the right tool for different requirements.
CO5	Apply various operations.

Instructions:

Word Orientation: The instructor needs to give an overview of word processor. Details of the four tasks and features that would be covered Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.	
1.	Using word to create Resume Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
2.	Creating an Assignment Features to be covered: - Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
3.	Creating a Newsletter Features to be covered :- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs
4.	Creating a Feedback form Features to be covered :- Forms, Text Fields, Inserting objects, Mail Merge in Word.
Excel Orientation: The instructor needs to tell the importance of Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered Excel – Accessing, overview of toolbars, saving excel files,	
1.	Creating a Scheduler Features to be covered :- Gridlines, Format Cells, Summation, auto fill, Formatting Text
2.	Calculations

	Features to be covered :- Cell Referencing, Formulae in excel – average, std.deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
3.	Performance Analysis Features to be covered :- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting
4.	Game (like Cricket, badminton) Score Card Features to be covered :- Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation
Presentation Orientation:	
1.	Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows
2.	This session helps students in making their presentations interactive. Topics covered includes : Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts
3.	Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides. Auto content wizard, Slide Transition, Custom Animation, Auto Rehearsing
4.	Power point test would be conducted. Students will be given model power point presentation which needs to be replicated
Internet and its Applications The instructor needs to tell the how to configure Web Browser and to use search engines by defining search criteria using Search Engines	
1.	To learn to setup an e-mail account and send and receive e-mails
2.	To learn to subscribe/post on a blog and to use torrents for accelerated downloads
3.	Hands on experience in online banking and Making an online payment for any domestic bill

Reference Books:

1. IT Tools, R.K. Jain, Khanna Publishing House.
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning.

AECC (For UGC courses)
BTHU103-18 English:

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to their personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Detailed Contents:

Unit1- 1 (Introduction)

- Theory of Communication
- Types and modes of Communication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

Unit-3 (Reading and Understanding)

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)
  OR
  Precis writing /Paraphrasing (for International Students)
- Literary/Knowledge Texts

Unit-4 (Writing Skills)

- Documenting
- Report Writing
- Making notes
- Letter writing

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

AECC
BTHU104/18 English Practical/Laboratory
: 0L 0T 2P 1 Credit

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions and business office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self-Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Monologue

- Effective Communication/ Mis- Communication
- Public Speaking

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
5. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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Course Code: HVPE101-18
Course Name: Human Values, De-addiction and Traffic Rules

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 3
Semester: 1st	**Contact hours:** 33 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
CO2	To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
CO3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Note: This course is intended to provide a much needed orientational input in Value Education to the young enquiring minds.

Detailed Contents	Contact hours

Unit-I **Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** 1. Understanding the need, basic guidelines, content and process for Value Education 2. Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels [CO1]	8
Unit-II **Understanding Harmony in the Human Being - Harmony in Myself! [CO2]** 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' *2.* Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha* 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of 'I' and harmony in 'I' 5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail 6. Programs to ensure *Sanyam* and *Swasthya* - Practice Exercises and Case Studies will be taken up in Practice Sessions.	8
Unit-III **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship [CO2]** 1. Understanding harmony in the Family- the basic unit of human interaction *2.* Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;	6

Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship 3. Understanding the meaning of *Vishwas*; Difference between intention and competence 4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship *5.* Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals 6. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	
Unit-IV **Understanding Harmony in the Nature and Existence - Whole existence as Co-existence [CO3]** *1.* Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature 3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space 4. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	5
Unit-V **Implications of the above Holistic Understanding of Harmony on Professional Ethics [CO3]** 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems	6

6. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations.	

Text Book

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Reference Books

1. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How *the Other Half Dies*, Penguin Press. Reprinted 1986, 1991.
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Common wealth Publishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers*, Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, *Foundations of Ethics and Management,* Excel Books.
12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, http://uhv.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story

Course Code: HVPE102-18
Course Name: Human Values, De-addiction and Traffic Rules (Lab/ Seminar)

Program: BCA	**L**: 0 **T**: 0 **P**: 1
Branch: Computer Applications	**Credits:** 1
Semester: 1st	**Contact hours:** 1 hour per week
Internal max. marks: 25	**Theory/Practical:** Practical
External max. marks: 0	**Duration of end semester exam (ESE):** 3hrs
Total marks: 25	**Elective status:** Ability Enhancement

One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar at least once during the semester. It will be binding for all the students to attend the seminar.

Course Code: UGCA1907
Course Name: Fundamentals of Statistics

Program: BCA	**L: 3 T: 1 P: 0**
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the basic knowledge of mathematic terms.
Co requisite: NA
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.
Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Highlight the need of studying & analyzing numbers.
CO2	Identify visualization tools for representing data.
CO3	Describe various statistical formulas.
CO4	Compute various statistical measures.
CO5	Compare result of different statistical measures.

Detailed Contents	Contact hours
Unit I Statistics and Probability: Introduction to Statistics – Origin of Statistics, Features of Statistics, Scope of Statistics, Functions of Statics, Uses and importance of Statistics, Limitation of Statistics, Distrust of Statistics	8 hours

Collection of Data: Introduction to Collection of Data, Primary and Secondary Data, Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data (Approximation). [CO1]	
Unit II Classification of Data Frequency Distribution: Introduction Classification of Data, Objectives of Classification, Methods of Classification, Ways to Classify Numerical Data or Raw Data. Tabular, Diagrammatic and Graphic Presentation of Data: Introduction to Tabular Presentation of Data, Objectives of Tabulation, Components of a Statistical Table, General Rules for the Construction of a Table, Types of Tables, Introduction to Diagrammatic Presentation of Data, Advantage and Disadvantage of Diagrammatic Presentation, Types of Diagrams, Introduction to Graphic Presentation of Data, Advantage and Disadvantage of Graphic Presentation, Types of Graphs. [CO2]	12 hours
Unit III Measures of Central tendency: Introduction to Central Tendency, Purpose and Functions of Average, Characteristics of a Good Average, Types of Averages, Meaning of Arithmetic Mean, Calculation of Arithmetic Mean, Merit and Demerits of Arithmetic Mean, Meaning of Median, Calculation of Median, Merit and Demerits of Median, Meaning of Mode, Calculation of Mode, Merit and Demerits of Mode, Harmonic Mean- Properties- Merit and Demerits. [CO3]	12 hours
Unit IV Measures of Dispersion: Meaning of Dispersion, Objectives of Dispersion, Properties of a good Measure of Dispersion, Methods of Measuring Dispersion, Range Introduction, Calculation of Range , Merit and Demerits of Range, Mean Deviation, Calculation of Mean Deviation , Merit and Demerits of Mean Deviation, Standard Deviation Meaning, Calculation of Standard Deviation , Merit and Demerits of Standard Deviation,	12 hours

Coefficient of Variation, Calculation of Coefficient Variance, Merit and Demerits of Coefficient of Variation. [CO4] [CO5]	

Text Books:

1. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December 2000.
2. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government of Tamilnadu.
3. Introduction to Statistics, David M. Lane.
4. Weiss, N.A., Introductory Statistics. Addison Wesley, 1999.
5. Clarke, G.M. & Cooke, D., A Basic course in Statistics. Arnold, 1998.

Reference Books:

1. Banfield J.(1999), Rweb: Web-based Statistical Analysis, Journal of Statistical Software.
2. Bhattacharya,G.K. and Johnson, R.A.(19977), Statistical Concepts and Methods, New York, John Wiley & Sons.

E-Books/ Online learning material

1. http://onlinestatbook.com/Online_Statistics_Education.pdf
2. https://textbookcorp.tn.gov.in/Books/12/Std12-Stat-EM.pdf
3. https://3lihandam69.files.wordpress.com/2015/10/introductorystatistics.pdf

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Course Code: UGCA1908
Course Name: Computer System Architecture

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Basics of Information Technology
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify the various internal and peripheral components of computer system
CO2	Categorize different number system.
CO3	Outline the role of various components of computer system.
CO4	Identify micro-operations.
CO5	Comment on the design of Combinational & Sequential circuits

Detailed Contents	Contact hours
Unit-I **Logic Gates:** AND, OR, NOT, NAND, NOR, XOR, XNOR, NAND & NOR as Universal Gates, Logic Gates Applications.[CO5] **Boolean Algebra:** Introduction, Theorems, Simplification of Boolean Expression using Boolean Algebra, SOP & POS Forms, Realization of Boolean Expression using Gates, K-Maps, Simplification of Boolean Expression using K-Maps. [CO2]	12
Unit-II **Combinational Logic Circuits:** Half Adder & Half Subtractor, Full Adder & Full Subtractor, Parallel Binary Adder, Binary Adder/Subtractor. [CO4] **Combinational Logic Circuits:** Multiplexers & Demultiplexers, Implementation of Boolean equations using Multiplexer and Demultiplexer, Encoders & Decoders.	12
Unit-III **Sequential Logic Circuits:** Latch, Flip Flops- R-S Flip-Flop, J-K Flip-Flop, Race Around Condition, Removing Race Around Condition, Master-Slave J-K Flip-Flop, D Flip-Flop, T Flip-Flop, Applications of Flip-Flops. [CO3]	8
Unit-IV **Introduction to Computer Organization:** Introduction to Computer and CPU (Computer Organization, Computer Design and Computer Architecture), Stored Program Concept- Von Neumann Architecture, Harvard Architecture, RISC and CISC Architecture. [CO1] **Register Transfer and Micro operations**- Introduction to Registers, Instruction Format, Types of Instructions- Memory Reference Instructions, Register Reference Instructions and Input-Output Instructions. **Common Bus System**: Introduction to Common Bus System, Types of Buses (Data Bus, Control Bus, Address Bus), 16-bit Common Bus System--Data Movement among registers using Bus.[CO4]	12

Text Books:

1. Computer System Architecture, M.M. Mano, Third Edition, PHI.
2. Digital Computer Electronics, Malvino, Second Edition, Mc-Graw Hill.

3. Modern Digital Electronics, R. P. Jain, Fourth Edition, TMH.

Reference Books:

1. Computer Organization and Architecture, Stallings, Eighth Edition, PHI.
2. Computer Organization and Architecture, J.P.Hayes, Third Edition, TMH.
3. Digital and Electronic Circuits, T. C. Bartee, McGraw Hill.
4. Digital Fundamentals, Floyd, Ninth Edition, PHI.
5. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.

Course Code: UGCA1909
Course Name: Object Oriented Programming using C++

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Outline the role of programming for solving real world problems.
CO2	Explain Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	Implement computer based solutions to various real-world problems using C++
CO4	Select the right Object Oriented Concept for optimal solution.
CO5	Review different solutions for a common problem.

Detailed Contents	Contact hours
Unit-I **Principles of object oriented programming** Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language(C) and Object Oriented Language [CO1]	12
Unit-II	10

Classes & Objects and Concept of Constructors Defining classes, Defining member functions, Declaration of objects to class, Access to member variables from objects, Different forms of member functions, Access specifiers (Private, public, protected), Array of objects. Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors.[CO2]	
Unit-III **Inheritance and Operator overloading** Introduction to Inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloading operators [CO3]	12
Unit-IV **Polymorphism and File Handling** Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes. [CO5] Opening and Closing File, Reading and Writing a file.	10

Text Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Code: UGCA1910
Course Name: Object Oriented Programming using C++ Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 2nd	**Contact hours:** 4 hours per week

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Design the classes.
CO2	Illustrate the concept of memory representation for objects
CO3	Implement programs using OOP concepts for various problems.
CO4	Implement file handling in C++
CO5	Select the right data types to represent class properties.

Instructions: Develop all program in C++
Assignments:

1.	Write a program to enter mark of 6 different subjects and find out the total mark (Using cin and cout statement)
2.	Write a function using reference variables as arguments to swap the values of pair of integers.
3.	Write a function to find largest of three numbers.
4.	Write a program to find the factorial of a number.
5.	Define a class to represent a bank account which includes the following members as Data members: a) Name of the depositor b) Account Number c) Withdrawal amount d) Balance amount in the account Member Functions: a) To assign initial values b)To deposit an amount c) To withdraw an amount after checking the balance d) To display name and balance.
6.	Write the above program for handling n number of account holders using array of objects.
7.	Write a C++ program to compute area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept.
8.	Consider a publishing company that markets both book and audio cassette version to its works. Create a class Publication that stores the title (a string) and price (type float) of a publication. Derive the following two classes from the above Publication class: Book which adds a page count (int) and Tape which adds a playing time in minutes(float). Each class should have get_data() function to get its data from the user at the keyboard. Write the main() function to test the Book and Tape classes by creating instances of them asking the user to fill in data with get_data() and then displaying it using put_data().

9.	Consider an example of declaring the examination result. Design three classes student, exam and result. The student has data members such as rollno, name. Create the lass exam by inheriting the student class. The exam class adds data members representing the marks scored in 5 subjects. Derive the result from exam-class and it has own data members like total, avg.
10.	Write a program for overloading of Unary ++ operator.
11.	Write a program for overloading of Binary + operator.
12.	Write a program of Virtual Functions.
13.	Write a program of Abstract Classes.
14.	Write a program to read and write from file.

Reference Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Code: UGCA1911
Course Name: Fundamentals of Statistics Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the knowledge of Spreadsheet.
Co requisite: The students will develop analytical behavior & will have better understanding of analyzing data and testing hypotheses.
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Create Frequency table and Graphs for data representation.
CO2	Apply various statistical operations using statistical tool like excel.
CO3	Compute various statistical measures using statistical tool like excel.

