

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

Coimbatore - 641 029



DEPARTMENT OF COMPUTER SCIENCE WITH DATA ANALYTICS

CURRICULUM AND SCHEME OF EXAMINATIONS
(2021 - 2022 and onwards)

DEPARTMENT OF COMPUTER SCIENCE WITH DATA ANALYTICS (DA)

Vision

To emerge as a throbbing and pioneering academic and research hub of global standards to empower students in Computer Science with Data Analytics.

Mission

- To incorporate modern trends in Data Science and Analytics.
- To fuel the passion in student community to excel in all fronts like logical thinking, decision making, reliability and application based on strong theoretical foundation and extensive practical training.
- To undertake industry – institute collaborations for knowledge and technology exchange.
- To generate new knowledge by high impact research in data analytics that has significant benefits for individual, industry and society by enabling better decision making.

Programme Outcomes (POs)	
On successful completion of the B.Sc. Computer Science with Data Analytics	
PO1	Exhibit good domain knowledge and completes the assigned responsibilities Effectively and efficiently in par with the expected quality standards
PO2	Apply analytical and critical thinking to identify, formulate, analyze, and solve complex problems in order to reach authenticated conclusions
PO3	Design and develop research-based solutions for complex problems with specified needs through appropriate consideration for the public health, safety, cultural, societal, and environmental concerns
PO4	Establish the ability to Listen, read, proficiently communicate and articulate complex ideas with respect to the needs and abilities of diverse audiences.
PO5	Deliver innovative ideas to instigate new business ventures and possess the qualities of a good entrepreneur
PO6	Acquire the qualities of a good leader and engage in efficient decision-making.
PO7	Graduates will be able to undertake any responsibility as an individual/member of multidisciplinary teams and have an understanding of team leadership
PO8	Function as socially responsible individual with ethical values and accountable to ethically validate any actions or decisions before proceeding and actively contribute to the societal concerns.
PO9	Identify and address own educational needs in a changing world in ways sufficient to maintain the competence and to allow them to contribute to the advancement of knowledge
PO10	Demonstrate knowledge and understanding of management principles and apply these to one own work to manage projects and in multidisciplinary environment.

Programme Specific Outcomes (PSOs)	
After the successful completion of B.Sc. Computer Science with Data Analytics programme the students are expected to	
PSO1	Impart education with domain knowledge effectively and efficiently in par with the expected quality standards for Data analyst professional.
PSO2	Ability to apply the mathematical, technical and critical thinking skills in the discipline of Data analytics to find solutions for complex problems.
PSO3	Ability to engage in life-long learning and adopt fast changing technology to Prepare for professional development.
PSO4	Expose the students to key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.
PSO5	Inculcate effective communication skills combined with professional & ethical Attitude.

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE – 641 029

Course Name: Computer Science with Data Analytics

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2021-2022)

Semester	Part	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam (hours)	Credits
					CIA	ESE	TO TAL		
I	I	21TML1A1	Language I@	6	50	50	100	3	3
	II	21ENG101	English -I	6	50	50	100	3	3
	III	21UDA101	Core Paper 1 : Programming in C	4	50	50	100	3	4
	III	21UDA1CL	Core Practical 1 : Programming Lab C	2	50	50	100	3	2
	III	21UDA102	Core Paper 2 : Data Structures	4	50	50	100	3	4
	III	21UDA1A1	Allied Paper 1 : Introduction to Linear Algebra	6	50	50	100	3	5
	IV	21EVS101	Environmental Studies **	2	-	50	50	3	2
Total				30	-	-	650	-	23
II	I	21TML2A2	Language II@	6	50	50	100	3	3
	II	21ENG202	English -II	6	50	50	100	3	3
	III	21UDA203	Core Paper 3 : Programming in C ++	4	50	50	100	3	4
	III	21UDA2CM	Core Practical 2 : Programming Lab- C ++	4	50	50	100	3	2
	III	21UDA2CN	Core Practical 3 : Internet Basics Lab	2	25	25	50	3	2
	III	21UDA2A2	Allied Paper 2 : Discrete Mathematics	6	50	50	100	3	5
	IV	21VED201	Value Education: Moral and Ethics**	2	-	50	50	3	2
Total				30	-	-	600	-	21
III	III	21UDA304	Core Paper 4 : Object Oriented Programming in Java	6	50	50	100	3	4
	III	21UDA3CO	Core Practical 4 : Object Oriented Programming in Java Laboratory	6	50	50	100	3	3
	III	21UDA3CP	Core Practical 5:Data Manipulation Using Advanced Excel Laboratory	3	25	25	50	3	2
	III	21UDA305	Core Paper 5: Big Data Science and Data Analytics	5	50	50	100	3	4
	III	21UDA3A3	Allied Paper 3: Text and Predictive Analytics	6	50	50	100	3	5
	IV	21UDA3S1	Skill Based Subject 1: Cyber Security	2	50	50	100	3	3
	IV	21TBT301/ 21TAT301/ 21UHR3N1	Basic Tamil* / Advanced Tamil**/ Non-Major Elective-1-Human Rights**	2	-	75	75	3	2
Total				30	-	-	625	-	23
IV	III	21UDA406	Core Paper 6: Python Programming	5	50	50	100	3	4
	III	21UDA4CQ	Core Practical 6: Python Programming Laboratory	5	50	50	100	3	2
	III	21UDA407	Core Paper 7: Relational Database Management System	5	50	50	100	3	5
	III	21UDA4CR	Core Practical 7: Relational Database Management System Laboratory	5	50	50	100	3	2
	III	21UDA4A4	Allied Paper 4: Web and Social Network Analytics	6	50	50	100	3	5
	IV	21UDA4SL	Skill Based Subject 2: Web Design Laboratory	2	50	50	100	3	3
	IV	21TBT402/ 21TAT402/ 21UWR4N2	Basic Tamil* / Advanced Tamil** / Non-Major Elective-2-Women's Rights**	2	-	75	75	3	2
Total				30	-	-	675	-	23

