Scheme & Syllabus of

Bachelor of Science in Data Analytics

(B. Sc. Data Analytics)

Batch 2021 onwards

By

Board of Study Computer Applications

Department ofAcademics

IKGujralPunjabTechnicalUniversity

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Bachelors of Science in Data Analytic (B.Sc. Data Analytic):
It is a Under Graduate (UG) Programme of 3 years duration (6 semesters)

PROGRAM OUTCOMES (POs)

Program: B Sc in Data Analytics

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

2. **Disciplineknowledge**:Anabilitytoapplydiscipline–specificknowledgeto solve core and/or applied computationalproblems.

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

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

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

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

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

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

9. **Communication:** An ability to communicateeffectively.

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 Bachelor of Science in Data Analytic (B Sc. Data Analytics)

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)

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Second Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1985	Core Theory	Probability and Statistics	3	1	0	40	60	100	4
UGCA1922	Core Theory	Database Management Systems	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	ObjectOriented Programming using C++ Laboratory	0	0	4	60	40	100	2
UGCA1986	Core Practical/Laboratory	Probability and Statistics Laboratory	0	0	4	60	40	100	2
UGCA1925	Core Practical/ Laboratory	Database Management Systems 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**

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ThirdSemester

CourseCode	CourseType	CourseTitle	LoadAllocation			MarksDistribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1923	CoreTheory	OperatingSystems	3	1	0	40	60	100	4
UGCA1931	CoreTheory	Data Warehouse and Mining	3	1	0	40	60	100	4
UGCA1915	CoreTheory	DataStructures	3	1	0	40	60	100	4
UGCA1926	Core Practical/Laboratory	OperatingSystems Laboratory	0	0	4	60	40	100	2
UGCA1937	Core Practical/Laboratory	Data Warehouse and Mining Laboratory	0	0	4	60	40	100	2
UGCA1918	Core Practical/Laboratory	DataStructures Laboratory	0	0	4	60	40	100	2
UGCA1914	Skill EnhancementCourse-I	Programmingin Python	3	0	0	40	60	100	3
UGCA1917	Skill EnhancementCourse-Laboratory	Programmingin PythonLaboratory	0	0	2	30	20	50	1
BMPD302-18		Mentoringand Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**3**	**15**	**395**	**380**	**775**	**23**

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Fourth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA2004	Core Theory	Data Visualization	3	1	0	40	60	100	4
UGCA2006	Core Theory	Big data Analytics	3	1	0	40	60	100	4
UGCA 1947	Core Theory	Digital Marketing	3	1	0	40	60	100	4
UGCA 1946	Core Theory	R Programming	3	1	0	40	60	100	4
UGCA2005	Core Practical/Laboratory	Data Visualization Laboratory	0	0	4	60	40	100	2
UGCA 1953	Core Practical/Laboratory	Digital Marketing Laboratory	0	0	4	60	40	100	2
UGCA 1952	Core Practical/ Laborary	R Programming Laboratory Laboratory	0	0	4	60	40	100	2
BMPD402-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**4**	**13**	**365**	**360**	**725**	**23**

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1901
Course Name: Mathematics

Program: B. Sc. Data Analytics	**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	Represent data using various mathematical notions.
CO2	Explain different terms used in basic mathematics.
CO3	Describe various operations and formulas used to solve mathematical problems.

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Detailed contents	Contact hours
Unit-I Set Introduction, Objectives, Representation of Sets (Roster Method, Set BuilderMethod),TypesofSets(NullSet,SingletonSet,FiniteSet,InfiniteSet, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, DifferenceofSet,SymmetricDifferenceofSet)UniversalSets,Complement of a Set.	12 hours
Unit-II Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.	10 hours
Unit -III Matrices Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix,Unit Matrix,NullMatrix,ComparableMatrix,EqualMatrix),ScalarMultiplication,	12 hours

Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix.	
Unit-IV Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantitiesinA.P,ArithmeticMeans,GeometricProgression,GeometricMean.	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. RDSharma
2. Comprehensive Mathematics, ParmanandGupta
3. Elements of Mathematics, MLBhargava

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: B. Sc. Data Analytics	**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-

CourseOutcomes:

CO#	Course outcomes

CO1	Understanding the concept of input and output devices of Computers
CO2	Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.
CO3	Understand an operating system and its working, and solve common problems related to operating systems
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.
CO5	Study to use the Internet safely, legally, and responsibly

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. **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. **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. **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.	10
Unit-III **Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using	10

formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	
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),UnifiedPaymentInterface(UPI),ImmediatePaymentSystem(IMPS), Digital Signature and CertificationAuthority. 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, PearsonEducation.
3. Fundamentals of Computers, P. K.Sinha & P. Sinha, 2007, BPBPublishers.
4. IT Tools, R.K. Jain, Khanna PublishingHouse
5. "IntroductiontoInformationTechnology",SatishJain,AmbrishRai&ShashiSingh, Paperback Edition, BPB Publications,2014.

Reference Books:

1. "Introduction to Computers", Peter Norton
2. Computers Today, D. H. Sanders, McGrawHill.
3. "Computers", Larry long & Nancy long, Twelfth edition, PrenticeHall.
4. ProblemSolvingCasesinMicrosoftExcel,JosephBrady&EllenFMonk,Thomson Learning

E Books/ Online learning material

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

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1903

Course Name: Problem Solving using C

Program: B. Sc. Data Analytics	**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-

CourseOutcomes:

CO#	Course outcomes
CO1	Student should be able to understand the logic building used in Programming.
CO2	Students should be able to write algorithms for solving various real life problems.
CO3	To convert algorithms into programs using C .

Detailed Contents	Contact hours
Unit-I **LogicDevelopment:**DataRepresentation,Flowcharts,ProblemAnalysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Characterset,IdentifiersandKeyWords,Datatypes,Constants,Variables, Expressions, Statements, SymbolicConstants. **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.	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.	10
Unit-III	11

Functions: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays. **Strings**: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and staticvariables.	
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	12

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGrawHill.
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, GalgotiaPublications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, NewDelhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGrawHills.
4. Problem Solving and Programming in C, R.S. Salaria, SecondEdition
5. Programming in C, AtulKahate.

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1904

Course Name: Workshop on Desktop Publishing

Program: B. Sc. Data Analytics	**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 tobe 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	The students will gain professional skills of *Desk Top Publishing* Tools like designing, Printing & Publishing by using various tools.
CO2	Develop skills in printing jobs through basic understanding of a variety of designing tools.
CO3	Apply these concepts and knowledge in designing field including practice from text formatting to final publishing.
CO4	Workshops are included to enhance professional skills like Brochures, Flexes, Business Cards, Certificates and News Letter layouts etc.