CO4	Analyze real life data usign statistical tool
CO5	Prepare data in different formats and styles

Instructions: Sample exercises are given below and Instructor can increase or decrease the experiments as per the requirement.

1:	Display the Maximum and Minimum market data.
2:	Display year wise strength of the students of a college in Tabular form & Graphical form.
3:	Calculate the average marks of the students of your College.
4:	Print measure of Central Tendency using grouped and ungrouped data.
5:	Construct & print frequency distribution using data with the following Techniques: a) Histogram b) Frequency Polygon c) Frequency Curve c) Ogive curves.
6:	Find out & display the Median and Mode from the following series by using suitable method: Class 156-158 158-160 160-162 162-164 164-166 Frequency 4 8 28 51 89
7:	Calculate an appropriate measure of dispersion using grouped and ungrouped data.
8:	Make an array and calculate range of the data.
9:	Represent the placement record of the students of your college.
10:	Calculate & display Letter Grade using spreadsheet.
11:	Represent the following data by suitable graphs, determine therefrom the number of children having IQ (i) Below 105 (ii) Above 124. IQ 75-84 85-94 95-104 105-114 115-124 125-134 No. of Children 8 20 45 54 28 16

Reference Books:

1. Statistics for Economics, TR Jain, VK Ohri.
2. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December 2000.

E-Books/ Online learning material

1. https://www.meritnation.com/cbse-class-11-commerce/economics/class_13_tr_jain.
2. http://college.cengage.com/mathematics/brase/understandable_statistics/9780618949922_ch03.pdf
3. http://www.rockcreekschools.org/pages/uploaded_files/Excel%201%20Lab%20Exercises.pdf

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1912

Course Name: Computer System Architecture Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Basic knowledge of Fundamentals of Computer and IT

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify various types of Gates and Circuits
CO2	Higlight the functioning of various gates and circuits
CO3	Validate the outcome of various gates and circuits
CO4	Differentiate between the various types of gates and circuits
CO5	Outline the use of each type of gate and curcuit

Assignments:

1.	To verify the Truth Table of Basic Logic Gates
2.	To verify the Truth Table of Combinational Logic Gates
3.	To verify the Truth Table of Universal Logic Gates
4.	To verify the Truth Table of Half Adder Combinational Circuit
5.	To verify the Truth Table of Full Adder Combinational Circuit
6.	To verify the Truth Table of Half Subtractor Combinational Circuit
7.	To verify the Truth Table of Full Subtractor Combinational Circuit
8.	To verify the Truth Table of Decoder Combinational Circuit
9.	To verify the Truth Table of Encoder Combinational Circuit
10.	To verify the Truth Table of Multiplexer Combinational Circuit
11.	To verify the Truth Table of De Multiplexer Combinational Circuit
12.	To verify the Truth Table of S-R Flip-Flop
13.	To verify the Truth Table of J-K Flip-Flop
14.	To verify the Truth Table of Master Slave J-K Flip-Flop
15.	To verify the Truth Table of D Flip-Flop
16.	To verify the Truth Table of T Flip-Flop
17.	To verify the working of Asynchronous Up Counter
18.	To verify the working of Asynchronous Down Counter
19.	To verify the working of Asynchronous MOD-N Counter
20.	To verify the working of Synchronous Up Counter
21.	To verify the working of Synchronous Down Counter
22.	To verify the working of Synchronous MOD-N Counter

23.	To verify the working of Asynchronous Bidirectional Counter
24.	To verify the working of Synchronous Bidirectional Counter

Reference Books:

1. Computer Organization and Architecture, Stallings, Eighth Edition, PHI.
2. Modern Digital Electronics, R. P. Jain, Fourth Edition, TMH.
3. Digital Logic & Computer Design, D. Morris Mano, Second Edition, PHI.
4. Digital and Electronic Circuits, T. C. Bartee, McGraw Hill.
5. Digital Fundamentals, Floyd, Ninth Edition, PHI.
6. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.

Ability Enhancement Compulsory Course
EVS102-18 Environmental Studies

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.

2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.

3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.

4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

UNIT-1: Introduction to Environmental Studies
Multidisciplinary nature of Environmental Studies: Scope & Importance
Need for Public Awareness

UNIT-2: Ecosystems
Concept of an Ecosystem: Structure & functions of an ecosystem (Producers, Consumers & Decomposers)
Energy Flow in an ecosystem: Food Chain, Food web and Ecological Pyramids
Characteristic features, structure & functions of following Ecosystems:

- Forest Ecosystem
- Aquatic Ecosystem (Ponds, Lakes, River & Ocean)

UNIT-3: Natural Resources

Renewable & Non-renewable resources
Forest Resources: Their uses, functions & values (Biodiversity conservation, role in climate change, medicines) & threats (Overexploitation, Deforestation, Timber extraction, Agriculture Pressure), Forest Conservation Act
Water Resources: Their uses (Agriculture, Domestic & Industrial), functions & values, Overexploitation and Pollution of Ground & Surface water resources (Case study of Punjab), Water Conservation, Rainwater Harvesting,

Land Resources: Land as a resource; Land degradation, soil erosion and desertification

Energy Resources: Renewable & non-renewable energy resources, use of alternate energy resources (Solar, Wind, Biomass, Thermal), Urban problems related to Energy

UNIT-4: Biodiversity & its conservation
Types of Biodiversity: Species, Genetic & Ecosystem
India as a mega biodiversity nation, Biodiversity hot spots and biogeographic regions of India
Examples of Endangered & Endemic species of India, Red data book

UNIT-5: Environmental Pollution & Social Issues
Types, Causes, Effects & Control of Air, Water, Soil & Noise Pollution
Nuclear hazards and accidents & Health risks
Global Climate Change: Global warming, Ozone depletion, Acid rain, Melting of Glaciers & Ice caps, Rising sea levels
Environmental disasters: Earthquakes, Floods, Cyclones, Landslides

UNIT-6: Field Work
Visit to a National Park, Biosphere Reserve, Wildlife Sanctuary
Documentation & preparation of a Biodiversity (flora & fauna) register of campus/river/forest
Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
Identification & Photography of resident or migratory birds, insects (butterflies)
Public hearing on environmental issues in a village

Suggested Books:

1. Bharucha, E. Text Book for Environmental Studies. University Grants Commission, New Delhi.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R)
9. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p

10. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
11. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
12. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
13. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
14. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
15. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
16. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
17. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
18. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
19. Survey of the Environment, The Hindu (M)
20. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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Course Code: UGCA1913
Course Name: Computer Networks

Program: BCA	**L**: 3 **T**: 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: Information Technology
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Highlight the characteristics of various protocols.
CO2	Define different network technologies and their application.
CO3	Identify Hardware and software components for designing network.
CO4	Compare the performace of different network media
CO5	Implement various configutaion settings

Detailed Contents	Contact hours
Unit-I **Data communications concepts:** Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. [CO1] **Types of Networks:** LAN, MAN, WAN **Network Topologies:** Bus, Star, Ring, Mesh, Tree, Hybrid **Communication Channels: Wired transmissions:** Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission. **[**CO3] **Communication Switching Techniques**: Circuit Switching, Message Switching, Packet Switching. [CO1]	12
Unit-II **Network Reference Models**: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models. Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – Frequency division, Time division, Wavelength division. [CO2] **Data Link Layer Design Issues**: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP) [CO2]	10
Unit-III **MAC sub layer:** CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) [CO1] **Network Layer:** Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking. [CO1]	12
Unit-IV **Transport Layer**: Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols. [CO4] **Session, Presentation and Application Layers**: Session Layer – Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer – Distributed	10

application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol. [CO5]	

Text Books:

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

Reference Books:

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, "Computer Networking", Pearson Education.
4. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

Course Code: UGCA1914
Course Name: Programming in Python

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: 40%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: **-NA-**
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Explain environment, data types, operators used in Python.
CO2	Compare Python with other programming languages.
CO3	Outline the use of control structures and numerous native data types with their methods.
CO4	Design user defined functions, modules, files, and packages and exception handling methods.
CO5	Write solutions for Object Oriented Programming Concepts.

Detailed Contents	Contact hours
Unit-I **Introduction to Python Programming Language:** Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages. [CO1] [CO2] **Python Data Types & Input/Output:** Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. [CO1] **Operators and Expressions:** Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators. [CO1]	12
Unit-II **Control Structures:** Decision making statements, Python loops, Python control statements. **Python Native Data Types:** Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).[CO3]	10
Unit-III **Python Functions:** Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. [CO3] **Python Modules:** Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages. [CO3]	12
Unit-IV **Exception Handling:** Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.	10

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. [CO4] **Classes and Objects:** The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects. [CO5]	

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: UGCA1915
Course Name: Data Structures

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Apply appropriate constructs of Programming language, coding standards for application development
CO2	Select appropriate data structures for problem solving and programming
CO3	Illustrate the outcome of various operations on data structures.
CO4	Identify appropriate searching and/or sorting techniques for wide range of problems and data types.
CO5	Differentiate between various types of data structures

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Detailed Contents	Contact hours
Unit-I **Introduction to Data Structures:** Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion. [CO5] **Arrays, Pointers and Strings:** Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings. [CO1]	10
Unit-II **Stacks and Queue** Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue. [CO2]	8
Unit-III **Linked Lists and Trees** Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. [CO3] **Trees** Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree. [CO3]	14
Unit-IV **Graphs, Searching, Sorting and Hashing** **Graphs:** Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. [CO3] **Searching and Sorting:** Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. [CO4]	12

Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing [CO4]	

Text Books

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Kruse R.L. Data Structures and Program Design in C; PHI
3. Aho Alfred V., Hopperoft John E., Ullman Jeffrey D., "Data Structures and Algorithms", AddisonWesley

Reference books

1. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.
2. Yashwant Kanetkar, Understanding Pointers in C, BPB Publications.
3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.

Course Code: UGCA1916
Course Name: Computer Networks Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Outline the key features of various protocols
CO2	Implement network configuration settings for an operating system
CO3	Prepare different types of cables for netwroking.
CO4	Design network model using network simulation tool
CO5	Implement various setting on FTP, Proxy and other servers.

List of assignments:

1.	Familiarization with networking components and devices: LAN Adapters, Hubs, Switches, Routers etc

2.	Familiarization with transmission media and tools: Coaxial cable, UTP cable, Crimping tool, Connectors etc
3.	Preparing straight and cross cables
4.	Study of various LAN topologies and their creation using network devices, cables and computers
5.	Configuration of TCP/IP Protocols in Windows and Linux
6.	Implementation of resource sharing (file, printer etc.)
7.	Designing and implementing class A, B and C networks
8.	Subnet planning and its implementation
9.	To configure dynamic IP address for a computer connected to a LAN
10.	Use of commands like ping, ipconfig for trouble shooting network related problems
11.	Develop a program to compute the Hamming Distance between any two code words
12.	Installation of FTP server and client
13.	To configure proxy server
14.	Familiarization with network simulation tools.

Reference Books:

1. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
2. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

Course Code: UGCA1917
Course Name: Programming in Python Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 3rd	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems**: 90%
Internal max. marks: 60	**Duration of end semester exam (ESE)**: 3hrs
External max. marks: 40	**Elective Status :** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - Maintain practical note book as per the instructions given by the instructor.

Course Outcomes: Students will be able to :

CO#	Course outcomes
CO1	Outline various programming constructs like data types and control structures of Python.
CO2	Implement different data structures.
CO3	Implement modules and functions.

CO4	Illustrate concept of object oriented programming.
CO5	Implement file handling.

List of assignments:

1.	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2.	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute volume of following 3D shapes: cube, cylinder, cone and sphere.
4.	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user.
5.	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6.	Write a program to determine whether a triangle is isosceles or not?
7.	Print multiplication table of a number input by the user.
8.	Compute sum of natural numbers from one to n number.
9.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13…..n
10.	Compute factorial of a given number.
11.	Count occurrence of a digit 5 in a given integer number input by the user.
12.	Print Geometric and Harmonic means of a series input by the user.
13.	Evaluate the following expressions: a. $x-x^2/2!+x^3/3!- x^4/4!+\ldots x^n/n!$ b. $x-x^3/3!+x^5/5!- x^7/7!+\ldots x^n/n!$
14.	Print all possible combinations of 4, 5, and 6.
15.	Determine prime numbers within a specific range.
16.	Count number of persons of age above 60 and below 90.
17.	Compute transpose of a matrix.
18.	Perform following operations on two matrices. 1) Addition 2) Subtraction 3) Multiplication
19.	Count occurrence of vowels.
20.	Count total number of vowels in a word.
21.	Determine whether a string is palindrome or not.
22.	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list
23.	Display word after Sorting in alphabetical order.
24.	Perform sequential search on a list of given numbers.
25.	Perform sequential search on ordered list of given numbers.
26.	Maintain practical note book as per their serial numbers in library using Python dictionary.
27.	Perform following operations on dictionary 1) Insert 2) delete 3) change
28.	Check whether a number is in a given range using functions.
29.	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string.