V	III	21UDA508	Core Paper 8: R Programming	6	50	50	100	3	4	
	III	21UDA5CS	Core Practical 8: R Programming Laboratory	6	50	50	100	3	3	
	III	21UDA509	Core Paper 9: Design and Analysis of Algorithms	5	50	50	100	3	4	
	III	21UDA510	Core Paper 10: Database Design and Management	6	50	50	100	3	4	
	III	21UDA5E1	Major Elective I -	5	50	50	100	3	5	
	IV	-	EDC	2	50	50	100	3	3	
	-	21UDA5IT	Internship Training ****	Grade						
Total				30	-	-	600	-	23	
VI	III	21UDA611	Core Paper 11: Artificial Intelligence and its Applications	6	50	50	100	3	4	
	III	21UDA6CT	Core Practical 9: Artificial Intelligence and Machine Learning Laboratory	6	50	50	100	3	3	
	III	21UDA612	Core Paper 12: Machine Learning	6	50	50	100	3	4	
	III	21UDA6E2	Major Elective II -	6	50	50	100	3	5	
	III	21UDA6Z1	Project and Viva voce***	~	4	50	50	100	-	5
	IV	21UDA6S2	Skill Based Subject 3: Ethical Hacking	2	50	50	100	3	3	
	-	-	SWAYAM-MOOC	-	-	-	-	-	-	2
Total				30	-	-	600	-	26	
V	21NCC/NSS/YRC/ PYE/ECC/RRC/ WEC101#	Co-curricular Activities*	-	50	-	50	-	1		
Grand Total				-	-	-	3800	-	140	

Note:

- CBCS – Choice Based Credit system
CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

@ Hindi/Malayalam/ French/ Sanskrit – 22HIN/MLM/FRN/SAN101 - 202

* - No End-of-Semester Examinations. Only Continuous Internal Assessment (CIA)

** - No Continuous Internal Assessment (CIA). Only End-of-Semester Examinations (ESE)

*** Project Report – 35 marks; Viva voce – 15 marks; Internal-50 marks

~ Not to be included in faculty workload

**** The students shall undergo Internship training / field work for a minimum period of 2 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the respective Faculty. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85 – 100	O
70 – 84	D
60 – 69	A
50 – 59	B
40 – 49	C
< 40	U (Reappear)

Major Elective Papers

(Two papers are to be chosen from the following SIX papers)

1. Internet of Things
2. Software Testing and Quality Assurance
3. Cloud Computing Fundamentals
4. Digital Forensics
5. Natural Language Processing
6. Deep Learning

Non-Major Elective Papers

1. Human Rights
2. Women's Rights
3. Consumer Affairs

Sub. Code & Title of the Extra Departmental Course (EDC)

21UDA5XL - Internet Basics and Advanced Excel Laboratory

List of Cocurricular Activities

1. National Cadet Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

Note

In core/ allied subjects, no. of papers both theory and practical are included wherever applicable. However, the total credits and marks for core/allied subjects remain the same as stated below.

Tally Table

S.No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/Hindi/Malayalam/ French/ Sanskrit	200	6
2.	II	English	200	6
3.	III	Core – Theory/Practical	2000	70
	-	SWAYAM-MOOC	-	2
	III	Allied Electives/Project	400 300	20 15
4.	IV	Basic Tamil / Advanced Tamil/Non-Major Electives	150	4
		Skill Based subject	300	9
		EDC	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Cocurricular Activities	50	1
Total			3800	140

- 50 % CIA is applicable to all subjects except EDC, JOC, and COP.
- The students should complete a **SWAYAM-MOOC** before the completion of the 5th semester and the course-completed certificate should be submitted through the HOD to the Controller of Examinations. Two credits will be given to the candidates who have successfully completed. In case the students have completed more than one online course, the appropriate 2 extra credits shall be awarded to such candidates upon the submission of certificate through the HOD to the Controller of Examinations.
- A **Field Trip** preferably relevant to the course should be undertaken every year.