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.	PrepareNSS*Certificates*forappreciationusinglogosofUniversity,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 anyfive 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*ofyourcollege,University&Govt.ofPunjabalsodisplaytheselogos 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 byRapidex.
2. DTP Course Kit by Vikas Gupta published byComdex.
3. CorelDraw 9 by David Karlins published by Techmedia.
4. Adobe Illustrator CC by Brian Wood published by AdobePress.
5. Page Maker in Easy Steps - ScottBasham.

Software Tools:

1. Adobe Illustrator 14.
2. CorelDraw Graphics Suit.
3. GNU image manipulationprogram.
4. InkScape.
5. PhotoScapeSetup.

6.PM701.

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1905

Course Name: Problem Solving using C Laboratory

Program: B. Sc. Data Analytics	**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-

CourseOutcomes:

CO#	Course Outcomes
CO1	Students should be able understand the logic building used in programming
CO2	Students should be able to write algorithms for solving various real-life problems
CO3	Students should be able to convert the algorithms into computer programs using C language.

Instructions: Develop all programs in C programming language.

Assignments:

1.	WRITEAPROGRAMtodisplayyourname.Writeanotherprogramtoprintmessage 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.	WRITEAPROGRAMtofindareaofrectangleandprinttheresultusingunformatted 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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I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1906

Course Name: Fundamentals of Computer and IT Laboratory

Program: B. Sc. Data Analytics	**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-

CourseOutcomes:

CO#	Course outcomes
CO1	FamiliarizingwithOpenOffice(Wordprocessing,SpreadsheetsandPresentation).
CO2	To acquire knowledge on editor, spread sheet and presentation software.
CO3	The students will be able to perform documentation and accounting operations.
CO4	Students can learn how to perform presentation skills.

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 Featurestobecovered:-FormattingFontsinword,DropCapinword,Applying Texteffects,UsingCharacterSpacing,BordersandColors,InsertingHeaderand Footer, Using Date and Time option inWord.
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.	Studentswillbeworkingonbasicpowerpointutilitiesandtoolswhichhelpthem 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. Topicscoveredincludes:Hyperlinks,Inserting–Images,ClipArt,Audio,Video, Objects, Tables andCharts
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,DesignTemplates,Hiddenslides.Autocontentwizard,SlideTransition, 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.	Tolearntosubscribe/postonablogandtousetorrentsforacceleratedddownloads
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 PublishingHouse.

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. ProblemSolvingCasesinMicrosoftExcel,JosephBrady&EllenFMonk,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 ofcommunication.
- To help the students become the independent users of Englishlanguage.
- To develop in them vital communication skills which are integral to their personal, social and professionalinteractions.
- ThesyllabusshalladdresstheissuesrelatingtotheLanguageofcommunication.
- 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 takingetc.

The recommended readings given at the end are only suggestive; the students and teachershavethefreedomtoconsultothermaterialsonvariousunits/topicsgivenbelow.
Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommendedbooks.

Detailed Contents:

Unit1- 1 (Introduction)

- Theory ofCommunication
- Types and modes ofCommunication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken andWritten)
- Personal, Social andBusiness
- Barriers andStrategies
- Intra-personal, Inter-personal and Groupcommunication

Unit-3 (Reading and Understanding)

- CloseReading
- Comprehension
- SummaryParaphrasing

- Analysis andInterpretation
- Translation(from Hindi/Punjabi to English and vice-versa)
  OR
  Precis writing /Paraphrasing (for International Students)
- Literary/KnowledgeTexts

Unit-4 (Writing Skills)

- Documenting
- ReportWriting
- Makingnotes
- Letterwriting

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 RanjanaKaul, Dr BratiBiswas
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 ofcommunication.
- To help the students become the independent users of Englishlanguage.
- To develop in them vital communication skills which are integral to personal, social and professionalinteractions.
- ThesyllabusshalladdresstheissuesrelatingtotheLanguageofcommunication.
- 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 takingetc.

The recommended readings given at the end are only suggestive; the students and teachershavethefreedomtoconsultothermaterialsonvariousunits/topicsgivenbelow.
Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommendedbooks.

Interactive practice sessions in Language Lab on Oral Communication

- ListeningComprehension
- Self Introduction, Group Discussion and RolePlay
- Common Everyday Situations: Conversations andDialogues
- Communication atWorkplace
- Interviews
- FormalPresentations
- Monologue
- Effective Communication/ Mis-Communication
- PublicSpeaking

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 UniversityPress

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

Program: B. Sc. Data Analytics	**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-

CourseOutcomes:

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 coreaspirations 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 ofethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction withNature.

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 ValueEducation 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 HumanAspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correctpriority 5. UnderstandingHappinessandProsperitycorrectly-Acriticalappraisal of the currentscenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at variouslevels	8
Unit-II **Understanding Harmony in the Human Being - Harmony in Myself!** 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 andenjoyer) 4. Understanding the characteristics and activities of 'I' and harmonyin 'I'	8

5. UnderstandingtheharmonyofIwiththe Body:*Sanyam*and*Swasthya*; correct appraisal of Physical needs, meaning of Prosperity indetail 6. Programs to ensure *Sanyam* and*Swasthya* - Practice Exercises and Case Studies will be taken up in Practice Sessions.	
Unit-III **UnderstandingHarmonyintheFamilyandSociety-HarmonyinHuman-HumanRelationship** 1. Understanding harmony in the Family- the basic unit of human interaction 2. Understandingvaluesinhuman-humanrelationship;meaningof *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship 3. Understanding the meaning of *Vishwas*; Difference between intention andcompetence 4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values inrelationship 5. Understanding the harmony in the society (society being an extension offamily):*Samadhan,Samridhi,Abhay,Sah-astitva*ascomprehensive HumanGoals 6. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*-from family to worldfamily! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	6
Unit-IV **Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** *1.* Understanding the harmony in theNature *2.* Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation innature *3.* Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasivespace *4.* Holistic perception of harmony at all levels ofexistence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	5
Unit-V	6

Implications of the above Holistic Understanding of Harmony on Professional Ethics 1. Natural acceptance of humanvalues 2. Definitiveness of Ethical HumanConduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic UniversalOrder 4. Competence in professionalethics: a) Ability to utilize the professional competence for augmenting universal humanorder, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Abilitytoidentifyanddevelopappropriatetechnologiesand management patterns for above productionsystems. 5. Case studies of typical holistic technologies, management models and productionsystems 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 andmanagers b) Atthelevelofsociety:asmutuallyenrichinginstitutionsand 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 wealthPublishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age InternationalPublishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen (Vaidik) Krishi Tantra Shodh,Amravati.
8. DonellaH.Meadows,DennisL.Meadows,JorgenRanders,WilliamW.Behrens III, 1972, *Limits to Growth – Club of Rome's report,* UniverseBooks.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers,* Oxford UniversityPress

10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (includingHumanValues)*,EasternEconomyEdition,PrenticeHallofIndiaLtd.
11. B P Banerjee, 2005, *Foundations of Ethics and Management*, Excel Books.
12. BLBajpai,2004,*IndianEthosandModernManagement*,NewRoyalBookCo., Lucknow. Reprinted2008.