30.	To find the Max of three numbers using functions.
31.	Multiply all the numbers in a list using functions.
32.	Solve the Fibonacci sequence using recursion.
33.	Get the factorial of a non-negative integer using recursion.
34.	Write a program to create a module of factorial in Python.
35.	Design a Python class named *Rectangle*, constructed by a length & width, also design a method which will compute the area of a rectangle.
36.	Design a Python class named *Circle* constructed by a radius and two methods which will compute the area and the perimeter of a circle.
37.	Design a Python class to reverse a string 'word by word'.
38.	Write a Python program to read an entire *text file*.
39.	Design a Python program to read first n lines of a *text file.*
40.	Construct a Python program to write and append text to a file and display the text.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Ediiton, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: UGCA1918
Course Name: Data Structures Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - NA-

Course Outcomes: Student will be able to

CO#	Course outcomes
CO1	Implement Dynamic memory allocation.
CO2	Create different data structures in C/ C++
CO3	Implement various operations of all data structures

CO4	Illustrate the outcome of various operations with the help of examples.
CO5	Write programs to implement various types of searching and sorting algorithms

Instructions: Programs may be developed in C/C++/Python/Java language.

List of assignments:

1	Program for using Dynamic Functions (malloc(), calloc(), realloc() and free()) functions.
2	Program to insert, delete and traverse an element from an array
3	Program to merge one dimensional arrays
4	Program for addition and subtraction of two matrices.
5	Program for implementing multiplication of two matrices
6	Implement linear search using one and two dimensional array.
7	Program for implementing selection sort.
8	Program for implementing insertion sort.
9	Program for implementing quick sort.
10	Program for implementing merge sort.
11	Program to calculate length of the string using user defined function.
12	Program to concatenate and compare two strings using user defined function.
13	Program for using the concept of pointer to string.
14	Program to reverse a sentence by recursion.
15	Program to delete all repeated words in string.
16	Program to find the number of vowels, consonants, digits and white space in a string.
17	Program to find the length of the longest repeating sequence in a string.
18	Program to find highest and lowest frequency character in a string.
19	Program for implementing Stack using array.
20	Program for implementing Stack using pointer.
21	Program for implementing multiple stack.
22	Program for converting infix to postfix form.
23	Program for implementing Queue using array.
24	Program for dynamic implementation of queue.
25	Program for implementing circular queue.
26	Program for implementing dequeue.
27	Program for implementing priority queue.
28	Program for implementing Singly Linked list.
29	Program for implementing Doubly Linked list.
30	Program for implementing Binary Search Tree.
31	Program for Breadth First Search (BFS) for graph traversal.
32	Program for Depth First Search (DFS) for graph traversal.

Reference Books:

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.

2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", AddisonWesley
3. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.

Course Code: UGCA1919
Course Name: PC Assembly & Troubleshooting

Program: BCA	**L**:3**T**:0 **P**:0
Branch: Computer Applications	**Credits**: 3
Semester : 3rd	**Contact hours:**33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 80%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks:60	**Elective status:** Skill Enhancement
Total marks:100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Identify various components of computer systems.
CO2	Differentiate between types of processors required for different computer systems.
CO3	Explain the steps to install, connect and configure various peripheral devices
CO4	Execute the troubleshooting issues in Computer Systems
CO5	Explain how resources can be shared over network

Detailed contents	Contact hours
Unit I: Brief history of computer on the basis Hardware. Computer system modules/ components and its operations, need of hardware and software for computer to work, different hardware components within a computer and connected to a computer as peripheral devices, different processors used for personal computers and notebook computers. [CO1]	9
Unit II: Perform installation, configuration, and upgrading of microcomputer/ computer: Hardware and software requirement, Assemble/setup microcomputer/ computer systems, accessory boards, types of motherboards, selection of right motherboard, Installation replacement of motherboard, troubleshooting problems with memory. [CO2]	8

Unit III: Install/connect associated peripherals: Working of printers and scanners, Installation of printers and scanners, sharing a printer over a local area network, troubleshooting printer and scanner problems, troubleshooting hard drive problems. Drivers: Meaning, role and types.[CO3]	8
Unit IV: Diagnose and troubleshooting of microcomputer/ computer systems hardware & software and other peripheral equipment: Approaches to solve a PC problem, troubleshooting a failed boot before the OS is loaded, different approaches to installing and supporting I/O device, managing faulty components. Booting and its types. [CO4][CO5]	8

Text Books:

1. PC Hardware: The Complete Reference, McGraw-Hills

Reference Books:

1. The Indispensable PC Hardware Book (4th Edition) Hans-Peter Messmer
2. PC Hardware: A Beginner's Guide by Ron Gilster.

Course Code: UGCA1920
Course Name: PC Assembly & Troubleshooting Laboratory

Program: BCA	**L**:0 **T**:0 **P**:2
Branch: Computer Application	**Credits**:1
Semester: 3rd	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 95%
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:20	**Elective status:** Skill Enhancement
Total marks:50	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify key component of computer system while assembling a system.
CO2	Implement installation and configuration of computer system
CO3	Perform installation, configuration and sharing of peripheral devices.
CO4	Solve troubleshooting issues in Computer Systems
CO5	Execute dual booting.

List of assignments:

1.	Assembling and De Assembling of Computer System
2.	Loading and configuration procedure of Microsoft Client O/S Win XP /Win 7 and Windows 8
3.	Installation of utility tools (Software)
4.	Installation of utility tools (Drivers)
5.	Firewall configuration, Antivirus/Internet security loading and configuration procedure
6.	Installation and configuration of I/O devices – Printers, Webcams, Scanners.
7.	Installation and configuration of I/O devices – Digital Camera, USB Wi-fi, USB BT, USB Storages, Projectors
8.	Multiple OS loading and trouble shooting

Recommended Hardware:

All hardware component as mentioned above in the syllabus.

Text Books:

1. PC Hardware: The Complete Reference, McGraw-Hills

Reference Books:

1. The Indispensable PC Hardware Book (4th Edition) Hans-Peter Messmer
   PC Hardware: A Beginner's Guide by Ron Gilster

Course Code: UGCA1921
Course Name: Software Engineering

Program: BCA	**L:** 3 **T:**1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**:-
Internal max. marks: 40	**Duration of end semester exam (ESE):** -
External max. marks: 60	**Core/Elective status:** core
Total marks: 100	

Prerequisite: -
Co requisite:-

Additional material required in ESE:-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Highlight the need of software engineering
CO2	Outline the phases and activities involved in the conventional software life cycle models
CO3	Design documents for various phases of software life cycle.
CO4	Compute the complexity of the software based on multiple metrices.
CO5	Identify the tools needed for different types of documents required in software engineering.

Detailed contents	Contact hours
Unit 1 The Nature of Software, Need of Software Engineering, Prescriptive Process Models, Specialized Process Models, The Unified Process. [CO1]	10
Unit 2 Role of a system analyst, SRS, Properties of a good SRS document, functional and non-functional requirements, Decision tree and Decision table, Formal Requirements Specification, Software Cost Estimation. [CO2]	10
Unit 3 Software design and its activities, Preliminary and detailed design activities, Characteristics of a good software design, Features of a design document, Cohesion and Coupling, Structured Analysis, Function Oriented Design, Object-Oriented Design. [CO3]	12
Unit 4 Testing Fundamentals, Unit Testing, Integration Testing, Validation Testing, System Testing, Maintenance and Reengineering, Measures, Metrics, and Indicators, Software Measurement, Metrics for Requirements Model, Metrics for Design Model, Metrics for Testing, Metrics for Maintenance. [CO4] [CO5]	12

Text Books:

1. Software Engineering–A Practitioner's Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.

Reference Books:

1. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005
2. Software Engineering, Ian Sommerville, Ninth Edition, Addison-Wesley, 2011

Course Code: UGCA1922
Course Name: Database Management Systems

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Define the basic concepts of DBMS.
CO2	Design SQL queries.
CO3	Illustrate the concept of data normalization with the help of real life examples.
CO4	Explain the concept of transaction management.
CO5	Outline features of advanced database management systems.

Detailed contents	Contact hours
Unit-I Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model. [CO1]	10

Unit-II Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers. [CO2]	12
Unit-III Introduction to Normalization, First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF). [CO3]	12
Unit-IV Database Recovery, Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases. [CO4] [CO5]	10

Text Books:

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition, (2012).
2. "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", Ivan Bayross, BPB Publications, 4th Revised Edition (2009)
2. "An Introduction to Database Systems", C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006).
3. Database Management Systems, Raghu Ramakrishnan, McGraw-Hill, Third Edition, 2014.

Course Code: UGCA1923
Course Name: Operating Systems

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 15%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs

External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: Basic understanding of computer system.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Discuss the evaluation of operating systems.
CO2	Explain different resource managements performed by operating system.
CO3	Describe the architecture in terms of functions performed by different types of operating systems.
CO4	Analyze the performance of different algorithms used in design of operating system components.
CO5	Compare the key properties of different types of Operating Sysytems.

Detailed contents	Contact hours
Unit-I **Fundamentals of Operating system**: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems.[CO1] **Process & Thread Management**: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization. [CO2] **CPU Scheduling**: Need of CPU scheduling, CPU I/O Burst Cycle, Pre-emptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCSC, SJF, Round-Robin, Multilevel Queue). [CO2]	12
Unit-II **Memory Management**: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms. [CO2]	12
Unit-III	08

I/O Device Management: I/O devices and controllers, device drivers; disk storage. **File Management**: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.[CO3]	
Unit-IV **Advanced Operating systems:** Introduction to Distributed Operating system, Characteristics, architecture, Issues, Communication & Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization & Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure & Scheduling. Case study of Linux operating system [CO4] [CO5]	12

Text Books:

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.
2. Principals of Operating System by Naresh Chauhan, Published by OXFORD University Press, India.

Reference Books:

1. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education.
2. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India)

Course Code: UGCA1924
Course Name: Software Engineering Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Identify the scope and objective of different domains that have impact on society
CO2	Create data flow diagrams
CO3	Compute software complexity using latest tools
CO4	Design a software engineering process life cycle.
CO5	Implement specification, design, implementation, and testing process using latest tools

Assignments:

1.	Identify project scope and objective of given problem: *a. College automation system.* *b. Banking Management System.*
2.	Develop software requirements specification for (1 a.) and (1 b.) problem.
3.	Develop UML Use case model for a problem.
4.	Develop Class diagrams
5.	Represent project Scheduling of above-mentioned projects
6.	Use any model for estimating the effort, schedule and cost of software project
7.	Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project
8.	Develop sequence diagram
9.	Develop Structured design for the DFD model developed
10.	Develop the waterfall model, prototype model and spiral model of the product
11.	Explain with reason which model is best suited for the product
12.	Develop a working protocol of any of two problem
13.	Use LOC, FP and Cyclomatic Complexity Metric of above-mentioned problem
14.	Find Maintainability Index and Reusability Index of above-mentioned problem
15.	Using any Case Tool find number of statements, depth and complexity of the prototype

Reference Books:

1. Software Engineering–A Practitioner's Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.
2. The Unified Modeling Language Reference Manual, Grady Booch, Second Edition, Addison Wesley, 2005.
3. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005.

Course Code: UGCA1925
Course Name: Database Management Systems Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 100%
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Differentiate between DDL, DML and DCL commands
CO2	Implement DDL, DML and DCL commands
CO3	Write integrity constraints on a database
CO4	Design Databases and Tables in relational model for some project related to society welfare
CO5	Implement PL/SQL.

Instructions:

1.	Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations)
2.	Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations)
3.	Use of simple select statement.
4.	Use of select query on two relations
5.	Use of nesting of queries.
6.	Use of aggregate functions.
7.	Use of substring comparison.
8.	Use of order by statement.
9.	Consider the following schema for a Library Database: BOOK (*Book_id, Title, Publisher_Name, Pub_Year*) BOOK_AUTHORS (Book_id, Author_*Name*) PUBLISHER (*Name, Address, Phone*) BOOK_COPIES (*Book_id, Branch_id, No-of_Copies*) BOOK_LENDING (*Book_id, Branch_id, Card_No, Date_Out, Due_Date*) LIBRARY_BRANCH (*Branch_id, Branch_Name, Address*) Write SQL queries to 1. Retrieve details of all books in the library_id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books between Jan 2018 to Jun 2018

	3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
10.	Consider the following schema for Order Database: SALESMAN (*Salesman_id, Name, City, Commission*) CUSTOMER (*Customer_id, Cust_Name, City, Grade, Salesman_id*) ORDERS (*Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id*) Write SQL queries to 1. Count the customers with grades above Amritsar's average. 2. Find the name and numbers of all salesmen who had more than one customer. 3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
11.	Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time.
12.	Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop.
13.	Write a program to create a trigger which will convert the name of a student to upper case before inserting or updating the name column of student table.
14.	Write a PL/SQL block to count the number of rows affected by an update statement using SQL%ROWCOUNT
15.	Write a PL/SQL block to increase the salary of all doctors by 1000.

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition, Ivan Bayross (2009).
2. "Oracle PL/SQL Programming", 5th Edition, Steven Feuerstein and Bill Pribyl (2009).