Components of Continuous Internal Assessment (50 Marks)

Components		Marks	Total
Theory			
CIA I	75	(75+75) converted to 30	50
CIA II	75		
Problem based Assignment**		10	
Attendance		5	
Others*		5	
Practical			
CIA Practical		(50) converted to 30	50
Observation Notebook		15	
Attendance		5	
Project			
Review		45	50
Regularity		5	

Components of Continuous Internal Assessment (25 Marks)

Practical		
CIA Practical	(25) converted to 10	25
Observation Notebook	10	
Attendance	5	

* Class Participation, Case Studies Presentation, Field Work, Field Survey, Group Discussion, Term Paper, Workshop/Conference Participation. Presentation of Papers in Conferences, Quiz, Report/Content writing. Etc.

** Two Assignments to be given. (Each 5 marks).

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

(K1-Remembering; K2-Understanding; K3-Appling; K4-Analyzing; K5-Evaluating)

Theory Examination – Part I, II, III & IV (SBS only)

CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 20	A (Answer all)	20 x 1 = 20	MCQ-10/ Fill ups-5/ One word-5	75**
K2 – K5 Q21 to 28	B (5 out of 8)	5 x 5 = 25	Short Answers	
K2 – K5 Q29 to 33	C (3 out of 5)	3 x 10 = 30	Descriptive / Detailed	

** For ESE 75 marks converted to 50 marks.

ESE Practical Examination

Option 1:

Knowledge Level	Section	Marks	Total
K3	Experiments	45	50
K4		Record Work	
K5			

Knowledge Level	Section	Marks	Total
K3	Experiments	20	25
K4		Record Work	
K5			

ESE Project Viva Voce

Option 1:

Knowledge Level	Section	Marks	Total
K3	Project Report	35	50
K4		Viva voce	
K5			

Content

S.No	Title of the Paper	Page No
1	Core Paper 1: Programming in C	1
2	Core Practical 1: Programming Lab – C	3
3	Core Paper 2: Data Structures	5
4	Core Paper 3: Programming in C++	7
5	Core Practical 2: Programming Lab - C++	9
6	Core Practical 3 : Internet Basics Lab	12
7	Core Paper 4: Object Oriented Programming in Java	14
8	Core Practical 4: Object Oriented Programming in Java Laboratory	16
9	Core Practical 5: Data Manipulation Using Advanced Excel Laboratory	19
10	Core Paper 5: Big Data Science and Data Analytics	21
11	Allied Paper 3: Text and Predictive Analytics	23
12	Core Paper 6: Python Programming	25
13	Core Practical 6: Python Programming Laboratory	27
14	Core Paper 7: Relational Database Management System	30
15	Core Practical 7: Relational Database Management Systems Laboratory	32
16	Allied Paper 4: Web and Social Network Analytics	34
17	Core Paper 8: R Programming	37
18	Core Practical 8: R Programming Laboratory	39
19	Core Paper 9: Design and Analysis of Algorithms	42
20	Core Paper 10: Database Design and Management	44
21	Core Paper 11: Artificial Intelligence and its Applications	46
22	Core Practical 09: Artificial Intelligence and Machine Learning Laboratory	49
23	Core Paper 12: Machine Learning	52
24	Project & Viva voce	54
25	Major Elective: Internet of Things	56
26	Major Elective: Software Testing and Quality Assurance	58
27	Major Elective: Cloud Computing Fundamentals	60
28	Major Elective: Digital Forensics	62
29	Major Elective : Natural Language Processing	65
30	Major Elective : Deep Learning	67
31	Skill Based Subject 1: Cyber Security	70
32	Skill Based Subject 2: Web Design Laboratory	73
33	Skill based Subject 3: Ethical Hacking	76
34	Environmental Studies	79
35	Value Education – Moral Ethics	82
36	Non Major Elective 1: Human Rights	85
37	Non Major Elective 2: Women’s Rights	87
38	Non Major Elective 3: Consumer Affairs	89
39	EDC: Internet Basics and Advanced Excel Laboratory	93
40	Internship Training	95

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Paper 1: Programming in C			
Batch 2021-2022	Hours / Week 4/15	Total Hours 60	Credits 4

Course Objectives

1. To introduce the concepts of Procedure Oriented Programming and the various Programming constructs of C programming
2. To provide exposure to problem solving through programming and to develop programming skills.
3. To impart adequate knowledge of programming languages and problem solving techniques.

Course Outcomes (CO)

K1 to K5	CO1	Describe about the about the fundamentals of computers, history and various types of software and hardware devices.
	CO2	Interpret the concepts of Variables, Constant, Operators and various types of expressions.
	CO3	Apply the concept of Decision making statements and looping constructs for solving basic programs.
	CO4	Developing programs using pointer, enumerated data types, function, Union and nested structures.
	CO5	Designing programs using pointers and file concepts.

Syllabus**UNIT I****(12 Hours)**

Fundamentals of Computers : Introduction – History of Computers - Generations of Computers - Classification of Computers - Basic Anatomy of a Computer System - Input Devices - Processor - Output Devices - Memory Management – Types of Software - Overview of Operating System- Programming Languages - Translator Programs - Problem Solving Techniques - Overview of C.