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: B. Sc. Data Analytics	**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.

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code:UGCA1985

Course Name: Probability and Statistics

Program: B. Sc. Data Analytics	**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	Understand the science of studying & analyzing numbers.
CO2	Define probability.
CO3	Describe various statistical formulas.
CO4	Compute various statistical measures.

Detailed Contents	Contact hours
Unit I Define probability, Random experiment, outcome, trial and event, Exhaustive events, favourable events, Independentevents, sample space, definition of probability, addition theorem of probability, conditional probability, independent events, Mutually and pair wise independent events, multiplication theorem of probability for independent events, Baye'stheorem.	11 hours
Unit II Random Variable (Univariate): Random Variable, Distribution function, discrete random variable, Probability mass function, Distribution function of discrete random variable, Continuous random variable, Probability density function. Distribution function of continuous random variable. Two dimensional probability mass function, Marginal probability function, conditional probability function, Two dimensional distribution function, marginal distribution function, Joint density function, marginal density function.	11 hours

Unit III Define statistics, 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.	11 hours
Unit IV Measures of Dispersion: Meaning of Dispersion, Objectives of Dispersion,PropertiesofagoodMeasureofDispersion,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 ofStandard Deviation , Merit and Demerits of Standard Deviation, Coefficient of Variation, Calculation of CoefficientVariance, Merit and Demerits of Coefficient of Variation.	11 hours

Text Books:

1. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December2000.
2. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government ofTamilnadu.
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 andMethods, 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

Course Code: UGCA1922
Course Name: Database Management Systems

Program: B. Sc. Data Analytics	**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	Understand the basic concepts of DBMS.
CO2	Formulate, using SQL, solutions to a broad range of query and data update problems.
CO3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4	Understand the concept of Transaction and Query processing in DBMS.

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.	10
Unit-II Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.	12
Unit-III Introduction to Normalization, First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued	12

Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).	
Unit-IV Database Recovery, Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases.	10

Text Books:

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition,(2012).
2. "DatabaseSystemConcepts",AbrahamSilberschatz,HenryF.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. "AnIntroductiontoDatabaseSystems",C.J.Date,A.Kannan,S.Swamynathan,8th Edition, Pearson Education,(2006).
3. DatabaseManagementSystems,RaghuRamakrishnan,McGraw-Hill,ThirdEdition, 2014.

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

Program: B. Sc. Data Analytics	**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-

CourseOutcomes:

CO#	Course outcomes
CO1	To learn programming from real world examples.

CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

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	12
Unit-II **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.	10
Unit-III **Inheritance and Operator overloading** IntroductiontoInheritance,Typesofinheritance:-Singleinheritance,Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloadingoperators	12
Unit-IV **Polymorphism and File Handling** EarlyBinding,LateBinding,VirtualFunctions,purevirtualfunctions,Abstract Classes. Opening and Closing File, Reading and Writing a file.	10

Text Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-GrawHill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition GalgotiaPublications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley PublishingCompany.
4. ObjectOrientedProgrammingUsingC++,Salaria,R.S,FourthEdition,Khanna Book Publishing.

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

Program: B. Sc. Data Analytics	**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: -NA-
Co requisite:-NA-
Additional material required in ESE: -NA-

CourseOutcomes:

CO#	Course outcomes
CO1	To learn programming from real world examples.
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Instructions: Develop all program in C++

Assignments:

1.	Writeaprogramtoentermarkof6differentsubjectsandfindoutthetotalmark(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 itsworks.CreateaclassPublicationthatstoresthetitle(astring)andprice(typefloat) 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).Eachclassshouldhaveget_data()functiontogetitsdatafromtheuser at the keyboard. Write the main() function to test the Book and Tape classes by creatinginstancesofthemaskingtheusertofillindatawithget_data()andthen displaying it using put_data().
9.	Consideranexampleofdeclaringtheexaminationresult.Designthreeclassesstudent, 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 owndata 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-GrawHill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition GalgotiaPublications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley PublishingCompany.
4. ObjectOrientedProgrammingUsingC++,Salaria,R.S,FourthEdition,Khanna Book Publishing.

Course Code: UGCA1986
Course Name: Probability and Statistics Laboratory

Program: B. Sc. Data Analytics	**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:NA.
Co requisite: NA.
Additional material required in ESE:.

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

CO#	Course Outcomes
CO1	Installation and use of open source statistical tool.
CO2	Apply various operations/ formulas using open source statistical tool.

Instructions:

1. Installation of any open source statisticaltool.
2. Implementation of various measures of centraltendency.
3. Implementation of various measures ofdispersion.
4. Implementation of probabilityfunctions.

Reference Books:

1. Statistics for Economics, TR Jain, VKOhri.
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

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Course Code: UGCA1925
Course Name: Database Management Systems Laboratory

Program: B. Sc. Data Analytics	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits:** 2
Semester: 2nd	**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-

CourseOutcomes:

CO#	Course outcomes
CO1	Able to understand various queries and their execution
CO2	Populate and query a database using SQL DML/DDL commands.
CO3	Declare and enforce integrity constraints on a database
CO4	Programming PL/SQL including stored procedures, stored functions, cursors, packages
CO5	Able to design new database and modify existing ones for new applications and reason about the efficiency of the result

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 betweenJan 2018 to Jun 2018 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulationoperation. 4. Partition the BOOK table based on year of publication. Demonstrate its workingwith a simplequery. 5. Create a view of all books and its number of copies that are currently available inthe 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'saverage. 2. Find the name and numbers of all salesmen who had more than onecustomer. 3. List all salesmen and indicate those who have and don't have customers in theircities (Use UNIONoperation.) 4. Create a view that finds the salesman who has the customer with the highest orderof aday. 5. DemonstratetheDELETEoperationbyremovingsalesmanwithid1000.Allhis orders must also be deleted.
11.	WriteaPL/SQLcodetoaddtwonumbersanddisplaytheresult.Readthenumbersduring run time.
12.	Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop.
13.	Writeaprogramtocreateatriggerwhichwillconvertthenameofastudenttouppercase before inserting or updating the name column of student table.
14.	WriteaPL/SQLblocktocountthenumberofrowsaffectedbyanupdatestatementusing 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).

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, environmentalinstitutesandvariouspersonalitieswhohavedonepracticalworkon various environmentalIssues.

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

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
ConceptofanEcosystem:Structure&functionsofanecosystem(Producers,Consumers &Decomposers)
Energy Flow in an ecosystem: Food Chain, Food web and Ecological Pyramids
Characteristic features, structure & functions of following Ecosystems:

- ForestEcosystem
- 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, NewDelhi.
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 EasternLtd.
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, BombayNatural History Society, Bombay(R)
11. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press1140p.
12. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.