Course Code: UGCA1926
Course Name: Operating Systems Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 100
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core

Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After going through the practical, student will be able to:

CO#	Course outcomes
CO1	Implement the installation and configuration of different operating systems.
CO2	Write programs for different scheduling algorithms.
CO3	Execute various commands in Vi editor
CO4	Implement the dual boot installation
CO5	Execute commands in shell programming

Instructions:

1	Installation of windows OS.
2	Installation of Linux OS.
3	Dual boot installation of Operating systems.
4	Implementation of FCFS Scheduling algorithm
5	Implementation of SJF Scheduling algorithm
6	Implementation of Round-Robin Scheduling algorithm
7	Vi Editor & its commands
8	Shell Commands
9	Shell Scripting- Using variables
10	Shell Scripting- Input & Output
11	Shell Scripting- Data types
12	Shell Scripting- Use of arithmetic operators
13	Shell Scripting- if control statement programs
14	Shell Scripting- while control statement
15	Shell Scripting- for control statement

Reference Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw-Hill Publication.
2. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

Course Code: UGCA1927
Course Name: Web Designing

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 3
Semester: 4th	**Contact hours:** 33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 80%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Skill Enhancement
Total marks: 100	

Prerequisite: Student must have the basic knowledge of any text editor like notepad, notepad++ and Edit plus etc.
Co requisite: Student must know the background of Markup Language.
Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: The students will be able to:

CO#	Course Outcomes
CO1	Create pages with simple tags in HTML
CO2	Design webpages with multiple sections or frames
CO3	Explain how to link webpages through hypertext or images a links
CO4	Outline the key web designing concepts using java script
CO5	Design forms with special controls using HTML

Detailed Contents	Contact hours
Unit-I **Internet Basics** Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address. **Introduction To HTML** Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags), Commonly Used Html Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines). Basic Formatting Tags HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. [CO1]	8

Unit-II **Lists** Type of Lists (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. **Adding Graphics To Html Documents** Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute. [CO2] **Tables** Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell padding Attribute, Using the Cell spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes [CO2] **Linking Documents** Links (External Document References, Internal Document References), Image As Hyperlinks. [CO3] **Frames** Introduction to Frames: The<FRAMESET> tag, The <FRAME> tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style Tag. [CO2]	9
Unit-III **Forms Used by a Web Site** The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element). [CO4]	8
Unit 4 **Introduction to JavaScript** JS Introduction, Where To, Output, Statements, Syntax, Comments, Variables, Operators, Arithmetic, Assignment, Data Types, Functions, Objects, Events, Strings, String Methods, Numbers, Number Methods, Arrays, Array Methods, Array Sort, Array Iteration, Dates, Date Formats, Date Get Methods, Date Set Methods, Math, Random, Booleans, Comparisons, Conditions, Switch, Loop For, Loop While, Break, Type Conversion, Bitwise, RegExp, Errors, Scope, Hoisting, Strict Mode, JSON, Forms, Forms API [CO5] JS Functions, Function Definitions, Function Parameters, Function Invocation, Function Call, Function Apply, Function Closures [CO5]	8

Text Books/Reference Books:

1. Internet for EveryOne: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppe, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.
3. Raj Kamal, "Internet& Web Technologies", edition Tata McGraw-Hill Education.2009.

E-Books/ Online learning material:

1. BayrossIvan, "HTML, DHTML, JavaScript, PERL, CGI", 3rd Edition, BPB Publication,2009.
2. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
3. A Beginner's Guide To Html Http://www.Ncsa.Nine.Edit/General/Internet/www/Html.Prmter
4. https://www.tutorialspoint.com/html/html_tutorial.pdf
5. https://www.w3schools.com/js/
6. https://www.w3schools.com/html/
7. https://www.cs.uct.ac.za/mit_notes/web_programming.html
8. http://www.pagetutor.com/table_tutor/index.html

Course Code: UGCA1928
Course Name: Web Designing Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits**: 1
Semester: 4th	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 80%
Internal max. marks: 30	**Duration of End Semester Exam (ESE):** 3hrs
External max. marks: 20	**Elective status:** Skill Enhancement
Total marks: 50	

Prerequisite: Students must have the knowledge of editors like Notepad etc.
Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.
Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Design pages with simple tags in HTML

CO2	Create web pages with Auido and Video content in it.
CO3	Illustrate the movement from one web page to another
CO4	Implement advanced web designing concepts using java script
CO5	Execute a small web pased project for the benefit of scoiety

Instructions: Instructor can increase/decrease the experiments as per the requirement.

1.	Create a simple HTML page to demonstrate the use of different tags.
2.	Design index page of a book on web designing.
3.	Display Letter Head of your college on a web page.
4.	Create a Hyperlink to move around within a single page rather than to load another page.
5.	Display letter using different Text formatting Tags.
6.	Design Time Table of your department and highlights of most important periods.
7.	Use Tables to provide layout to your web page.
8.	Embed Audio and Video into your web page.
9.	Divide a web page vertically and horizontally and display logo of your college in left pane and logo of university in right pane.
10.	Create a student Bio- Data.
11.	Design front page of hospital with different style sheets.
12.	Design a web page and display two different pages at a time.
13.	Write a program to create a login form. On submitting the form, the user should get navigated to a profile page using JavaScript.
14.	Write a code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials using JavaScript.
15.	Write an HTML code to create your Institute website/Department website/ Tutorial website for specific subject. Also use Java Script for validation.

Reference Books:

1. Greenlaw R; Hepp E, "Fundamentals of Internet and www", 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner's Guide to HTML
   http://www.Ncsa.Nine.Edit/General/Internet/www/
   a. html.prmter.

Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1929
Course Name: Programming in PHP

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 3
Semester: 5th	**Contact hours:** 33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 80%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Skill Enhancement
Total marks: 100	

Prerequisite: Students must have basic knowledge of any text editor like notepad++ and Edit plus etc.

Co requisite: Students must know the background of HTML, Front-End, Back-End & concept of Structure Query Language.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Outline the importance and benefits of PHP
CO2	Compare Client Side Script & Server Side Script.
CO3	Explain the use of control structures, data types used in PHP.
CO4	Implement database connectivity.
CO5	Develop Dynamic Website that can interact with different kinds of Database Languages.

Detailed contents	Contact hours
Unit-I **Introduction to PHP** Evolution of PHP & its comparison Interfaces to External systems, Hardware and Software requirements, PHP Scripting. Basic PHP Development, Working of PHP scripts, Basic PHP syntax, PHP data types. [CO1] **Displaying type information:** Testing for a specific data type, Changing type with Set type, Operators, Variable manipulation, Dynamic variables and Variable scope. [CO1]	11

Unit-II **Control Statements** if() and elseif() condition Statement, The switch statement, Using the? Operator, Using the while() Loop, The do while statement, Using the for() Loop. [CO3] **Functions** Function definition, Creation, Returning values, Library Functions, User-defined functions, Dynamic function, default arguments, Passing arguments to a function by value. [CO3] **String Manipulation** Formatting String for Presentation, Formatting String for Storage, Joining and Splitting String, Comparing String . **Array** Anatomy of an Array, Creating index based and Associative array, Looping array using each() and foreach() loop. [CO2]	10
Unit-III **Forms** Working with Forms, Super global variables, Super global array, Importing user input, Accessing user input, Combine HTML and PHP code, Using hidden fields, Redirecting the user. **Working with File and Directories** Understanding file & directory, Opening and closing a file, Coping, renaming and deleting a file, Working with directories, File Uploading & Downloading. Generating Images with PHP: Basics computer Graphics, Creating Image.	10
Unit-IV **Database Connectivity with MySql** Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select).[CO4] [CO5]	2

Text Books:

1. PHP: The Complete Reference, "Steven Holzner" , Tata McGraw Hill.
2. Programming PHP, "Kevin Tetroi" , O' Reilly.

3. Robin Nixon, Learning PHP, MySQL, and JavaScript, Shroff/O'Reilly.

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/php/php_tutorial.pdf
2. https://www.w3schools.com/php/
3. https://education.fsu.edu/wp-content/uploads/2015/04/Learning-PHP-MySQL-JavaScript-and-CSS-2nd-Edition-1.pdf

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Course Code: UGCA1930
Course Name: Programming in PHP Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits:** 1
Semester: 5th	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 80%
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 20	**Elective status:** Skill Enhancement
Total marks: 50	

Prerequisite: Students must have the knowledge of editors like Notepad++ and Edit plus etc.

Co requisite: Students must know the background of Markup Language, Front-End, Back-End & concept of Structure Query Language.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course outcomes
CO1	Write scripts for basic web page designs
CO2	Design the work flow of web page with the help of various control statements
CO3	Differentiate between client side and server side scripting
CO4	Illustrate the concept of static and dynamic websites
CO5	Implement the database concepts in PHP

Instructions: Instructor can increase/decrease the experiments as per the requirement.

1.	Take values from the user and compute sum, subtraction, multiplication, division and exponent of value of the variables.
2.	Write a program to find area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute and print roots of quadratic equation.
4.	Write a program to determine whether a triangle is isosceles or not?
5.	Print multiplication table of a number input by the user.
6.	Calculate sum of natural numbers from one to n number.
7.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13 21…..n
8.	Write a program to find the factorial of any number.
9.	Determine prime numbers within a specific range.
10.	Write a program to compute, the Average and Grade of students marks.
11.	Compute addition, subtraction and multiplication of a matrix.
12.	Count total number of vowels in a word “Develop & Empower Individuals”.
13.	Determine whether a string is palindrome or not?
14.	Display word after Sorting in alphabetical order.
15.	Check whether a number is in a given range using functions.
16.	Write a program accepts a string and calculates number of upper case letters and lower case letters available in that string.
17.	Design a program to reverse a string word by word.
18.	Write a program to create a login form. On submitting the form, the user should navigate to profile page.
19.	Design front page of a college or department using graphics method.
20.	Write a program to upload and download files.

Reference Books:

1. PHP: The Complete Reference, “Steven Holzner” , January 1, 2007. Tata McGraw-Hill Education.
2. Programming PHP, “Kevin Tetroi”, O' Reilly.
3. Published by Wiley Publishing, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256

E-Books/ Online learning material:

1. http://cs.petrsu.ru/~musen/php/2013/Books/Beginning%20PHP%205.3%20by%20Matt%20Doyle.pdf
2. https://www.w3schools.com/php/

Course Code: UGCA1931
Course Name: Data Warehouse and Mining

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 20%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	Highlight the need of Data Warehousing & Mining
CO2	Differentiate between the Transactional and Analytical data models.
CO3	Identify the real life applications where data mining can be applied.
CO4	Apply different data mining algorithms on wide range of data sets.
CO5	Explain the role of visualization in data representation and analysis.

Detailed Contents	Contact hours
Unit-I Need for strategic information, difference between operational and Informational data stores Data warehouse definition, characteristics, Data warehouse role and structure, OLAP Operations, Data mart, Different between data mart and data warehouse, Approaches to build a data warehouse, Building a data warehouse, Metadata & its types. [CO1]	11
Unit-II Data Pre-processing: Need, Data Summarization, Methods. Denormalization, Multidimensional data model, Schemas for multi-dimensional data (Star schema, Snowflake Schema, Fact Constellation Schema, Difference between different schemas. Data warehouse architecture, OLAP servers, Indexing OLAP Data, OLAP query processing, Data cube computation [CO2]	11
Unit-III Data Mining: Definition, Data Mining process, Data mining methodology, Data mining tasks, Mining various Data types & issues. Attribute-Oriented Induction, Association rule mining, Frequent itemset mining, The Apriori Algorithm, Mining multilevel association rules.[CO3]	12

Unit-IV Overview of classification, Classification process, Decision tree, Decision Tree Induction, Attribute Selection Measures. Overview of classifier's accuracy, Evaluating classifier's accuracy, Techniques for accuracy estimation, Increasing the accuracy of classifier. [CO4] Introduction to Clustering, Types of clusters, Clustering methods, Data visualization & various data visualization tools [CO5]	10

Text Books:

1. Data Warehousing, Data Mining & Olap by Berson, Tata Mcgraw- Hill.
2. Han J., Kamber M. and Pei J., Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
4. Adriaans P., Zantinge D., Data mining, Pearson education press (1996), 1st ed.
5. Pooniah P., Data Warehousing Fundamentals, Willey interscience Publication, (2001), 1st ed.

Course Code: UGCA1937
Course Name: Data Warehouse and Mining Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 90
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Basic understanding of database concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After going through this laboratory, student will be able to:

CO#	Course outcomes
CO1	Identify different data mining tools used to analyze data.
CO2	Implement classification/ Clustering techniques in R/ Weka
CO3	Create visualization for representing data.
CO4	Execute various data preprocessing techniques
CO5	Analyze the data which has direct impact on the society

Instructions:

1	Introduction to WEKA and R tools.
2	Installation of Weka/ R Tool.
3	Introduction to various components of WEKA/ R tool.
4	Fundamental programming using WEKA/ R tool.
5	Implementing data preprocessing.
6	Implementing apriori algorithm.
7	Implementing classification using decision tree.
8	Implementing classification using decision tree induction.
9	Implementation k-mean clustering
10	Implementing different Data visualization tools.

- Number of practical's can be more than 10 by implementing these algorithms on different data sets. Also, visualization tools can be used simultaneously to represent the outcomes in a better way

Reference Books:

1. Data Mining: Practical Machine Learning Tools and Techniques, 3rd edition by Ian H. Witten, Eibe Frank, Mark A. Hall Published by Morgan Kaufmann.
2. Data analytics using R, 1st edition by Seema Acharya Published by Tata Mcgraw Hill.

E Books/ Online learning material

Students can refer to youtube channel: Data Mining with Weka (WekaMOOC) by University of WAIKATO for reference using the following link: https://www.youtube.com/user/WekaMOOC

Course Code: UGCA1932
Course Name: Programming in Java

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours**: 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 40%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status**: Elective
Total marks:100	

Prerequisite: Basic knowledge of programming like Programming in C.
Co requisite: - Knowledge of Object Oriented Concepts through any language like C++.
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes

CO1	Define various Object Oriented concepts in Java Programming.
CO2	Compare different data types in java.
CO3	Differentiate between built-in and user defined functions/methods, interfaces and packages etc.
CO4	Outline the importance of exception handling in programs.
CO5	Explain advanced concepts like multithreading, applet used in java.