UNIT II**(12 Hours)**

Overview of C - Introduction - Character set - C tokens - keyword & Identifiers - Constants - Variables - Data types - Declaration of variables - Assigning values to variables - Defining Symbolic Constants - Arithmetic, Relational, Logical, Assignment, Conditional, Bitwise, Special, Increment and Decrement operators - Arithmetic Expressions - Evaluation of expression - precedence of arithmetic operators - Type conversion in expression – operator precedence & associativity - Mathematical functions - Reading and Writing a character - Formatted input and output.

UNIT III**(12 Hours)**

Decision Making and Branching: Introduction – if, if...else, nesting of if...else statements - else if ladder- The switch statement -The?: Operator – The goto Statement. Decision Making and Looping: Introduction- The while statement - the do statement – The for statement - Jumps in loops. Arrays – Character Arrays and Strings.

UNIT IV**(12 Hours)**

User-Defined Functions: Introduction – Need and Elements of User-Defined Functions- Definition- Return Values and their types - Function Calls – Declarations – Category of Functions - Nesting of Functions - Recursion – Passing Arrays and Strings to Functions - The Scope, Visibility and Lifetime of Variables- Multi file Programs- **Structures and Unions***.

UNIT V**(12 Hours)**

Pointers: Introduction-Understanding pointers-Accessing the address of a variable-Declaration and Initialization of pointer Variable – Accessing a variable through its pointer-Chain of pointers- Pointer Expressions – Pointer Increments and Scale factor- Pointers and Arrays- Pointers and Strings – Array of pointers – Pointers as Function Arguments- Functions returning pointers – Pointers to Functions – Pointers and Structures. File Management in C.

* Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Smart Classroom / PowerPoint presentation / Seminar / Quiz / Discussion

Text Book

1. E Balagurusamy (2008), “Computing Fundamentals & C Programming” – Tata McGraw-Hill Education Pvt. Ltd.

Reference Books

1. Ashok N Kamthane (2002),”Programming with ANSI and Turbo C”, Pearson.
2. Henry Mullish& Herbert L Cooper, (1996), “The Spirit of C”,Jaico Publication House.
3. P.J.Deitel and H.M.Deitel,(2008),“C How to Program” ,5th Edition, Tata McGraw Hill
4. Yeswanth Kanethkar,(2007),”Let Us C”, Eighth Edition - BTB Publications

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Practical 1: Programming Lab - C			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2/15	30	2

Course Objectives

1. To introduce C Programming concepts to develop the programming knowledge.
2. To enhance their analyzing and problem solving skills and use the same for writing programs in C.
3. To guide the candidates to explore the fundamental building blocks in the programming language.

Course Outcomes (CO)

K3 to K5	CO1	Learning process helps in deep understanding the concepts of C language.
	CO2	Developing programs using control statements, Arrays and Strings.
	CO3	Apply the various basic programming constructs like structures, pointers and files
	CO4	Design programs using the concept of files in C and be able to simulate operations.
	CO5	Implementing the strings and files concepts.

LIST OF PRACTICAL PROGRAMS

1. Develop various C Programs using Control Structures.
2. Develop various C programs using Switch case.
3. Develop various C program for the implementation of looping.
4. Develop various C program for the implementation of looping & Control Structures.
5. Develop a C program to illustrate recursive function.
6. Develop a C program to find the palindrome in a given sentence.
7. Develop a C program to manipulate strings using string functions.
8. Develop a C Program using Functions.
9. Develop a C program to swap two integers using pointers.
10. Develop a C program using Array of Pointers.
11. Develop a C program using the structures.
12. Develop a C program using Array of Structures.
13. Develop a C program to calculate electricity bill using files.
14. Develop a C program to encrypt and decrypt a string.
15. Develop a C program to encrypt and decrypt files.

Text Book

1. E Balagurusamy (2008), "Computing Fundamentals & C Programming", Tata Mcgraw, Hill Education Pvt. Ltd.

Reference Books

1. Ashok N Kamthane (2002), "Programming with ANSI and Turbo C", Pearson.
2. Henry Mullish & Herbert L Cooper, (1996), "The Spirit of C", Jaico Publication House.
3. P.J.Deitel and H.M.Deitel, (2008), "C How to Program", 5th Edition, Tata McGraw Hill.
4. Yeswanth Kanethkar, (2007), "Let Us C", Eighth Edition - BTB Publications.

Teaching Methods

Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Assignment, Video Lectures

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:

Observation: 15 Marks

Attendance: 5 Marks

One Model Practical: 30 Marks.

MAPPING						
PSO \ CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	S	S	S	H	M	
CO2	S	S	M	H	H	
CO3	S	H	H	S	M	
CO4	H	S	M	H	M	
CO5	S	H	H	S	S	
S – Strong		H – High		M – Medium		L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Paper :2 Data Structures			
Batch 2021-2022	Hours / Week 4/15	Total Hours 60	Credits 4

Course Objectives

1. To introduce the concept of data structures and the types of data structures.
2. To demonstrate how various data structures can be implemented and used in various applications.
3. To study various algorithms of Sorting, Searching methods in Data structures.