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, USA499p

CourseCode:UGCA1923
CourseName:OperatingSystems

Program:B.Sc.DataAnalytics	**L**: 3 **T**: 1 **P**:0
Branch:ComputerApplications	**Credits**:4
Semester:3rd	**Contacthours:**44hours
Theory/Practical: Theory	**Percentageofnumerical/designproblems:** 15%
Internalmax.marks: 40	**Durationof endsemesterexam(ESE):** 3hrs
External max. marks:60	**Electivestatus:**Core
Totalmarks:100	

Prerequisite: Basicunderstandingofcomputersystem.
Corequisite:-NA-
Additional material required in ESE: -NA-

CourseOutcomes: Students willbe ableto:

CO#	Courseoutcomes
CO1	Discusstheevaluationof operatingsystems.
CO2	Explaindifferent resourcemanagements performedbyoperatingsystem.
CO3	Describethearchitecture intermsoffunctionsperformedbydifferenttypesof operatingsystems.
CO4	Analyzetheperformance ofdifferentalgorithmsusedindesignofoperatingsystem components.
CO5	ComparethekeypropertiesofdifferenttypesofOperatingSysytems.

Detailedcontents	Contacthours

Unit-I **Fundamentals of Operating system**: Introduction to Operating system,Functions of an operating system. Operating system as a resourcemanager.Structureofoperatingsystem(Roleof kerneland Shell). Viewsofoperatingsystem.Evolution andtypesofoperatingsystems.[CO1] **Process&ThreadManagement**:Programvs.Process;PCB,Statetransition diagram, Scheduling Queues, Types of schedulers, Concept ofThread,Benefits,Typesof 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,schedulingalgorithms(FCSC,SJF,Round-Robin,MultilevelQueue).[CO2]	12
Unit-II **Memory Management**: Introduction, address binding, relocation,loading, linking, memory sharing and protection; Paging andsegmentation; Virtual memory: basic concepts of demand paging, pagereplacementalgorithms.[CO2]	12
Unit-III	08
I/ODeviceManagement:I/Odevices andcontrollers,devicedrivers;diskstorage. **FileManagement**: Basicconcepts,fileoperations,accessmethods,directory structures and management, remote file systems; fileprotection.[CO3]	
Unit-IV **Advanced Operating systems:** Introduction to Distributed Operatingsystem, Characteristics, architecture, Issues, Communication &Synchronization; Introduction Multiprocessor Operating system,Architecture,Structure,Synchronization&Scheduling;Introducti ontoReal-TimeOperatingSystem,Characteristics,Structure&Scheduling. CasestudyofLinuxoperatingsystem[CO4][CO5]	12

TextBooks:

1. OperatingSystemPrinciplesbyAbrahamSilberschatz andPeterBaerGalvin,SeventhEdition, Published byWiley-India.
2. Principals of Operating System by Naresh Chauhan, Published by OXFORDUniversityPress,India.

ReferenceBooks:

1. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published byPearsonEducation.
2. OperatingsystembyStalling,W., SixthEdition,PublishedbyPrenticeHall(India)

CourseCode:UGCA1931

CourseName: DataWarehouseand Mining

Program:B.Sc.DataAnalytics	**L**: 3 **T**: 0 **P**:0
Branch: ComputerApplications	**Credits:**3
Semester:3rd	**Contacthours:**44hours
Theory/Practical: Theory	**Percentageofnumerical/designproblems:**20%
Internalmax.marks:40	**Durationofendsemesterexam (ESE):** 3hrs
Externalmax.marks:60	**Electivestatus:**Elective
Totalmarks: 100	

Prerequisite:-NA-Corequisite:-NA-

AdditionalmaterialrequiredinESE: -NA-

CourseOutcomes: Aftercompletingthiscourse,studentswillbeableto:

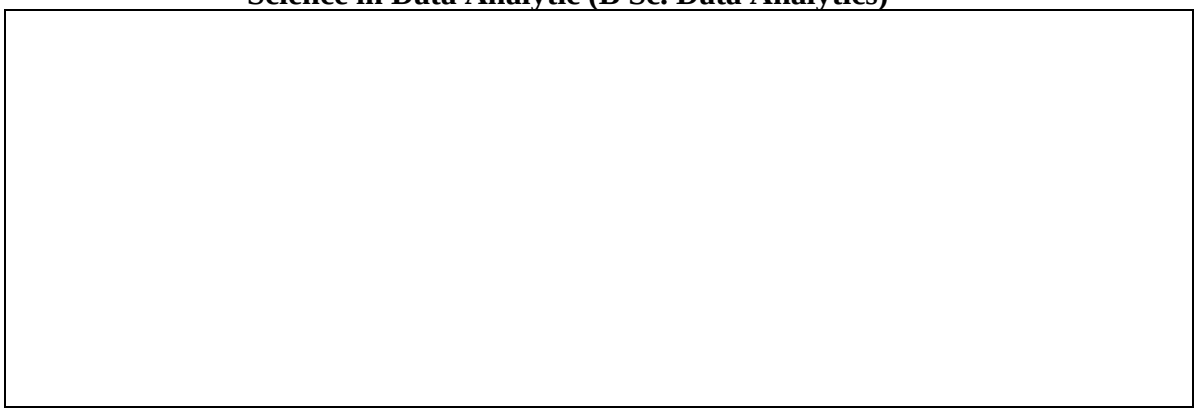
CO#	Courseoutcomes
CO1	ExplaintheneedofData Warehousing&Mining
CO2	Evaluate theTransactionalandAnalyticaldatamodels.
CO3	Analyzethereal-lifeapplicationswheredataminingcanbe applied.
CO4	Applydifferent datamining algorithmson widerangeofdata sets.

DetailedContents	Contacthours

Unit-I Needforstrategicinformation,differencebetweenoperationalandInformationaldata stores Datawarehousedefinition,characteristics,Datawarehouseroleandstructure,OLAPOperations,Datamart,Differentbetweendatamartanddata warehouse, Approaches to build a data warehouse, Building a datawarehouse,Metadata & itstypes.	11
Unit-II DataPre-processing:Need,DataSummarization,Methods.Denormalization,Multidimensionaldatamodel,Schemasformulti-dimensional data (Star schema, Snowflake Schema, Fact ConstellationSchema,Differencebetween different schemas. Datawarehousearchitecture,OLAPservers,IndexingOLAPData,OLAPquery processing,Data cubecomputation	11
Unit-III Data Mining: Definition, Data Mining process, Data miningmethodology,Dataminingtasks,MiningvariousDatatypes& issues.	12
Attribute-OrientedInduction,Associationrulemining,Frequentitemsetmining,TheApriori Algorithm,Mining multilevelassociationrules.	
Unit-IV Overviewofclassification,Classificationprocess,Decisiontree,Decision TreeInduction, Attribute Selection Measures.Overview ofclassifier's accuracy, Evaluating classifier's accuracy, Techniques foraccuracyestimation,Increasingtheaccuracyofclassifier. Introduction to Clustering, Types of clusters, Clustering methods, Datavisualization& various data visualization tools	10

TextBooks:

1. Berson, DataWarehousing,Data Mining&OLAP,TataMcGraw-Hill.
2. Han J., Kamber M. and Pei J., Data mining concepts and techniques, MorganKaufmannPublishers (2011) 3rd ed.
3. PudiV.,KrishanaP.R.,DataMining,OxfordUniversitypress,(2009)1sted.
4. AdriaansP.,ZantingeD.,Datamining,Pearsoneducationpress(1996),1sted.
5. Pooniah P., Data Warehousing Fundamentals, Willey interscience Publication,(2001),1st ed.