Detailed Contents	Contact hours
Unit-I **Java Programming Fundamentals:** Introduction to Java, Stage for Java, Origin, Challenges of Java, Java Features, Java Program Development, Object Oriented Programming. [CO2] **Java Essentials:** Elements of Java Program, Java API, Variables and Literals, Primitive Data Types, The String class, Variables, Constants, Operators, Scope of Variables & Blocks, Types of Comment in Java. [C2]	10
Unit-II **Control Statements:** Decision making statements (if, if-else, nested if, else if ladder, switch, conditional operator), Looping statements (while, do-while, for, nested loops), Jumping statements (Break and Continue). [CO1] **Classes and Objects:** Basic concepts of OOPS, Classes and Objects, Modifiers, Passing arguments, Constructors, Overloaded Constructors, Overloaded Operators, Static Class Members, Garbage Collection. [CO1] **Inheritance:** Basics of inheritance, Inheriting and Overriding Superclass methods, Calling Superclass Constructor, Polymorphism, Abstract Classes, Final Class. [CO1]	12
Unit-III **Arrays and Strings:** Introduction to array, Processing Array Contents, Passing array as argument, Returning array from methods, Array of objects, 2D arrays, Array with three or more dimensions. String class, string concatenation, Comparing strings, Substring, Difference between String and String Buffer class, String Tokenizer class. **Interface and Packages:** Basics of interface, Multiple Interfaces, Multiple Inheritance Using Interface, Multilevel Interface, Packages, Create and Access Packages, Static Import and Package Class, Access Specifiers.[CO2]	10

Exception Handling: Introduction, Try and Catch Blocks, Multiple Catch, Nested Try, Finally, Throw Statement, Built-In Exceptions.[CO5]	
Unit-IV **Multithreading:** Introduction, Threads in Java, Thread Creation, Lifecycle of Thread, Joining a Thread, Thread Scheduler, Thread Priority, Thread Synchronization.[CO4] **Applets:** Introduction, Applet Class, Applet Life Cycle, Graphics in Applet, Event-Handling.[CO4] **File and I/O Streams:** File Class, Streams, Byte Streams, Filtered Byte Streams, Random Access File Class, Character Streams.[CO4]	12

Text Books:

1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, TMH.
2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.
3. Java Fundamentals, A Comprehensive Introduction, H. Schildt, D. Skrien, TMH.

Reference Books:

1. Java, The complete Reference, H. Schildt, 7th Edition, TMH.

Course Code: UGCA1938
Course Name: Programming in Java Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 5th	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 90%
Internal max. marks: 60	**Duration of end semester exam (ESE)**: 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: - Basic knowledge of Programming language like Programming in C.
Co requisite: - Knowledge of Object Oriented Concepts through any language like C++.
Additional material required in ESE: - Minor Project.

Course Outcomes: Students will be able to

CO#	Course Outcomes
CO1	Execute Core Java concepts.

CO2	Illustrate the role of differentdata type, operators and control statement in java with the help of programs.
CO3	Write programs to hadle exceptions
CO4	Implement multithreading in java
CO5	Execute interfaces and packages.

Instructions: All programs are to be developed in Java programming language.

List of assignments:

1.	Write a program to perform following operations on two numbers input by the user: 1) Addition 2) subtraction 3) multiplication 4) division
2.	Write a Java program to print result of the following operations. 1. -15 +58 * 45 2. (35+8) % 6 3. 24 + -5*3 / 7 4. 15 + 18 / 3 * 2 - 9 % 3
3.	Write a Java program to compute area of: 1) Circle2) rectangle 3) triangle 4) square
4.	Write a program to convert temperature from Fahrenheit to Celsius degree using Java.
5.	Write a program through Java that reads a number in inches, converts it to meters.
6.	Write a program to convert minutes into a number of years and days.
7.	Write a Java program that prints current time in GMT.
8.	Design a program in Java to solve quadratic equations using if, if else
9.	Write a Java program to determine greatest number of three numbers.
10.	Write program that gets a number from the user and generates an integer between 1 and 7 subsequently should display the name of the weekday as per that number.
11.	Construct a Java program to find the number of days in a month.
12.	Write a program to sum values of an Single Dimensional array.
13.	Design & execute a program in Java to sort a numeric array and a string array.
14.	Calculate the average value of array elements through Java Program.
15.	Write a Java program to test if an array contains a specific value.
16.	Find the index of an array element by writing a program in Java.
17.	Write a Java program to remove a specific element from an array.
18.	Design a program to copy an array by iterating the array.
19.	Write a Java program to insert an element (on a specific position) into Multidimensional array.
20.	Write a program to perform following operations on strings: 1) Compare two strings. 2) Count string length. 3) Convert upper case to lower case & vice versa. 4) Concatenate two strings. 5) Print a substring.

21.	Developed Program & design a method to find the smallest number among three numbers.
22.	Compute the average of three numbers through a Java Program.
23.	Write a Program & design a method to count all vowels in a string.
24.	Write a Java method to count all words in a string.
25.	Write a method in Java program to count all words in a string.
26.	Write a Java program to handle following exceptions: 1) Divide by Zero Exception. 2) Array Index Out Of B bound Exception.
27.	To represent the concept of *Multithreading* write a Java program.
28.	To represent the concept of all types of inheritance supported by Java, design a program.
29.	Write a program to implement *Multiple Inheritance* using interface.
30.	Construct a program to design a package in Java.
31.	To write and read a plain text file, write a Java program.
32.	Write a Java program to append text to an existing file.
33.	Design a program in Java to get a list of all file/directory names from the given.
34.	Develop a Java program to check if a file or directory specified by pathname exists or not.
35.	Write a Java program to check if a file or directory has read and write permission.

Text Books:

1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, TMH.
2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.
3. Java Fundamentals, A Comprehensive Introduction, H. Schildt, D. Skrien, TMH.

Reference Books:

1. Java, The complete Reference, H. Schildt, 7th Edition, TMH.
2. Data Analytics using R, Seema Acharya, TMH.

Course Code: UGCA1933
Course Name: Internet of Things

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Define the concept of IoT
CO2	Outline various domains of IOT
CO3	Explain M2M (machine to machine) applications with necessary protocols
CO4	Express the need of IOT system management.
CO5	Implement the basic Raspberry PI platform for creating IOT applications.

Detailed Contents	Contact hours
Unit-I Definition and Need of IoT, Characteristics of IoT, Physical Design of IoT – IoT Protocols, Logical Design of IoT, IoT Enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Templates.[CO1]	11
Unit-II Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.M2M Applications, Software Defined Networks, Network Function Virtualization. [CO2]	11
Unit-III Need for IoT System Management, Simple Network Management Protocol, Network Operator Requirements, NETCONF, YANG, IoT System Management with NETCOZF-YANG, IoT Design Methodology. [CO3]	11
Unit-IV Introduction to Raspberry PI-Interfaces (serial, SPI, I2C), Introduction to Cloud Storage Models and Communication APIs Webserver – Web Server for IoT, Cloud for IoT, Security Management in an IoT System. [CO4] [CO5]	11

Text Books:

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, First Edition, 2015, University Press.

Reference Books:

1. The Internet of Things-Enabling Technologies, Platforms, and Use Cases, Pethuru Raj & Anupama C. Raman, CRC Press, 2017.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014
3. The Definitive Guide to the Internet of Things for Business, Syed Zaeem Hosain, Aeris Communications, 2016, 2nd edition.
4. Internet of Things: Architecture and Design Principals, Raj Kamal, McGraw-Hill, 2017.

Course Code: UGCA1939
Course Name: Internet of Things Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours a week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify different types of IOT devices and sensors.
CO2	Analyze sensor generated data
CO3	Outline the use of Bluetooth for connectivity of mobile application with IOT device
CO4	Designing small IoT applications
CO5	Building interface of application with various devices

Instructions:

1	Interfacing Light Emitting Diode (LED) for Blinking LED
2	Interfacing Button and LED for LED blinking when button is pressed
3	Interfacing Light Dependent Resistor (LDR) and LED for displaying automatic night lamp
4	Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)

5	Interfacing Liquid Crystal Display (LCD) to display data generated by sensor on LCD
6	Interfacing Air Quality Sensor-pollution (e.g. MQ135) to display data on LCD , switch on LED when data sensed is higher than specified value.
7	Interfacing Bluetooth module (e.g. HC05) for receiving data from mobile phone on Arduino and display on LCD
8	Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

Reference Books:

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, First Edition, 2015, Universities Press.
2. Arduino Projects for Engineers, Neerparaj Rai, First Edition, 2016, BPB Publications.
3. 21 Internet of Things (IOT) Experiments, Yashavant Kanetkar, Shrirang Korde, First Edition, 2015, BPB Publications.

List of components:

1. One kit for 3-4 students: Arduino Uno, sensors (Bluetooth module (HC05), MQ135, DHT11, breadboard, LCD, 2-relay module etc.)
2. Consumables: LED, button, connecting wires, LDR, LM35, battery, etc

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Course Code: UGCA1934
Course Name: Computer Graphics

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE): 3**hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify different types of Input and Output devices.
CO2	Outline the key characteristics of virtual relaity.
CO3	Explain different algorithms to draw shapes like line, circle, point, etc.
CO4	Differentiate between 2-D and 3-D coordinate system
CO5	Define projection.

Detailed contents	Contact hours
Unit-I **Introduction to Computer Graphics** Applications of Computer Graphics. Graphs and Types of Graphs **Input Devices:** Light Pens, Graphic Tablets, Joysticks, Track Ball, Data Glove, Digitizers, Image Scanner. [CO1] **Video Display Devices:** Refresh Cathode Ray Tube, Raster Scan displays, Random Scan displays, Color CRT - monitors and Color generating techniques (Shadow Mask, Beam Penetration), Flat-Panel Displays; 3-D Viewing Devices, Graphics monitors and workstations, Color Models (RGB and CMY), Lookup Table. [CO1] **Introduction Virtual Reality & Environments:** Applications in Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.[CO2]	11
Unit-II **Scan-conversions** Process and need of Scan Conversion, Scan conversion algorithms for Line, Circle and Ellipse using direct method, Bresenham's algorithms for line & circle and Midpoint Ellipse Algorithm along with their derivations, Area Filling Techniques, Flood Fill Techniques, Character Generation. [CO3]	11
Unit-III **2 – Dimensional Graphics** Cartesian and need of Homogeneous co-ordinate system, Geometric transformations (Translation, Scaling, Rotation, Reflection, Shearing), Viewing transformation and clipping (line, polygon and text) using Cohen-Sutherland, Sutherland Hodgeman and Liang Barsky algorithm for clipping. [CO4]	10
Unit-IV **3 – Dimensional Graphics** Introduction to 3-dimensional Graphics: Geometric Transformations (Translation, Scaling, Rotation), Mathematics of Projections (Parallel & Perspective). Color Shading. Introduction to Morphing techniques.[CO5]	12

Text Books:

1. D. Hearn and M.P. Baker, *Computer Graphics*, PHI New Delhi.
2. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes,. R.L Phillips, *Computer Graphics Principles & Practices*, Second Edition, Pearson Education, 2007.
3. R.A. Plastock and G. Kalley, *Computer Graphic*, McGraw Hill, 1986.

E Books/ Online learning material

1. www.sakshat.ac.in
2. https://swayam.gov.in

Course Code: UGCA1940
Course Name: Computer Graphics Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Implement algorithms for drawing basic shapes like circle, line and point.
CO2	Write programs to implement 2-D and 3-D corrdibate transformations.
CO3	Design basic shapes for logo's
CO4	Develop programs for basic animations using C or C++
CO5	Design a small gaming project.

Instructions:

1.	Use of basic functions of graphic available like circle, putpixel, rectangle, arc, ellipse, floodfill, setcolor etc.
2.	Design a logo/poster using primitive functions.
3.	Draw a 3 D object using palettes.
4.	Line Drawing Algorithm : Direct method and DDA
5.	Bresenham's Line Drawing Algorithm
6.	Circle Generating Algorithm : Equation and trigonometric function.
7.	Bresenham's Circle Generating Algorithm

8.	Draw an ellipse using Midpoint Algorithm.
9.	Translation transformation on a polygon.
10.	Scaling transformation on a polygon.
11.	Rotation transformation on a polygon.
12.	Reflection transformation on a polygon.
13.	Shearing transformation on a polygon.
14.	Mixed transformation on an object
15.	Minor project (eg Game/ Animation etc.)