Course Outcomes (CO)

K1 to K5	CO1	Define the concept of data structures and list the various classifications of data structures.
	CO2	Demonstrate how arrays, stacks, queues, lists, trees and graphs are represented in the main memory and various operations are performed on those data structures.
	CO3	Discover the real time applications of the various data structures.
	CO4	Design algorithms for various sorting and searching techniques.
	CO5	Analyzing file organizations and various indexing techniques.

Syllabus**UNIT I****(12 Hours)**

Introduction: Introduction of Algorithms, Analyzing Algorithms. Arrays: Sparse Matrices - Representation of Arrays. Stacks and Queues: Fundamentals - Evaluation of Expression Infix to Postfix Conversion - Multiple Stacks and Queues

UNIT II**(12 Hours)**

Linked List: Singly Linked List - Linked Stacks and Queues - Polynomial Addition - More on Linked Lists - Sparse Matrices - Doubly Linked List and Dynamic - Storage Management - Garbage Collection and Compaction.

UNIT III**(12 Hours)**

Trees: Basic Terminology - Binary Trees - Binary Tree Representations - Binary Trees - Traversal - More on Binary Trees - Threaded Binary Trees - Binary Tree Representation of Trees – Counting Binary Trees. Graphs: Terminology and Representations - Traversals, Connected Components and Spanning Trees, Shortest Paths and Transitive Closure

UNIT IV**(12 Hours)**

External Sorting: Storage Devices -Sorting with Disks: K-Way Merging - Sorting with Tapes Symbol Tables: Static Tree Tables - Dynamic Tree Tables - Hash Tables: Hashing Functions *- Overflow Handling.

UNIT V**(12 Hours)**

Internal Sorting: Insertion Sort - Quick Sort - 2 Way Merge Sort - Heap Sort - Shell Sort - Sorting on Several Keys. Files: Files, Queries and Sequential organizations - Index Techniques - File Organizations

* Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Chalk and Talk, Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Seminar, Quiz

Text Book

1. Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia Publication.

Reference Books

1. Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms, Galgotia Publication.
2. Ashok N Kamthane,(2004),“Programming and Data Structures”, First Edition, Pearson Education.
3. Alfred V.Aho, John E. Hopcroft,Jeffrey D.Ullman,(2008) – “Data Structures and algorithms”, Pearson Education.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	M	S	S
CO2	S	S	H	H	S
CO3	H	H	S	M	H
CO4	S	H	M	S	H
CO5	H	S	S	H	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Paper 3: Programming in C++			
Batch	Hours / Week	Total Hours	Credits
2021-2022	4/15	60	4

Course Objectives

1. To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of C++.
2. To develop an in-depth understanding of functional, logic, and object-oriented programming paradigms.
3. To program using more advanced OOP's features such as objects, operator overloading, dynamic memory allocation, inheritance and polymorphism, File I/O.

Course Outcomes (CO)

K1 to K5	CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and object.
	CO2	Demonstrate the various basic programming constructs like decision-making statements. Looping statements and functions.
	CO3	Explain the object oriented concepts like operator overloading, inheritance & virtual base classes.
	CO4	Implementing the concepts of pointers, virtual functions and polymorphism.
	CO5	Evaluating the usage of concepts of various file stream classes, file types, usage of templates and exception handling mechanisms.

Syllabus**UNIT I****(12 Hours)**

Introduction to C++ - Key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures: - Decision Making and Statements: If.. else, jump, goto, break, continue, switch case statements - Loops in C++ : for, while, do - functions in C++ - inline functions – Function Overloading.

UNIT II**(12 Hours)**

Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects – friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.

UNIT III**(12 Hours)**

Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchical, Hybrid, Multi path inheritance – Virtual base classes – Abstract Classes.

UNIT IV**(12Hours)**

Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object – Binding, Polymorphism and Virtual Functions*.

UNIT V**(12 Hours)**

Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - Strings – Declaring and Initializing string objects – String Attributes – Miscellaneous functions .

* Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Seminar, Quiz

Text Book

1. Ashok N Kamthane (2003),”Object-Oriented Programming with Ansi And Turbo C++”, Pearson Education.

Reference Books

1. E. Balagurusamy (1998),” Object-Oriented Programming with C++”, TMH.
2. Maria Litvin & Gray Litvin (2002)” C++ for you”, Vikas publication.
3. John R Hubbard (2002)”Programming with C”, 2nd Edition, TMH publication.

MAPPING

PSO \ CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	S
CO2	S	H	S	H	M
CO3	S	H	M	H	S
CO4	S	M	S	M	H
CO5	S	H	H	H	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Practical 2: Programming Lab - C++			
Batch 2021-2022	Hours / Week 4/15	Total Hours 60	Credits 2

Course Objectives

1. To introduce the concepts of Object Oriented Programming Paradigm and the Programming constructs of C++.
2. To develop the ability to write a program to solve specific problems.
3. To practice the fundamental methodology to implement file and I/O stream concepts.