I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1915

CourseName:DataStructures

Program:B.Sc.DataAnalytics	**L**: 3 **T**: 1 **P**:0
Branch:ComputerApplications	**Credits**:4
Semester:3rd	**Contacthours:**44hours
Theory/Practical: Theory	**Percentageofnumerical/designproblems:--**
Internalmax.marks: 40	**Durationof endsemesterexam(ESE):** 3hrs
External max. marks:60	**Electivestatus:**Core
Totalmarks:100	

Prerequisite:-NA-Corequisite:-NA-

Additional material required in ESE: -NA-

CourseOutcomes: Studentswill beableto

CO#	Courseoutcomes
CO1	ApplyappropriateconstructsofProgramminglanguage,codingstandardsforapplication development
CO2	Selectappropriatedatastructuresforproblemsolvingandprogramming
CO3	Illustratetheoutcomeof variousoperationsondatastructures.
CO4	Identifyappropriatesearchingand/orsortingtechniquesforwiderangeofproblemsand datatypes.
CO5	Differentiatebetweenvarioustypesofdatastructures

DetailedContents	Contacthours
Unit-I **IntroductiontoDataStructures:** Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity ofAlgorithm, Introduction and Definition of Data Structure, Classification ofData, Arrays, Various types of Data Structure, Static and Dynamic MemoryAllocation,Function, Recursion.[CO5] **Arrays, PointersandStrings:** IntroductiontoArrays,Definition,OneDimensionalArrayandMulti-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Arrayand Pointer. Strings.Introduction to Strings, Definition, Library Functions ofStrings.[CO1]	10

Unit-II **StacksandQueue** Introduction to Stack, Definition, Stack Implementation, Operations of Stack,Applications of Stack and Multiple Stacks. Implementation of Multiple StackQueues,IntroductiontoQueue,Definition,QueueImplementation,Operatio nsofQueue, CircularQueue, De-queueand PriorityQueue.[CO2]	8
Unit-III **LinkedListsandTrees** Introduction, Representation and Operations of Linked Lists, Singly LinkedList, Doubly Linked List, Circular Linked List, And Circular Doubly LinkedList.[CO3] **Trees** Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree,Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded BinaryTree,AVLTreeBTree,B+Tree.[CO3]	14
Unit-IV **Graphs,Searching,SortingandHashing** **Graphs:**Introduction,RepresentationtoGraphs,GraphTraversalsShortestPathAl gorithms.[CO3] **SearchingandSorting:**Searching,TypesofSearching,Sorting,Typesofsortinglik equick sort, bubble sort, mergesort, selectionsort.[CO4] **Hashing:**HashFunction,TypesofHashFunctions,Collision,Collision ResolutionTechnique(CRT),Perfect Hashing[CO4]	12

TextBooks

1. BrijeshBakariya.DataStructuresandAlgorithmsImplementationthroughC,BPBPublications.
2. KruseR.L.DataStructures andProgramDesignin C;PHI
3. AhoAlfredV.,HopperoftJohnE.,UllmanJeffreyD.,"DataStructuresandAlgorithms",AddisonWesley

Referencebooks

1. Horowitz&Sawhaney: FundamentalsofDataStructures,GalgotiaPublishers.
2. YashwantKanetkar,UnderstandingPointersin C,BPBPublications.
3. Horowitz,S.Sahni,andS.Rajasekaran,ComputerAlgorithms,GalgotiaPub.Pvt.Ltd.,1998.

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

CourseCode:UGCA1914
CourseName:ProgramminginPython

Program:B.Sc.DataAnalytics	**L**: 3 **T**: 1 **P**:0
Branch:ComputerApplications	**Credits**:4
Semester:3rd	**Contacthours:**44hours
Theory/Practical:Theory	**Percentageofnumerical/designproblems**:40%
Internalmax. marks:40	**Durationof endsemesterexam(ESE):** 3hrs
External max. marks:60	**Electivestatus:**Core
Totalmarks:100	

Prerequisite:-NA-Corequisite:-NA-
Additional material required in ESE: -NA-

CourseOutcomes: Students willbe ableto:

CO#	CourseOutcomes
CO1	Explainenvironment,datatypes,operatorsusedinPython.
CO2	ComparePythonwithotherprogramminglanguages.
CO3	Outlinetheuseofcontrolstructuresand numerous nativedatatypeswith their methods.
CO4	Designuserdefinedfunctions,modules,files,andpackagesandexceptionhandling methods.
CO5	WritesolutionsforObjectOrientedProgrammingConcepts.

DetailedContents	Contacthours
Unit-I **IntroductiontoPythonProgrammingLanguage:**ProgrammingLanguage,History and Origin of Python Language, Features of Python, Limitations,MajorApplicationsofPython,Getting,InstallingPython,SettingupPathandEnvironmentVariables,RunningPython,FirstPythonProgram,PythonInteractive Help Feature, Python differences from other languages. [CO1][CO2] **PythonDataTypes&Input/Output:**Keywords,Identifiers,PythonStatement,Indentation,Documentation,Variables,MultipleAssignment,Understanding Data Type, Data Type Conversion, Python Input and OutputFunctions,Import command.[CO1] **OperatorsandExpressions:**OperatorsinPython,Expressions,Precedence,Associativityof Operators, Non AssociativeOperators.[CO1]	12

Unit-II **ControlStructures:**Decisionmakingstatements,Pythonloops,Pythoncontrolstatements. **PythonNativeDataTypes:**Numbers,Lists,Tuples,Sets,Dictionary,Functions &Methodsof Dictionary,Strings(indetailwiththeirmethodsandoperations).[CO3]	10
Unit-III **Python Functions:** Functions, Advantages of Functions, Built-in Functions,User defined functions, Anonymous functions, Pass by value Vs. Pass byReference,Recursion, ScopeandLifetime ofVariables.[CO3] **Python Modules:** Module definition, Need of modules, Creating a module,Importingmodule,PathSearchingofaModule,ModuleReloading,StandardModules,Python Packages.[CO3]	12
Unit-IV **ExceptionHandling:**Exceptions,Built-inexceptions,Exceptionhandling,Userdefined exceptions in Python.	10
FileManagementinPython: Operationsonfiles(opening,modes,attributes,encoding,closing),read()&write()methods,tell()&seek()methods,renaming&deletingfilesin Python, directories inPython.[CO4] **Classes and Objects:** The concept of OOPS in Python, Designing classes,Creating objects, Accessing attributes, Editing class attributes, Built-in classattributes,Garbagecollection, Destroyingobjects.[CO5]	

TextBooks:

1. ProgramminginPython, PoojaSharma,BPBPublications,2017.
2. CorePython Programming, R.NageswaraRao, 2nd Edition,Dreamtech.