Reference Books:

1. D. Hearn and M.P. Baker, *Computer Graphics,* PHI New Delhi.
2. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes,. R.L Phillips, *Computer Graphics Principles & Practices,* Second Edition, Pearson Education, 2007.
3. R.A. Plastock and G. Kalley, *Computer Graphic*, McGraw Hill, 1986.
4. Mark Lutz, *Learning Python*, O'REILY

Course Code: UGCA1935
Course Name: Linux Operating System

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 60%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

P**rerequisite**: Operating System
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	Discuss the evolution of Open Source operating systems.
CO2	Prepare environment for working on open source operating system like Linux.
CO3	Perform resource management in Linux
CO4	Write scripts in Linux.
CO5	Execute user level privileges

Detailed contents	Contact hours
Unit-I **Introduction to Linux**	12

History of Linux & Unix, Overview of Linux Operating System, structure of Linux Operating system, Installation. [CO1] Desktops (The X window System, GNOME, KDE), desktop operations. Different types of editors, vi editor and its command.	
Unit-II **Shells and Utilities** Role of shells in the Linux environment, Different types of shells in Linux Operating system, Shell configuration: Shell initialization & configuration directories & file, Aliases, Filename expansion, Standard Input/ Output & Redirection, Pipes, Managing Jobs.[CO3] **Shell Scripting:** Different types of statements in shell script, variables in shell, assign values to shell variables, Default shell variables value, Rules for Naming variables, Display the value of shell variables Getting User writing simple shell scripts to accept input from the user and display a message on screen, Shell scripts to implement various control statements. [CO4]	12
Unit-III **Files Systems & Linux Software** Linux Files, File structure, commands for managing files & directories with other commonly used commands, Software Management, Office and Database Applications, Graphics Tools and Multimedia, Internet & Network services, Web, FTP & java Clients. [CO3]	10
Unit-IV **Linux Administration** Managing users, Superuser Control, System Run levels, Managing File Systems, [CO3] **Kernel Administration**: Linux kernel sources, rebuilding kernel, installing kernel, Virtualization, backup management. [CO5]	10

Text Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw-Hill Publication.
2. Linux in a Nutshell: A Desktop Quick Reference, 6th Edition by Stephen Figgins, Arnold Robbins, Ellen Siever & Robert Love Published by O'Reilly Media.
3. Linux Administration: A Beginner's Guide by Steve Shah & Wale Soyinka, Published by McGraw-Hill Education

4. Unix Shell Programming by Yashavant P. Kanetkar, Published by BPB Publishers.

Course Code: UGCA1941
Course Name: Linux Operating System Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 100
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Operating system
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Prepare the environment for installation and use of Linux operating system
CO2	Write Shell Scripts
CO3	Implement C programs using gcc compiler
CO4	Impelment virtualization
CO5	Execute commands related to grantinf and revoking user priviledges.

Instructions:

1	Installation of Linux OS.
2	Writing advanced shell programs
3	Installation and management of printers
4	Using gcc compiler to write c programs
5	Configuring mail server
6	Configuring FTP server
7	Connecting to internet
8	Implementing different commands to manage file system
9	Implementation of virtualization
10	Becoming super user and implementing configuration commands
11	Implementing commands to manage users

- Instructor can select the commands, utilities and services to be managed on their own.

Reference Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw-Hill Publication.
2. Linux in a Nutshell: A Desktop Quick Reference, 6th Edition by Stephen Figgins, Arnold Robbins, Ellen Siever & Robert Love Published by O'Reilly Media.
3. Unix Shell Programming by Yashavant P. Kanetkar, Published by BPB Publishers.

Course Code: UGCA1936
Course Name: Cloud Computing

Program: BCA	**L**: 3 **T**: 1 **P**: 2
Branch: Computer Applications	**Credits:** 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Define the concept of cloud computing.
CO2	Outline the benefits if migrating to a cloud solution for different applications.
CO3	Compare different virtualization technologies.
CO4	Identify various resources needed to build cloud.
CO5	Explain various security threats to cloud.

Detailed contents	Contact hours
Unit-I **Overview of Computing Paradigm:** Recent trends in Computing -Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. [CO1] **Introduction to Cloud Computing:** Vision of Cloud Computing, Defining a Cloud, Cloud delivery Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing.[CO1]	12

Migrating into a Cloud: Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud. [CO2]	
Unit-II **Virtualization:** Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Hypervisor Technology Examples- Xen, VMware, Microsoft Hyper-V. [CO3] **Capacity Planning:** Elasticity vs Scalability, Introduction, Defining Baseline and Metrics-Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling. [C04]	12
Unit-III **SLA Management in Cloud Computing:** Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management.[CO4] **Securing Cloud services:** Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. Steps to ensure security over cloud.[CO5]	10
Unit-IV **Cloud Platforms in Industry:** Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. [CO4]	10

Text Books:

1. 1.Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India, Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3, New Delhi, India, 2011.

3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6, New Delhi, India, 2011

Reference Books:

1. 1.Cloud Computing for Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

E Books/ Online learning material

1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in: Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339–342.
2. P. Mell and T. Grance, "The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

Course Code: UGCA1942
Course Name: Cloud Computing Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Working Knowledge of Linux Operating system
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify major commercial projects in the field of cloud computing
CO2	Design basic cloud applications
CO3	Execute basic functionalities of open source tools like Open Stack.
CO4	Implement virtualization
CO5	Define major services provided by cloud service provider.

Instructions:

1.	Enlist various companies in cloud business and the corresponding services provided by them and tag them under SaaS , PaaS & IaaS.

2.	Create a warehouse application using tools supplied by any SaaS provider.
3.	Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S. Learn creation, migration, cloning and managing of virtual machines.
4.	Using public cloud service providers tools for exploring the usage of IaaS, PaaS and SaaS cloud services.
5.	Setting up a private cloud using open source tools (Eucalyptus/Open Stack etc.).

Course Code: UGCA1943
Course Name: Android Programming

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 3
Semester: 6th	**Contact hours:** 33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Skill Enhancement
Total marks: 100	

Prerequisite: The course will help students to develop applications for Android Mobile Phone. The students will use a software emulator for the phone to develop the application and a real phone to demonstrate the application. The main emphasis is on the aspects like develop, debug and test a variation of an existing application. Students must know all the basic concepts of Java.

Co requisite: -NA-

Additional material required in ESE: Students can carry their own data cable to execute the application built on Simulator for the sake of fast speed.

Course Outcomes:

CO#	Course outcomes
CO1	Prepare environment for working on Android OS.
CO2	Highlight various security issues in Android platform.
CO3	Design innovative User Interface and develop activity for android app.
CO4	Outline the steps for creating database applications.
CO5	Write programs for basic Android based applications.

Detailed contents	Contact hours

Unit-I Characteristics of Mobile applications, Introduction to Android Development Environment, Advantages and Futures of Android, Architecture and working of Android, User-interface design for mobile applications and managing application data. [CO1] [CO3]	8
Unit-II Integrating cloud services, networking, OS and hardware into mobile-applications. Enterprise requirements in mobile applications: Performance, Scalability, Modifiability, Availability and Security. [CO2]	7
Unit-III Mobile Software Engineering (Design Principles, Development, Testing methodologies for mobile applications.[CO4]	7
Unit-IV Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.[CO5]	8

Text Books:

1. Android Studio Application Development, Belen Cruz, Zapata, Packt Publishing
2. Deitel, P., Deitel, H., Deitle, A., and Morgano, M., Android for Programmers – An App-Driven Approach, Prentice Hall

Reference Books:

1. Professional Mobile Application Development, JEFFMCWHERTER, SCOTTGOWELL, Wiley.
2. Professional Android 4 Application Development, Reto Meier, Wrox Publication
3. Beginning iPhone Development with Swift, David Mark, A press Publication

E Books/ Online learning material

1. d.android.com
2. Safari Textbooks Online: http://library.ohio-state.edu/search/y?SEARCH=Safari
3. https://www.androidauthority.com/best-ebook-ereader-apps-for-android-170696/

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1944
Course Name: Android Programming Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:**--
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 20	**Elective status:** Skill Enhancement Laboratory
Total marks: 50	

Prerequisite: The course will help students to develop applications for Android Mobile Phone. The students will use a software emulator for the phone to develop the application and a real phone to demonstrate the application. The main emphasis is on the aspects like develop, debug and test a variation of an existing application. Students must know all the basic concepts of Java.

Co requisite: -NA-

Additional material required in ESE: Students can carry their own data cable to execute the application built on Simulator for the sake of fast speed.

Course Outcomes:

CO#	Course outcomes
CO1	Prapare environment for working on Android OS.
CO2	Program basic Android based applications.
CO3	Highlight various security issues in Android platform.
CO4	Implement database applications.
CO5	Design innovative User Interface and develop activity for android app.

Instructions:

1.	Installation of Java, android Framework
2.	Android SDK Manager and its all components
3.	Programs based on the overriding, constructor, classes in Java
4.	Programs based on the Final, this and static keyword in Java
5.	Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.
6.	Applications based on Text Boxes and Button
7.	Applications based on Check Boxes and button
8.	Applications based on Radio Buttons
9.	Applications based on Intents and Intent Filters
10.	Applications based on Activities and services
11.	Applications based on Action Bar
12.	Applications based on Option Menu
13.	Applications based on Rating Bar
14.	Applications based on Media Player
15.	Applications based on Content Providers
16.	Applications based on accessing camera
17.	Applications based on accessing location

18.	Applications based on the activation of sensors
19.	Applications based on Animations

Reference Books:

1. Deitel, P., Deitel, H., Deitle, A., and Morgano, M., Android for Programmers – An App-Driven Approach, Prentice Hall, Upper Saddle River, NY, 2012, ISBN: 212136-0.
2. Professional Mobile Application Development, JEFFMCWHERTER, SCOTTGOWELL, Wiley.

Course Code: UGCA1945
Course Name: Artificial Intelligence

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks:100	

Prerequisite: NA--
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Highlight the significance and domains of Artificial Intelligence and knowledge representation.
CO2	Outline the advantages and disadvantages of various search techniques.
CO3	Identify various Expert Systems and AI applications.
CO4	Define the role of AI in different areas like NLP, Pattern Recognition etc.
CO5	Select the right AI tool for different AI based applications.

Detailed Contents	Contact hours
Unit-I **Introduction-**What is intelligence? Foundations of artificial intelligence (AI). History of AI. AI problems: Toy Problems, Real World problems- Tic-Tac-Toe,	10

Water Jug, Question-Answering, 8-puzzle, 8-Queens problem. Formulating problems, Searching for Solutions.[CO1] **Knowledge Representation:** Propositional Logic, Propositional Theorem Proving-Inference and Proofs, Proof by Resolution, Horn Clauses and definite Clauses, Forward and Backward chaining; First order Logic, Inference in First Order Logic. [CO1]	
Unit-II **Uncertain Knowledge and Reasoning:** Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic. **Structured Knowledge:** Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.	**10**
Unit-III **Uninformed Search strategies-** Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed search strategies.[CO2] **Informed (Heuristic) Search Strategies-** Hill Climbing, Simulated Annealing, Genetic Algorithm, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search.[CO2]	**12**
Unit-IV **Natural language processing:** Grammars, Parsing.[CO4] **Pattern Recognition:** Recognition and Classification Process-Decision Theoretic Classification, Syntactic Classification; Learning Classification Patterns, Recognizing and Understanding Speech. [CO5] **Expert System Architectures:** Characteristics, Rule-Based System Architectures, Nonproduction System Architectures, Knowledge Acquisition and Validation.[CO3]	12

Text Books:

1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed.,Tata McGraw-Hill.
3. Artificial Intelligence And Expert Systems, D.W.Patterson, Prentice Hall.
4. Artificial Inteligence Structures and Strategies for complex Problem Solving, George F. Luger, Pearson Addison Wesley.

Reference Books:

1. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.

Course Code: UGCA1951
Course Name: Artificial Intelligence Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 weeks per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Working Knowledge of Python Programming Language
Co requisite: Installing Python, Installing packages, Loading data
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify right tool for different AI based problems.
CO2	Develop basic applications using AI tools.
CO3	Represent various real life problem domains using logic based techniques and use this to perform inference or planning.
CO4	Outline the use of Bayesian approach to solve uncertain problems.
CO5	Implement basic Natural Language processing programs.

Instructions:

1.	Learn the building blocks of Logic Programming in Python.
2.	Python script for comparing mathematical expressions and finding out unknown values.
3.	Use logic programming in Python to check for prime numbers.
4.	Use logic programming in Python parse a family tree and infer the relationships between the family members.
5.	Python script for building a puzzle solver.
6.	Implementation of Naïve Bayes classifier, computing its accuracy and visualizing its performance.
7.	Creation of a fuzzy control system which models how you might choose to tip at a restaurant.
8.	Implementation of uninformed search techniques in Python.
9.	Implementation of heuristic search techniques in Python.

10.	Python script for tokenizing text data.
11.	Extracting the frequency of terms using a Bag of Words model.
12.	Predict the category to which a given piece of text belongs.
13.	Python code for visualizing audio speech signal
14.	Python code for Generating audio signals
15.	Python code for Synthesizing tones to generate music

Reference Books:

1. Artificial Intelligence with Python, Prateek Joshi, Packt Publishing.

Course Code: UGCA1946
Course Name: R Programming

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact Hours**: 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: 40%
Internal max. marks: 40	**Duration of end semester exam (ESE)**: 3hrs
External max. marks: 60	**Elective status**: Elective
Total marks:100	

Prerequisite: Logics of basic programming terminologies.
Co requisite: Simulation study.
Additional material required in ESE: **-NA-**

Course Outcomes:

CO#	Course Outcomes
CO1	Identify the key components of R programming Language.
CO2	Define the concept of data Science.
CO3	Differentiate between vectors and arrays.
CO4	Outline the usage of data frames, lists, factors, tables and R structures.
CO5	Explain the need and utilization of various visualization tools.