Course Outcomes (CO)

K3 to K5	CO1	Designing programs using appropriate predefined functions and classes in C++.
	CO2	Developing applications using Friend functions, Inheritance and polymorphism.
	CO3	Illustrate the concept of virtual classes, inline functions and friend functions.
	CO4	Compare the various file stream classes, file types and exception handling mechanisms.
	CO5	Implementing stream I/O, Files and usage of the available classes to handle stream objects.

LIST OF PRACTICAL PROGRAMS

1. Write a C++ Program to create a class to implement the data structure STACK. Write a constructor to initialize the TOP of the STACK. Write a member function PUSH () to insert an element and member function POP () to delete an element check for overflow and underflow conditions.
2. Write a C++ Program to create a class ARITHMETIC which consists of a FLOAT and an INTEGER variable. Write member functions ADD (), SUB (), MUL (), DIV () to perform addition, subtraction, multiplication, division respectively. Write a member function to get and display values.
3. Write a C++ Program to read an integer number and find the sum of all the digits until it reduces to a single digit using constructors, destructors and inline member functions.
4. Write a C++ Program to create a class FLOAT that contains one float data member. Overload all the four Arithmetic operators so that they operate on the object FLOAT.
5. Write a C++ Program to create a class STRING. Write a Member Function to initialize, get and display strings. Overload the operators ++ and == to concatenate two Strings and to compare two strings respectively.
6. Write a C++ Program to create class, which consists of EMPLOYEE Detail like E_Number, E_Name, Department, Basic, Salary, and Grade. Write a member function to get and display them. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade.

7. Write a C++ Program to create a class SHAPE which consists of two VIRTUAL FUNCTIONS Calculate_Area() and Calculate_Perimeter() to calculate area and perimeter of various figures. Derive three classes SQUARE, RECTANGLE, TRIANGE from class Shape and Calculate Area and Perimeter of each class separately and display the result.
8. Write a C++ Program to create two classes each class consists of two private variables, a integer and a float variable. Write member functions to get and display them. Write a FRIEND Function common to both classes, which takes the object of above two classes as arguments and the integer, float values of both objects separately, and display the result.
9. Write a C++ Program using Function Overloading to read two Matrices of different Data Types such as integers and floating point numbers. Find out the sum of the above two matrices separately and display the sum of these arrays individually.
10. Write a C++ Program to check whether the given string is a palindrome or not using Pointers.
11. Write a C++ Program to create a File and to display the contents of that file with line numbers.
12. Write a C++ Program to merge two files into a single file.

Text Book

1. Ashok N Kamthane (2003), "Object-Oriented Programming with Ansi And Turbo C++", Pearson Education.

Reference Books

1. E. Balagurusamy (1998), "Object-Oriented Programming with C++", TMH.
2. Maria Litvin & Gray Litvin (2002) "C++ for you", Vikas publication.
3. John R Hubbard (2002) "Programming with C", 2nd Edition, TMH publication.

Teaching Methods

Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Assignment, Video Lectures

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:**Observation:** 15 Marks**Attendance:** 5Marks**One Model Practical:** 30 Marks.

MAPPING						
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	S	S	S	H	M	
CO2	S	S	M	H	H	
CO3	S	H	H	S	M	
CO4	H	S	M	H	M	
CO5	S	H	H	S	S	
S – Strong		H – High		M – Medium		L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Practical 3 : Internet Basics Lab			
Batch 2021-2022	Hours / Week 2/15	Total Hours 30	Credits 2

Course Objectives

1. Introduce the fundamentals of Internet and the Web functions.
2. Impart knowledge and essential skills necessary to use the internet and its various components.
3. Find, evaluate, and use online information resources.
4. Use Google Apps for education effectively.

Course Outcomes (CO)

K3 to K5	CO1	Understand features of Internet and email
	CO2	Apply the predefined procedures to create Gmail account, check and receive messages
	CO3	Apply the predefined procedures to perform various basic operations on internet
	CO4	Utilize various google applications like docs, google classroom, google drive, google forms, google meet.
	CO5	Design various google applications like google sheets and slides.

LIST OF PRACTICAL PROGRAMS

1. Create an email account in Gmail. Using the account created compose a mail to invite other college students for your college fest, enclose the invitation as attachment and send the mail to at least 50 recipients. Use CC and BCC options accordingly.
2. Open your inbox in the Gmail account created, check the mail received from your peer from other college inviting you for his college fest, and download the invitation. Reply to the mail with a thank you note for the invite and forward the mail to other friends.
3. Assume that you are studying in final year of your graduation and are eagerly looking for a job. Visit any job portal and upload your resume.
4. Create a meeting using Google calendar and share meeting id to the attendees. Transfer the ownership to the Manager once the meeting id is generated.
5. Create a label and upload bulk contacts using import option in Google Contacts.
6. Create your own Google classroom and invite all your friends through email id. Post study material in Google classroom using Google drive. Create a separate folder for every subject and upload all unit wise E-Content Materials.
7. Create and share a folder in Google Drive using „share a link“ option and set the permission to access that folder by your friends only.