ReferenceBooks:

1. Python, ThecompleteReference,MartinC.Brown,McGraw HillEducation.
2. PythoninaNutshell,A.Martelli,A.Ravenscroft, S.Holden,OREILLY.

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

CourseCode:UGCA1926
CourseName:OperatingSystemsLaboratory

Program:B.Sc.DataAnalytics	**L**: 0 **T**: 0 **P**:4
Branch:ComputerApplications	**Credits**:2
Semester:3rd	**Contacthours**:4hoursperweek
Theory/Practical: Practical	**Percentageofnumerical/designproblems:** 100
Internalmax.marks: 60	**Durationof endsemesterexam(ESE):** 3hrs
External max. marks:40	**Electivestatus:**Core
Totalmarks:100	

Prerequisite:-NA-Corequisite:-
NA-
AdditionalmaterialrequiredinESE: -NA-

CourseOutcomes: Aftergoingthroughthepractical,studentwill beableto:

CO#	Courseoutcomes
CO1	Implementtheinstallationandconfigurationofdifferentoperatingsystems.
CO2	Writeprogramsfordifferentschedulingalgorithms.
CO3	Executevariouscommands inVieditor
CO4	Implementthedualbootinstallation
CO5	Executecommandsinshellprogramming

Instructions:

1	Installationofwindows OS.
2	InstallationofLinuxOS.
3	DualbootinstallationofOperatingsystems.
4	ImplementationofFCFSSchedulingalgorithm
5	ImplementationofSJFSchedulingalgorithm
6	ImplementationofRound-RobinSchedulingalgorithm
7	ViEditor &its commands
8	ShellCommands
9	ShellScripting-Usingvariables
10	ShellScripting- Input&Output
11	ShellScripting-Datatypes
12	ShellScripting-Useof arithmeticoperators
13	ShellScripting-ifcontrolstatementprograms
14	ShellScripting-whilecontrolstatement
15	ShellScripting-forcontrolstatement

ReferenceBooks:

1. Linux:ThecompletereferencebyRichardPetersen,PublishedbyTataMcGraw-HillPublication.
2. OperatingSystemPrinciplesbyAbrahamSilberschatzandPeterBaerGalvin,SeventhEdition, Published byWiley-India.

CourseCode:UGCA1917
CourseName: ProgramminginPythonLaboratory

Program:B.Sc.DataAnalytics	**L**: 0 **T**: 0 **P**:4
Branch:ComputerApplications	**Credits**:2
Semester:3rd	**Contacthours**:4hoursperweek
Theory/Practical:Practical	**Percentageofnumerical/designproblems**:90%
Internalmax. marks:60	**Duration of endsemesterexam(ESE)**:3hrs
External max.marks:40	**ElectiveStatus :**Core
Totalmarks:100	

Prerequisite:-NA-Corequisite:-NA-
AdditionalmaterialrequiredinESE:-Maintainpracticalnotebookaspertheinstructionsgiven bytheinstructor.

CourseOutcomes:Students willbeable to:

CO#	Courseoutcomes
CO1	Outlinevariousprogrammingconstructslikedata typesandcontrolstructuresof Python.
CO2	Implementdifferentdatastructures.
CO3	Implementmodules and functions.
CO4	Illustrateconceptofobjectorientedprogramming.
CO5	Implement filehandling.

Listofassignments:

1.	Computesum,subtraction,multiplication,divisionandexponentofgivenvariables input bythe user.
2.	Computeareaoffollowingshapes:circle,rectangle,triangle,square,trapezoidand parallelogram.
3.	Computevolumeoffollowing3Dshapes:cube,cylinder,coneandsphere.
4.	Computeandprintrootsofquadraticequation$ax^2+bx+c=0$,wherethevaluesofa,b, and c areinputbythe user.
5.	Print numbers up to N which arenot divisible by3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6.	Writeaprogramto determinewhetheratriangle isisosceles ornot?
7.	Printmultiplication tableof anumberinput bytheuser.
8.	Computesumof naturalnumbersfromonetonnumber.
9.	PrintFibonacci seriesupton numberse.g. 0 11235813…..n

10.	Computefactorialofagivennumber.
11.	Countoccurrenceof adigit 5in a given integer numberinput bythe user.
12.	PrintGeometric and Harmonicmeans ofaseries input bytheuser.
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.	Printallpossiblecombinationsof4,5,and6.
15.	Determineprimenumberswithinaspecificrange.
16.	Countnumber ofpersonsof ageabove60 andbelow 90.
17.	Computetranspose ofamatrix.
18.	Performfollowingoperationsontwomatrices. 1)Addition2)Subtraction 3)Multiplication
19.	Countoccurrenceofvowels.
20.	Counttotalnumberofvowelsin aword.
21.	Determinewhetherastringispalindromeornot.
22.	Performfollowingoperations onalist ofnumbers: 1)Insertan element2)deletean element3)sortthelist4)deleteentirelist
23.	Displayword after Sortingin alphabetical order.
24.	Performsequentialsearch onalist ofgivennumbers.
25.	Performsequentialsearchonorderedlistofgivennumbers.
26.	MaintainpracticalnotebookaspertheirserialnumbersinlibraryusingPython dictionary.
27.	Performfollowingoperationsondictionary 1)Insert2)delete3)change
28.	Checkwhetheranumber isinagivenrangeusingfunctions.
29.	WriteaPythonfunctionthatacceptsastringandcalculatesnumberofuppercase lettersandlower caselettersavailableinthatstring.
30.	TofindtheMaxofthreenumbersusingfunctions.
31.	Multiplyall the numbersin a list usingfunctions.
32.	SolvetheFibonaccisequenceusingrecursion.
33.	Getthefactorialofanon-negativeintegerusingrecursion.
34.	Writeaprogramto createamoduleoffactorial inPython.
35.	DesignaPythonclassnamed*Rectangle*,constructedbyalength&width,alsodesign amethod whichwill compute theareaofarectangle.
36.	DesignaPythonclassnamed*Circle*constructedbyaradiusandtwomethodswhich willcomputethe areaand the perimeterof acircle.
37.	Design aPython classtoreverseastring‘wordbyword’.
38.	WriteaPythonprogramtoreadanentire*textfile*.
39.	DesignaPythonprogramtoreadfirstnlinesof a *text file.*
40.	Constructa Pythonprogram to writeand appendtext to afileand displaythetext.