Detailed Contents	Contact hours
Unit-I **R Programming Fundamentals:** Introduction to R, Installing R, Windows/Linux/Mac Installation, Setting up Path, Using Packages, and Running R: Interactive Mode, Batch Mode, Getting Help, Startup and Shut Down.[CO1]	11

Vectors: Scalars, Vectors, Arrays and Matrices, Declarations, Recycling, Common Vector Operations, Using all() and any(), Na and Null Values, Filtering, ifelse() Function.[CO3] **Matrices and Arrays:** Creating Matrices, General Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding & Deleting Matrix Rows and Columns, Difference Between Matrix and Vector.[CO3]	
Unit-II **Lists:** Creating Lists, General List Operations, Accessing List Components and Values, Applying Functions to Lists, Recursive Lists. **Data Frames:** Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames. [CO4] **Factors and Tables:** Introduction, Common Functions use with Factors, Working with Tables.[CO4] **R Programming Structures:** Control Statements, Arithmetic and Boolean Operators, Default Values for Arguments, Return Values, Recursion.[CO4]	11
Unit-III **Object Oriented Programming:** Concept of Classes, S3 Classes, S4 Classes, S3 Versus S4 Classes, Managing Objects.[CO1] **Input/Output:** Accessing Keyboard and Monitor, Reading and Writing Files, Accessing the Internet. **String Manipulation:** Overview of String Manipulation Functions [grep(), nchar(), paste(), sprintf(), substr(), strsplit(), regexpr(), gregexpr(), Regular expression].[CO5]	12
Unit-IV **Graphics:** Creating Graphs, Customizing Graphs, Saving Graphs to Files, Creating 3D Plots. **Debugging:** Principles of Debugging, Use of Debugging Tool, ~~Using~~ R Programming Debugging Facilities. [CO3] **Simulation:** Generating Random Numbers, Setting the Random Number Seed, Simulating ~~a~~ Linear Model, Random Sampling.[CO5]	10

Text Books:

1. The ART of R Programming, Norman Matloff, No Starch Press.
2. R Programming for Data Science, Roger D. Peng, Lean Publishing.
3. R Programming for Beginners, S. Rakshit, TMH.

Reference Books:

1. Data Analytics using R, Seema Acharya, TMH.

Course Code: UGCA1952
Course Name: R Programming Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems**: --
Internal max. marks: 60	**Duration of End Semester Exam (ESE)**: 3hrs
External max. marks: 40	**Elective Status:** Elective
Total marks: 100	

Prerequisite: - Logics of basic programming terminologies.
Co requisite: - Simulation study.
Additional material required in ESE: - Record the *Simulation Results* on practical file.

Course Outcomes: Students will be able to

CO#	Course Outcomes
CO1	Write programs for arrays and matrices.
CO2	Execute data frames and lists.
CO3	Differentiate between arrays from vectors.
CO4	Implement factors in R
CO5	Execute minor projects using R.

Instructions: All programs are to be developed in R Programming Language.

1.	Design a program to take input from the user (name and age) and display the values through R Programming.
2.	Write a program to get the details of the objects in memory using R Programming.
3.	Create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91 using R Programming.
4.	Create a vector which contains 10 random integer values between -50 and +50 using R Programming.
5.	Demonstrate through a program to display the details of the objects in memory.
6.	Write a R program to get the first 10 Fibonacci numbers.
7.	Show all prime numbers up to a given number usingh R rogramming..
8.	Design a R program to find the factors of a given number.
9.	Write a R program to find the maximum and the minimum value of a given vector.
10.	Write a program to get the unique elements of a given string and unique numbers of vector.
11.	Convert a given matrix to a 1 dimensional array through R programming.
12.	Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors.

13.	Create a 3 dimensional array of 24 elements using dim() function.
14.	Write a R program to create an array using four given columns, three given rows and two given tables, also display the contents of the array.
15.	To convert a given matrix to 1 dimensional array design a R program.
16.	Write a R program to concatenate two given factor in a single factor.
17.	Write a R program to create an 3 dimensional array of 24 elements using the dim() function.
18.	Construct a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.
19.	Write a R program to create a data frame from four given vectors.
20.	Write a program to get the structure of a given data frame.
21.	Design a R program to get the statistical summary and nature of the data of a given data frame.
22.	Write a R program to extract specific column from a data frame using column name.
23.	Design a R program to create a data frame from four given vectors.
24.	Demonstrate a R program to get the structure of a given data frame.
25.	Write a R program to get the statistical summary and nature of the data of a given data frame.
26.	Design a R program to extract specific column from a data frame using column name.
27.	Demonstrate a R program to create a data frame from four given vectors.
28.	Write a R program to create a matrix taking a given vector of numbers as input. Display the matrix.
29.	Construct a R program to create a matrix taking a given vector of numbers as input and define the column and row names. Display the matrix.
30.	Write a R program to access the element at 3rd column and 2nd row, only the 3rd row and only the 4th column of a given matrix.
31.	Develop a R program to create a vector of a specified type and length. Create vector of numeric, complex, logical and character types of length 6.
32.	Write a R program to add two vectors of integers type and length.
33.	Design a R program to append value to a given empty vector
34.	Write a R program to multiply two vectors of integers type and length.
35.	Design a R program to create a list containing strings, numbers, vectors and a logical values.
36.	Write a R program to list containing a vector, a matrix and a list and give names to the elements in the list.
37.	Demonstrate a R program to find the levels of factor of a given vector.
38.	Write a R program to change the first level of a factor with another level of a given factor.
39.	Design a R program to create an ordered factor from data consisting of the names of months.
40.	Construct graphical output & display the results of any five tasks using simulator.

Text Books:

1. The ART of R Programming, Norman Matloff, No Starch Press.
2. R Programming for Data Science, Roger D. Peng, Lean Publishing.
3. R Programming for Beginners, S. Rakshit, TMH.

Reference Books:

1. Data Analytics using R, Seema Acharya, TMH.

Course Code: UGCA1947
Course Name: Digital Marketing

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Highlight the key elements of a digital marketing strategy.
CO2	Choose the right platform for digital marketing
CO3	Identify the major digital marketing channels.
CO4	Design content for digital marketing.
CO5	Develop digital marketing strategy and plan.

Detailed Contents	Contact hours
Unit-I **Introduction to Digital Marketing** Difference between Traditional Marketing and Digital Marketing, Benefits of using Digital Media, Inbound and Outbound Marketing, Online marketing POEM: (Paid, Owned, and Earned Media), Components of Online Marketing (Email, Forum, Social network, Banner, Blog), Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing. [CO1] **Email Marketing:** Email newsletters, Digests, Dedicated Emails, Lead Nurturing, Sponsorship Emails and Transactional Emails, Drawbacks of Email Marketing [CO1]	11

Social Media Marketing (SMM): Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc.[CO1]	
Unit –II **Search Engine Optimisation (SEO)** About SEO, Need of an SEO friendly website, Importance of Internet and Search Engines; Role of Keywords in SEO. [CO2] **On-Page Optimization (Onsite):** Basics of Website Designing / Development; HTML Basics for SEO; Onsite Optimization Basics; Website Structure and Navigation Menu Optimization; SEO Content Writing. Keywords Research and Analysis (eg. SWOT analysis of website, finding appropriate keywords). **Off Page Optimization:** Introduction; Local marketing of websites depending on locations; Promoting Subsequent pages of the website. Introduction to organic SEO vs non-organic SEO; Social Media Optimization Techniques and Page Rank Technology.[CO2]	**11**
Unit-III **Website Planning & Creation** **Content Marketing Strategy:** Goals and concepts, Strategic building blocks, Content creation & channel distribution, Tools of the trade, Advantages and challenges. **Keywords Research and Analysis:** Introduction to Keyword Research; Business Analysis; Types of Keywords; Keywords Analysis Tools.[CO3] **Web Presence:** How to increase online presence and drive more traffic for a website, Search result visibility in search engines for chosen keyword and phrases, Using e-mail marketing to drive traffic for a website, Posting social media content for lead generation, Tools to create and manage content, Use of Blogging as content strategy. [CO3] **Creating content:** Writing and posting content on the web and in social networks, blog and video; Create, manage and implement a content marketing strategy; Monitoring and recording results to improve content marketing campaigns; Successful content marketing strategies and case studies.[CO4]	**12**
Unit-IV **Online Advertising, Mobile Marketing and Web analytics** Introduction to Online Advertising and its advantages, Paid versus Organic, Pay Per Click (PPC) Model. Basic concepts Cost per Click (CPC), CPM, CTR, CR etc. About Mobile Marketing, Objectives of Mobile Advertising, Creating a Mobile Marketing Strategy, Introduction to SMS Marketing. About Web	**10**

Analytics, Types of Web Analytics (On-site, Off-site), Importance of Web Analytics [CO5]	

Text Books:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.
4. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO. " O'Reilly Media, Inc.".

E Books/ Online learning material:

1. www.sakshat.ac.in
2. https://swayam.gov.in
3. https://www.edx.org/course/online-marketing-strategies-curtinx- mkt5x
4. https://www.emarketinginstitute. org/free-courses/ eMarketing Institute

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Course Code: UGCA1953
Course Name: Digital Marketing Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Highlight the key elements of a digital marketing strategy.
CO2	Implement common digital marketing exerciseusing SEO, Social media and Blogs.
CO3	Identify the major digital marketing channels.
CO4	Design content for digital marketing.
CO5	Develop digital marketing strategy and plan.

Instructions:

The instructor needs to give an overview of digital marketing with case studies	
1.	Explore Facebook, LinkedIn, Twitter, Video, Instagram, blog etc
2.	Explore Online Display Advertising, Ecommerce Marketing, Mobile Web and Content marketing.
3.	Explore Email Marketing; Google AdWords and Google Analytics
The instructor needs to discuss a case study using Search Engine Optimisation (SEO). Case Study – I : Student will plan and create a webpage will display Web presence	
4.	How to increase online presence and drive more traffic for a website.
5.	Search result visibility in Google for chosen keyword and phrases.
6.	Using e-mail marketing to drive traffic for a website.
7.	Posting social media content for lead generation.
8.	Tools to create and manage content.
9.	Use of Blogging as content strategy
Case Study – II : Student will plan and create a commercial website	
10.	Show results for Search Engine Algorithms & Page Rank Technology
11.	How to promote home page, SWOT Analysis of Website & finding right appropriate keywords.
12.	Monitoring and recording results to improve content marketing campaigns
13.	Writing and posting content on the web and in social networks.
Case Study – III : Student will identify an activity for Email/ Mobile/ Social Media Marketing	
14.	Create a Video/ YouTuber
15.	Manage a Video/ YouTuber platform and enhance viewership.

Texts Books:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.
4. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO. " O'Reilly Media, Inc.".

Course Code: UGCA1948
Course Name: Information Security

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify issues involved in the field of information security.
CO2	Categorize various types of viruses.
CO3	Outline the information security risks across de Internet and WWW.
CO4	Explain different encryption techniques
CO5	Define crytography

Detailed Contents	Contact hours
Unit –I **The Security Problem in Computing:** The meaning of computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption algorithms, Secure Architecture of an open System. DES and RSA Algorithm, [CO1]	11

Asymmetric and symmetric Key Cryptography, Role based Security, Digital Signatures, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions, Uses of Encryption. [CO4]	
Unit-II **Security in Program and Operating System:** Secure Programs, Non malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General- Purpose operating system protected objects and methods of protection memory and addmens protection, File protection Mechanisms, User Authentication Designing Trusted.[CO2] **Operating System:** Security polices, models of security, trusted Operating System design, Assurance in trusted Operating System Implementation examples.	11
Unit-III **Database and Network Security:** Database Integration and Secrecy, Inferential Control, Sensitive data, Inference, multilevel database, proposals for multilevel security. Security in Network: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems,Secure E-Mail [CO1]	11
Unit-IV **Administering Security:** Security Planning, Risk Analysis, Organizational Security policies, Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, Case Studies of Corporate Security. [CO3] [CO5]	11

Text Books

1. Charles P.Pfleeger, Shari Lawrence. Security in Computing, Pfleeger. PHI.
2. Jason Andress. The Basics of Information Security, Syngress
3. Mark Stamp. Information Security: Principles and Practice, Wiley.
4. A. Kahate, Cryptography and Network Security, TMH.

Course Code: UGCA1954

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Name: Information Security Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Outline various types of attacks.
CO2	Categorize various types of viruses.
CO3	Preparae solutions to various threats
CO4	Review security policy
CO5	Implement Encyption Techniques

Instructions:

1	Study of System threat attacks - Denial of Services.
2	Study of Sniffing and Spoofing attacks.
3	Study of Techniques uses for Web Based Password Capturing.
4	Study of Different attacks causes by Virus and Trojans.
5	Study of Anti-Intrusion Technique – Honey pot.
6	Study of Symmetric Encryption Scheme – RC4.
7	Implementation of S-DES algorithm for data encryption
8	Implementation of Asymmetric Encryption Scheme – RSA.
9	Study of IP based Authentication.
10	Study of Cryptography Techniques
11	Study of Encryption algorithms
12	Study of Security polices
13	Study of Network Security Fundamentals, Ethical Hacking and Social Engineering

Reference Books:

1. Charles P.Pfleeger, Shari Lawrence. Security in Computing, Pfleeger. PHI.
2. Jason Andress. The Basics of Information Security, Syngress
3. Mark Stamp. Information Security: Principles and Practice, Wiley.
4. A. Kahate, Cryptography and Network Security, TMH.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1949
Course Name: Cyber Laws & IPR

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
CO2	Categorize case law and common law to current legal dilemmas in the technology field.
CO3	Outline the primary forms of intellectual property rights.
CO4	Compare the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	Analyze the effects of intellectual property rights on society as a whole.