8. Create one-page story in your mother tongue by using voice recognition facility of Google Docs.
9. Create a registration form for your Department Seminar or Conference using Google Forms.
10. Create a question paper with multiple-choice types of questions for a subject of your choice, using Google Forms.
11. Create a meet using Google Calendar and record the meet using Google Meet.
12. Create a Google slides for a topic and share the same with your friends
13. Create template for a seminar certificate using Google Slides.
14. Create a sheet to illustrate simple mathematical calculations using Google Sheets.
15. Create student's internal mark statement and share the Google sheets via link.

Teaching Methods

Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Assignment, Video Lectures

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 25 Marks)

1. Record Work – 05 Marks
2. Program, Typing and Execution: 20 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing		
Typing and Execution	5	5

MAPPING						
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	S	S	S	H	M	
CO2	S	S	M	H	H	
CO3	S	H	H	S	M	
CO4	H	S	M	H	M	
CO5	S	H	H	S	S	
S – Strong		H – High		M – Medium		L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 4: Object Oriented Programming in Java			
Batch 2021 – 2022	Hours / Week 6/15	Total Hours 90	Credits 4

Course Objectives

1. To understand Object Oriented Programming concepts and basic characteristics of Java
2. To know the principles of packages, inheritance and interfaces
3. To define exceptions and use I/O streams
4. To develop a java application with threads and generics classes
5. To design and build simple Graphical User Interfaces

Course Outcomes (CO)

K1 to K5	CO1	Develop Java programs using OOP principles
	CO2	Develop Java programs with the concepts inheritance and interfaces
	CO3	Build Java applications using exceptions and I/O streams
	CO4	Develop Java applications with threads and generics classes
	CO5	Develop interactive Java programs using swings

Syllabus**Unit I****(18 Hours)**

Introduction to Object Oriented Paradigm – Basic Concepts of Object Oriented Programming Java – Benefits of Object Oriented Programming – Application of Object Oriented Programming-Characteristics of Java – The Java Environment - Java Syntax - Java Comments -Java Variables -Java Data Types -Java Type Casting -Java Operators -Java Strings - Java String function - Java Math function - Java Booleans.

Unit II**(18 Hours)**

Java If...Else - Java Switch - Java While Loop Java For Loop -Java Break/Continue - Java Arrays - Java Methods -Java Method Parameters -Java Method Overloading -Java Scope -Java Recursion- Java Classes/Objects -Java - Class Attributes -Java Class Methods -Java Constructors -Java Modifiers -Java Encapsulation -Java Packages / API -Java Inheritance -Java Polymorphism -Java Inner Classes -Java Abstraction -Java Interface- Java User Input.

Unit III**(18 Hours)**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Java File Handling - Java Files -Java Create/Write Files -Java Read Files -Java Delete Files

Unit IV**(18 Hours)**

Differences between multi-threading and multitasking, ***thread life cycle**, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. *Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

Unit V**(18Hours)**

Graphics programming – ***Applet Programming**- AWT Classes - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - *AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

*** Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Herbert Schildt (2011),“Java The complete reference”, 8th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary Cornell, (2013),“Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall.

Reference Books

1. Patrick Naughton & Hebert Schildt (1999), “The Complete Reference Java 2” 3rd Edition, TMH.
2. Paul Deitel, Harvey Deitel (2015), “Java SE 8 for programmers”, 3rd Edition, Pearson.
3. Steven Holzner (2011), “Java 2 Black book”, Dream tech press.
4. E. Balagurusamy (2007),”Programming with Java – A Primer”,3rd Edition, TMH.

MAPPING

PSO \ CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Practical 4: Object Oriented Programming in Java Laboratory			
Batch	Hours / Week	Total Hours	Credits
2021-2022	6/15	90	3

Course Objectives

1. To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of JAVA.
2. To implement the Java language syntax and semantics.
3. To develop Java program using packages, inheritance and interface
4. To implement concepts such as variables, conditional and iterative execution methods.
5. To develop graphical User Interface using AWT.
6. Demonstrate event-handling mechanism.

Course Outcomes (CO)

K3 to K5	CO1	Applying the concepts of operators, control structures, inheritance, method overriding in Java.
	CO2	Implementing the concept of interface, packages, multithreading and applets.
	CO3	Apply the various basic programming constructs of JAVA like decision-making statements. Looping statements, overloading, inheritance, polymorphism, constructors and destructors.
	CO4	Design programs using frames, menubars, list boxes
	CO5	Evaluate programs using various file stream classes; file types, and frames.