TextBooks:

1. ProgramminginPython,PoojaSharma,BPBPublications,2017.
2. CorePythonProgramming,R.NageswaraRao,2nd Ediiton,Dreamtech.

ReferenceBooks:

1. Python, ThecompleteReference,MartinC.Brown,McGraw HillEducation.
2. PythoninaNutshell,A.Martelli,A.Ravenscroft, S.Holden,OREILLY.

CourseCode:UGCA1918
CourseName:DataStructuresLaboratory

Program:B.Sc.DataAnalytics	**L**: 0 **T**: 0 **P**:4
Branch:ComputerApplications	**Credits**:2
Semester:3rd	**Contacthours:**4hoursperweek
Theory/Practical: Practical	**Percentageofnumerical/designproblems:**--
Internalmax.marks: 60	**Durationof endsemesterexam(ESE):** 3hrs
External max. marks:40	**Electivestatus:**Core
Totalmarks:100	

Prerequisite:-NA-Corequisite:-NA-
Additional material required in ESE: - NA-

CourseOutcomes: Student willbeable to

CO#	Courseoutcomes
CO1	ImplementDynamicmemoryallocation.
CO2	CreatedifferentdatastructuresinC/C++
CO3	Implementvariousoperationsofalldatastructures
CO4	Illustratetheoutcomeofvariousoperationswiththehelpofexamples.
CO5	Writeprogramstoimplementvarioustypes ofsearchingandsortingalgorithms

Instructions: ProgramsmaybedevelopedinC/C++/Python/Javalanguage.

Listofassignments:

1	ProgramforusingDynamicFunctions (malloc(),calloc(),realloc()andfree())functions.
2	Programtoinsert,delete andtraverseanelementfroman array
3	Programtomergeonedimensionalarrays
4	Programforaddition and subtraction oftwomatrices.
5	Programforimplementingmultiplicationoftwomatrices
6	Implementlinearsearch usingoneandtwodimensionalarray.
7	Programforimplementingselectionsort.
8	Program forimplementinginsertionsort.
9	Programforimplementingquicksort.

10	Programforimplementingmergesort.
11	Programtocalculatelengthofthe stringusinguser definedfunction.
12	Programtoconcatenate andcomparetwo stringsusinguserdefinedfunction.
13	Programforusingtheconceptof pointertostring.
14	Programto reverseasentencebyrecursion.
15	Programtodeleteallrepeatedwordsinstring.
16	Programtofindthenumberofvowels,consonants, digitsandwhitespaceinastring.
17	Programtofindthelengthofthelongestrepeatingsequenceinastring.
18	Programtofindhighestandlowestfrequencycharacterinastring.
19	ProgramforimplementingStackusingarray.
20	ProgramforimplementingStackusingpointer.
21	Programforimplementingmultiplestack.
22	Programforconvertinginfixtopostfixform.
23	ProgramforimplementingQueueusingarray.
24	Programfordynamicimplementationofqueue.
25	Programforimplementingcircularqueue.
26	Programforimplementingdequeue.
27	Program forimplementingpriorityqueue.
28	ProgramforimplementingSinglyLinkedlist.
29	ProgramforimplementingDoublyLinked list.
30	ProgramforimplementingBinarySearchTree.
31	ProgramforBreadthFirstSearch(BFS)forgraphtraversal.
32	ProgramforDepthFirst Search(DFS)forgraphtraversal.

ReferenceBooks:

1. BrijeshBakariya.DataStructuresandAlgorithmsImplementationthroughC,BPBPublications.
2. AhoAlfredV.,HopperoftJohnE.,UIlmanJeffreyD.,"DataStructuresandAlgorithms",AddisonWesley
3. Horowitz&Sawhaney: Fundamentalsof DataStructures,GalgotiaPublishers.

CourseCode:UGCA1937

CourseName:DataWarehouseandMiningLaboratory

Program:B.Sc.DataAnalytics	**L**: 0 **T**: 0 **P**:2
Branch:ComputerApplications	**Credits:**1
Semester:3rd	**Contacthours:**4hours perweek
Theory/Practical: Practical	**Percentageofnumerical/designproblems:**90
Internalmax.marks:60	**Durationofendsemesterexam (ESE):** 3hrs
Externalmax.marks:40	**Electivestatus:**Elective
Totalmarks: 100	

Prerequisite: Basicunderstandingofdatabaseconcepts.

Corequisite:-NA-
AdditionalmaterialrequiredinESE: -NA-

CourseOutcomes: Aftergoing through thislaboratory, student willbeableto:

CO#	Courseoutcomes
CO1	Applydifferentdataminingtools usedtoanalyzedata.
CO2	Apply and Evaluate differentdata miningalgorithmstoanalyzedata.
CO3	Understand effectivevisualizationforrepresentingdata.

Instructions:

1	IntroductiontoWEK/ Rtool.
2	Installationof Weka/RTool.
3	IntroductiontovariouscomponentsofWEKA/Rtool.
4	FundamentalprogrammingusingWEKA/Rtool.
5	Implementingdatapreprocessing.
6	Implementingapriorialgorithm.
7	Implementingclassificationusingdecisiontree.
8	Implementingclassificationusingdecisiontreeinduction.
9	Implementationk-mean clustering
10	ImplementingdifferentDatavisualizationtools.

- Number of practical's can be more than 10 by implementing these algorithmson different data sets. Also, visualization tools can be used simultaneously torepresenttheoutcomes in abetter way

ReferenceBooks:

1. DataMining:PracticalMachineLearningToolsandTechniques,3rdeditionbyIanH.Witten, Eibe Frank,Mark A.HallPublished byMorganKaufmann.
2. DataanalyticsusingR,1steditionbySeemaAcharyaPublishedbyTataMcgrawHill.

EBooks/Onlinelearningmaterial

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

Fourth Semester

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1947
Course Name: Digital Marketing

Program: B.Sc. Data Analytics	**L**: 3 **T**: 1 **P**:0
Branch: Computer Applications	**Credits**:4
Semester:4th	**Contacthours:**44hours
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
Totalmarks:100	

Prerequisite:-NA-Corequisite:-NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Learn how to use new media such as mobile, search and social networking.
CO2	Understand how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy.
CO3	Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media.
CO4	Learn to develop, evaluate, and execute a comprehensive 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] **Social Media Marketing (SMM):** Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc. [co1]	11

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). [co2] **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. **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. **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. [co3]	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 Analytics, Types of Web Analytics (On-site, Off-site), Importance of Web Analytics. [co3, co4]	10

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

Course Code:UGCA1953

Course Name: Digital Marketing Laboratory

Program: B.Sc. Data Analytics	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits:**1
Semester:4th	**Contacthours:**4hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:**--
Internalmax.marks:60	**Duration of end semester exam (ESE):** 3hrs
Externalmax.marks:40	**Elective status:** core
Total marks: 100	

Prerequisite:-NA-Corequisite:-NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Familiarizing with the key elements of a digital marketing strategy.
CO2	The students will be able to perform practical skills in common digital marketing tools such as SEO, Social media and Blogs.
CO3	Learn to manage the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media
CO4	Learn to develop, evaluate, and execute a comprehensive 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.