Detailed Contents	Contact hours
Unit-I **Introduction** Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Jurisdictional Aspects in Cyber Law Issues of jurisdiction in cyberspace, Types of jurisdiction, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000. [CO1]	12
Unit-II **Cyber Crimes& Legal Framework** Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Ethics and Etiquettes of Cyber World, Cyber Pornography, Identity Theft & Fraud, Cyber Terrorism, Cyber Defamation, Right to Privacy and Data Protection on Internet, Concept of privacy, Threat to privacy on internet, Self-regulation approach to privacy.[CO2]	12

Unit-III **Overview of Intellectual Property** introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development IPR in abroad, Data Protection, Open Source Software, Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document How to protect your inventions?, Granting of patent, Rights of a patent.[CO3]	10
Unit-IV **Copyright, Related Rights and Trademarks** What is copyright? Latest editions of Designs, what is covered by copyright? How long does copyright last? Why protect copyright? What are related rights?, Distinction between related rights and copyright?, What is a trademark? Rights of trademark?, What kind of signs can be used as trademarks?, types of trademark, function does a trademark perform, How is a trademark protected?, How is a trademark registered?[CO4][CO5]	10

Text Books

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce, Universal Law Publishing.
3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.
4. Navneet Nagpal. Intellectual Property Right, Ebooks2go Inc.
5. Dr. S.K. singh. Intellectual Property Rights, Central Law Agency.

Course Code: UGCA1955
Course Name: Cyber Laws & IPR Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify tatutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
CO2	Categorize case law and common law to current legal dilemmas in the technology field.
CO3	Outline the primary forms of intellectual property rights.
CO4	Compare the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	Analyze the effects of intellectual property rights on society as a whole.

Instructions:

1	Study of Jurisdictional Aspects in Cyber Law Issues
2	Study of Jurisdiction under IT Act, 2000.
3	Study of Hacking, Digital Forgery.
4	Study of threat to privacy on internet.
5	Study about the difference between related rights and copyright.
6	Study of Privacy and Data Protection on Internet.
7	Study about registration process of trademark.
8	Study about different kind of signs can be used as trademarks.
9	Study of Copyright, Related Rights and Trademarks.
10	Study of Self-regulation approach to privacy.
11	Study of intellectual property right (IPR) in India.
12	Study about impact of the patent system.
13	Study for Granting of patent.
14	Study related to Rights of Patents
15	Discussion with reference to authentication of Electronic Record using Digital Signatures

Reference Books:

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce, Universal Law Publishing.
3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.
4. Navneet Nagpal. Intellectual Property Right, Ebooks2go Inc.
5. Dr. S.K. singh. Intellectual Property Rights, Central Law Agency.

Course Code: UGCA1950
Course Name: Machine Learning

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6^{th}	**Contact hours**: 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 40%

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status**: Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Define the concept of machine learning
CO2	Outline the key characteristics of machine learning algorithms
CO3	Compare the performance of different machine learning algorithms
CO4	Design solution for basic problems using machine learning algorithms
CO5	Explain the concept of reinforcement learning

Detailed Contents	Contact hours
Unit-I **Introduction** What is Machine Learning, Unsupervised Learning, Reinforcement Learning Machine Learning Use-Cases, Machine Learning Process Flow, Machine Learning Categories, Linear regression and Gradient descent.[CO1]	8
Unit-II **Supervised Learning** Classification and its use cases, Decision Tree, Algorithm for Decision Tree Induction Creating a Perfect Decision Tree, Confusion Matrix, Random Forest. What is Naïve Bayes, How Naïve Bayes works, Implementing Naïve Bayes Classifier, Support Vector Machine, Illustration how Support Vector Machine works, Hyper parameter Optimization, Grid Search Vs Random Search, Implementation of Support Vector Machine for Classification.[CO4]	12
Unit-III **Clustering** What is Clustering & its Use Cases, K-means Clustering, How does K-means algorithm work, C-means Clustering, Hierarchical Clustering, How Hierarchical Clustering works.[CO3]	12
Unit-IV	12

Why Reinforcement Learning, Elements of Reinforcement Learning, Exploration vs Exploitation dilemma, Epsilon Greedy Algorithm, Markov Decision Process (MDP) Q values and V values, Q – Learning, α values.[CO5]	

Text Books:

1. Pattern Reorganization and Machine learning by Christopher M. Bishop.
2. The elements of Statistical learning by Jeromeh. Friedman, Robert Tivshirani and Trevorhaspie.
3. Introduction to Machine Learning by Ethem Alpaydin. PHI Publisher.
4. Machine Learning, A practical approach on the statistical learinging theory by Rodrigo fernandes de Mello and Moacir Antonelli Ponti.
5. Machine Learning A probabilistic prospective by Kevin P. Murphy

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Course Code: UGCA1956
Course Name: Machine Learning Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical**: Practical
External max. marks: 30	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.
Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.
Additional material required in ESE:
Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Differentiate between various data types.
CO2	Implement programs for various Learning algorithms.
CO3	Compare different machine learning algorithms.
CO4	Choose the right algorithm for different problems.
CO5	Apply Machine Learning algorithms to solve real world problems.

Instructions: Instructor can increase/decrease the experiments as per the requirement.
Assignments:

1.	Read the numeric data from .CSV file and use some basic operation on it.

2.	Write a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3.	Write a program to demonstrate the working of the Random Forest algorithm.
4.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5.	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
6.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
7.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
8.	Write a program to demonstrate the working of the K-means clustering algorithm.
9.	Write a program to demonstrate the working of the Support Vector Machine for Classification Algorithm.
10.	Write a program to demonstrate the working of the Hierarchical Clustering

Reference Books:

1. Rodrigo fernandes de Mello and Moacir Antonelli Ponti., Machine Learning, A practical approach on the statistical learning
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
5. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014
6. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Course Code: UGCA1902
Course Name: Fundamentals of Computer and IT

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify of input and output devices of Computers
CO2	Utilize the functioning of various components of computer system
CO3	Define the role of Operating system
CO4	Prepare documents using word processing, Spreadsheet and Presentation Graphics Software's.
CO5	Highlight the Internet safety, legally, and other issues.

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. **Functional Units of Computer System:** CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.[CO2] **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. [CO1] **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.[CO2]	12

Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT. [C03]	
Unit-II **Concept of Computing & PC Software – I** **Concept of Computing, Types of Languages:** Machine, assembly and High level Language; Operating system as user interface, utility programs. **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors. [CO4]	12
Unit-III **PC Software – II** **Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. [CO4] **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.[CO4]	10
Unit-IV **The Impact of Computing and the Internet on Society** **Electronic Payment System:** Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority. [CO5] Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT)	10

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Computer Fundamentals, A. Goel, 2010, Pearson Education.
3. Fundamentals of Computers, P. K.Sinha & P. Sinha, 2007, BPB Publishers.
4. IT Tools, R.K. Jain, Khanna Publishing House

5. "Introduction to Information Technology", Satish Jain, Ambrish Rai & Shashi Singh, Paperback Edition, BPB Publications, 2014.

Reference Books:

1. "Introduction to Computers", Peter Norton
2. Computers Today, D. H. Sanders, McGraw Hill.
3. "Computers", Larry long & Nancy long, Twelfth edition, Prentice Hall.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning

E Books/ Online learning material

1. www.sakshat.ac.in
2. https://swayam.gov.in/course/4067-computer-fundamentals

Course Code: UGCA1903
Course Name: Problem Solving using C

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Express the logical flow used in Programming.
CO2	Design algorithms for solving various real life problems
CO3	Implement programs using C .
CO4	Choose the right data type and statements for programs.
CO5	Explain various concepts of C programming language.

Detailed Contents	Contact hours
Unit-I	10

Logic Development: Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants. [CO1] **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions. [CO2]	
Unit-II **Data Input and Output:** formatted & unformatted input output. **Control Statements:** While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements. [CO4]	10
Unit-III **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. [C05] **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays.[CO5] **Strings**: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.[CO5]	12
Unit-IV **Structures & Unions:** Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions. **Pointers:** Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays[CO5] **File Handling:** File Operations, Processing a Data File [CO3]	12

Text Books:

4. Programming in C, Atul Kahate
5. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill
6. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication

Reference Books:

6. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
7. Problem Solving and Programming in C, R.S. Salaria, Second Edition
8. Let us C,Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
9. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.

Course Code: UGCA1909
Course Name: Object Oriented Programming using C++

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Outline the role of programming for solving real world problems.
CO2	Explain Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	Implement computer based solutions to various real-world problems using C++
CO4	Select the right Object Oriented Concept for optimal solution.
CO5	Review different solutions for a common problem.

Detailed Contents	Contact hours
Unit-I **Principles of object oriented programming** Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language(C) and Object Oriented Language [CO1]	12
Unit-II **Classes & Objects and Concept of Constructors**	10

Defining classes, Defining member functions, Declaration of objects to class, Access to member variables from objects, Different forms of member functions, Access specifiers (Private, public, protected), Array of objects.[CO2] Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors. [CO2]	
Unit-III **Inheritance and Operator overloading** Introduction to Inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloading operators [CO3]	12
Unit-IV **Polymorphism and File Handling** Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes.[CO4] [CO5] Opening and Closing File, Reading and Writing a file.[CO3]	10

Text Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Code: UGCA1913
Course Name: Computer Networks

Program: BCA	**L**: 3 **T**: 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks:60	**Elective status:** Elective
Total marks:100	

Prerequisite: Information Technology
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Highlight the characteristics of various protocols.
CO2	Define different network technologies and their application.
CO3	Identify Hardware and software components for designing network.
CO4	Compare the performance of different network media
CO5	Implement various configuration settings

Detailed Contents	Contact hours
Unit-I **Data communications concepts:** Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex.[CO1] **Types of Networks:** LAN, MAN, WAN [CO1] **Network Topologies:** Bus, Star, Ring, Mesh, Tree, Hybrid[CO2] **Communication Channels: Wired transmissions:** Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission. **[CO2]** **Communication Switching Techniques**: Circuit Switching, Message Switching, Packet Switching.	12
Unit-II **Network Reference Models**: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models. Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – Frequency division, Time division, Wavelength division. **[CO1]**	10

Data Link Layer Design Issues: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP)[CO1]	
Unit-III **MAC sub layer:** CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) **Network Layer:** Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking. [CO4]	12
Unit-IV **Transport Layer**: Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols. [CO5] **Session, Presentation and Application Layers**: Session Layer – Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer – Distributed application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol.[CO5]	10

Text Books:

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

Reference Books:

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, "Computer Networking", Pearson Education.
4. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

Course Code: UGCA1922
Course Name: Database Management Systems

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Define the basic concepts of DBMS.
CO2	Design SQL queries.
CO3	Illustrate the concept of data normalization with the help of real life examples.
CO4	Explain the concept of transaction management.
CO5	Outline features of advanced database management systems.

Detailed contents	Contact hours
Unit-I Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model. [CO1]	10
Unit-II Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers. [CO2]	12
Unit-III Introduction to Normalization, First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).[CO3]	12
Unit-IV Database Recovery, Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases.[CO4][CO5]	10

Text Books:

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition, (2012).

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", Ivan Bayross, BPB Publications, 4th Revised Edition (2009)
2. "An Introduction to Database Systems", C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006).
3. "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).
4. Database Management Systems, Raghu Ramakrishnan, McGraw-Hill, Third Edition, 2014.

Course Code: UGCA1957
Course Name: Software Project Management

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Define the principal tasks of software project managers. And basic concepts in software projects.
CO2	Outline the basic concepts of Software projects.
CO3	Explain the fundamentals of Process Planning, effort estimation and quality planning.
CO4	Comment upon risk and quality management.
CO5	Apply management and development practices to develop software.

Detailed Contents	Contact hours
Unit-I	12

Project Management Concepts, Processes and Project Management, Project Management and the CMM, The Project Management Process, The Process Database, The Process Capability Baseline, Process Assets and The Body of Knowledge System. [CO1][CO2]	
Unit-II The Development Process, Requirement Change Management, Estimation and Scheduling Concepts, Effort Estimation, Scheduling, The Bottom-up Estimation Approach, The Top-Down Estimation Approach, The Use Case Points Approach, Quality Concepts, Quantitative Quality Management Planning, Defect Prevention Planning. [CO3]	12
Unit-III Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Concepts in Measurement, Measurements, Project Tracking, Team Management, Customer Communication and Issue Resolution, The Structure of The Project Management Plan.[CO4]	10
Unit-IV Concepts in Configuration Management, The Configuration Management Process, The Review Process, Data Collection, Monitoring and Control, Project Tracking, Defect Analysis and Prevention, Process Monitoring and Audit, Project Closure Analysis.[CO5]	10

Text Books:

1. Software Project Management in Practice, Pankaj Jalote, 2002, Pearson Education.

Reference Books:

1. Software Engineering-A Practitioner's Approach, Roger S. Pressman, 2010, McGraw-Hill Higher Education, seventh edition.
2. Software Engineering, Ian Sommerville, 2009, Pearson Education.
3. Software Project Management, Bob Hughes, Mike Cotterell, Rajib Mall, McGraw-Hill, Sixth Edition, 2018.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.