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.".

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA1946
Course Name: R Programming

Program: B.Sc. Data Analytics	**L**: 3 **T**: 1 **P**:0
Branch: Computer Applications	**Credits**:4
Semester:4th	**Contacthours:**44hours
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
Totalmarks:100	

Prerequisite:- Logics of basic programming terminologies.
Additional material required in ESE: -NA-

Course Outcomes: Simulation study

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] **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]	11

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: B.Sc. Data Analytics	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits:**2
Semester:4th	**Contacthours:**4hours per week

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Theory/Practical: Practical	**Percentage of numerical/design problems:**--
Internalmax.marks:60	**Duration of end semester exam (ESE):** 3hrs
Externalmax.marks:40	**Elective status:** core
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.	Write a R program to get the first 10 Fibonacci numbers.
6.	Show all prime numbers up to a given number using R programming.
7.	Design a R program to find the factors of a given number
8.	Write a R program to find the maximum and the minimum value of a given vector
9.	Write a R program to create a data frame from four given vectors.
10.	Write a program to get the structure of a given data frame.
11.	Write a R program to extract specific column from a data frame using column name.
12.	Write a R program to create a matrix taking a given vector of numbers as input. Display the matrix.

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

I. K. Gujral Punjab Technical University Bachelor of Science in Data Analytic (B Sc. Data Analytics)

Course Code: UGCA2004

Course Name: Data Visualization

Program: B.Sc. Data Analytics	**L**: 3 **T**: 1 **P**:
Branch: Computer Applications	**Credits:**4
Semester:4th	**Contacthours:**4hours per week
Theory/Practical: Theory	**Percentage of numerical/design problems:**--
Internalmax.marks:40	**Duration of end semester exam (ESE):** 3hrs
Externalmax.marks:60	**Elective status:** core
Total marks: 100	

Prerequisite:-NA-Corequisite:-NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Familiarize students with the basic and advanced techniques of information visualization and scientific visualization
CO2	To learn key techniques of the visualization process
CO3	A detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

Unit 1 Introduction of visual perception, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications. **[co1]**	
Unit 2 Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents. **[co2]**	
Unit 3 Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations. **[co2]**	
Unit 4 Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization. **TOOLS: Programming Statistical Data Visualization, Google Map API, Google Chart, Tableau - Heat Map Generation [co3]**	

Suggested Books.

1. Jon Raasch, Graham Murray, Vadim Ogievetsky, Joseph Lowery, "JavaScript and jQuery for Data Analysis and Visualization", WROX
2. Ritchie S. King, Visual story telling with D3" Pearson
3. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
4. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Relly
5. Andy Kirk, Data Visualization: A Successful Design Process, PAKT
6. Scott Murray, Interactive Data Visualization for Web, O'Relly
7. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
8. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

Course Code: UGCA2005

Course Name: Data Visualization Laboratory

Program: B.Sc. Data Analytics	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits:**2
Semester:4th	**Contacthours:**4hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:**--
Internalmax.marks:60	**Duration of end semester exam (ESE):** 3hrs
Externalmax.marks:40	**Elective status:** core
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	Design effective data visualizations to communicate information to the viewer.
CO2	Identify appropriate data that can be used in order to create a visualization.
CO3	Organize data and visualizations in order to prepare them for reuse.

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

1. Loading and Distinguishing Dependent and Independent parameters
2. Exploring Data Visualization tools
3. Drawing Charts
4. Drawing Graphs
5. Data mapping

6. Creating Scatter Plot maps

7. Using BNF Notations

8. Working with REGEX

9. Visualize Network Data

10. Understanding Data Visualization frameworks

11. Design applications to implement **Google Map API, Google Chart, Tableau - Heat Map Generation**

Reference Book:
1. E. Tufte, The Visual Display of Quantitative Information, Graphics Press. 2nd Edition, 2001
2. Alexandru C Telea, Data Visualization: Principles And Practice, 2nd Edition, 2014
3. Wang Kaining, Infographic & Data Visualizations, sew Edition. 2013
4. Andy Krik, Data Visualisation : A Handbook for Data Driven Design, 1st Edition, 2016

Course Code: UGCA2006
Course Name: Big Data Analytics

Program: B.Sc. Data Analytics	**L**: 3 **T**: 1 **P**:
Branch: Computer Applications	**Credits:**4
Semester:4th	**Contacthours:**4hours per week
Theory/Practical: Theory	**Percentage of numerical/design problems:**--
Internalmax.marks:40	**Duration of end semester exam (ESE):** 3hrs
Externalmax.marks:60	**Elective status:** core
Total marks: 100	

Prerequisite:-NA-Corequisite:-**NA-**
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Explain the need of Big Data.
CO2	Discuss the architecture of Big Data
CO3	Setup environment for creating Big Data Applications
CO4	Implement basic applications of Big Data.

Unit 1	11

An Overview of Big Data and Big Data Analytics, Big Data sources, Application areas of Big Data. Understanding Hadoop and its Ecosystem. Brief intro to Hadoop Ecosystem components: Hadoop Distributed File System, MapReduce, YARN, HBase, Hive, Pig, Sqoop, ZooKeeper, Flume, Oozie, Ambari. Understanding a Hadoop cluster. [co1]	
Unit 2 Overview of HDFS. Architecture of HDFS, Advantages and disadvantages of HDFS, HDFS Daemons, HDFS Blocks, HDFS file write and read, NameNode as SPOF, Hadoop HA, heartbeats, block reports and rereplication, Safemode of Namenode, Hadoop fs commands: cat, ls, put, get, rm, df, count, fsck, balancer, mkdir, du, copyfromlocal, copytolocal. [co2]	11
Unit 3 Hadoop fs commands: expunge, chmod, chown, chgrp, setrep, stat. Hadoop dfsadmin commands. Introduction to Apache Pig, Need of Pig, Installation of Pig, Execution modes of Pig, Pig – Architecture, Grunt shell and basic utility commands, Data types and Operators in Pig, Analysing data stored in HDFS using Pig, Pig operators for Data analysis: Dump, Describe, Explanation, Illustration, Store. [co2, co3]	10
Unit 4 Group, cogroup, join, split, filter, distinct, foreach, order by, limit operators. Functions in Pig: Eval functions, Load and store functions, Bag and tuple functions, String functions, Date time functions, Math functions, Case Studies: Analyzing various datasets with Pig. [co3, co4]	10

Suggested Books.

1. Big Data, Black Book by DT Editorial Services, Dreamtech Press.
2. Hadoop – The Definitive Guide 3rd Edition, Tom White/ OReilly-Yahoo press
3. Hadoop in Action, Chuck Lam/Manning
4. Hadoop – Beginner's Guide, Garry Turkington/Packt Publishing