LIST OF PRACTICAL PROGRAMS

1. Write a program to print "Hello World" on the screen and receive input from the user and Display a Given string on the Screen.
2. Java Program to perform various Arithmetic Operations on two Integer given by the User
3. Java Program to Check Whether an Alphabet is Vowel or Consonant
4. Java Program to Find the Largest Among Three Numbers
5. Java Program to Calculate Average Using Arrays
6. Java Program to Reverse a Sentence Using Recursion
7. Java Program to Sort Elements in Lexicographical Order (Dictionary Order)

8. Write a Java Applications to perform single inheritance
9. Write a Java Applications to extract a portion of a character string and print the extracted string.
10. Write a Java Program to implement the concept of multiple inheritance using Interfaces.
11. Write a Java Program to create an Exception called payout-of-bounds and throw the exception.
12. Write a Java Program to create a frame with four-text field's name, street, city and pin code with suitable tables. Also, add a button called my details. When the button is clicked, its corresponding values are to be appeared in the text fields.
13. Write a Java Program to create a frame with three text fields for name, age and qualification and a text field for multiple line for address.
14. Write a Java Program to create Menu Bars and pull down menus.
15. Write a Java Program, which open an existing file and append text to that file and display

Text Books

1. Herbert Schildt (2011), "Java The complete reference", 8th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary cornell, (2013), "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall.

Reference Books

1. Patrick Naughton & Hebert Schildt(1999), "The Complete Reference Java 2" 3rd Edition, TMH.
2. Paul Deitel, Harvey Deitel(2015), "Java SE 8 for programmers", 3rd Edition, Pearson.
3. Steven Holzner(2011), "Java 2 Black book", Dream tech press.
4. E. Balagurusamy (2007), "Programming with Java – A Primer", 3rd Edition, TMH.

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:**Observation:** 15 Marks**Attendance:** 5Marks**One Model Practical:** 30 Marks.

MAPPING					
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong		H – High		M – Medium	
				L – Low	

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Core Practical 5:Data Manipulation Using Advanced Excel Laboratory			
Batch	Hours / Week	Total Hours	Credits
2021-2022	3/15	45	2

Course Objectives

Provide high level of understanding and practical hands on experience using basic and advanced Excel capabilities, from standard usage, cell formatting, function, charts, and pivot tables and up to the basic usage of Macros.

Course Outcomes (CO)

K3 to K5	CO1	Microsoft Excel provides you with the ability to easily search and filter the required information
	CO2	Uses effective tips, techniques and formulas to the individuals that will effectively help them to make the best use of Excel in their organization.
	CO3	Acquiring in-depth knowledge of working with Microsoft Excel functions and formulas will enable us to use Excel efficiently in their daily work life
	CO4	Using advanced formulas to crunch data and analyse it to get simpler answers. Automating repetitive task
	CO5	Interpretation and Analysis of Data and Visual Reporting

LIST OF PRACTICAL PROGRAMS

1. Perform the following basic operations in Worksheet, Row, Column Moving on Worksheet, Enter Data, Select Data, Delete Data ,Move Data, Copy Paste Data, Spell Check ,Insert Symbols
2. Perform the various Excel Fill Handle in Excel
3. Create a Excel program to Perform various Arithmetic Operations
4. Create a Excel program to Perform Data Validation in Excel like Filters, Grouping, Sorting
5. Create an Excel program to Perform Various Excel Formulas.
6. Create a Excel program to Perform Various built in functions in Excel
7. To Perform IF and Nested Functions in Excel
8. To Perform AND, OR & NOT Logical
9. Create Sheet and Charts in Excel to analysis Student Mark of your Class
10. Import XML to Excel File and do basic Operations
11. To perform Excel VLOOKUP basic Operations
12. Find and Remove duplicates value in Excel

13. To perform Excel to add or remove Hyperlink in Excel of Multiple Sheets
14. Use different Freeze panes in Excel
15. To Perform Mail merge from Excel to Word
16. To Perform Various Separate text Operations in Excel
17. To compute various Excel Substring formula
18. To compute add/remove Password from Excel
19. To compute Convert Columns to Rows in Excel
20. To perform various Conditional formatting in Excel

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 25 Marks)

1. Record Work – 05 Marks
2. Program, Typing and Execution: 20 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing		
Typing and Execution	5	5

Internal Mark Split-up for 25 Marks:

Observation- 05 Marks

Attendance- 5 Marks and

One Model Practical-15 Marks.

MAPPING					
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong H – High M – Medium L – Low					

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper: Core Paper 5: Big Data Science and Data Analytics			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 4

Course Objectives

1. To optimize business decisions and create competitive advantage with Big Data analytics
2. To explore the fundamental concepts of big data analytics
3. To learn to analyze the big data using intelligent techniques.
4. To understand the various search methods and visualization techniques.
5. To learn to use various techniques for mining data stream.
6. To understand the applications using Map Reduce Concepts.
7. To introduce programming tools PIG & HIVE in Hadoop ecosystem

Course Outcomes (CO)

K1 to K5	CO1	Work with big data platform and explore the big data analytics techniques business applications.
	CO2	Design efficient algorithms for mining the data from large volumes.
	CO3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
	CO4	Explore on Big Data applications Using Pig and Hive.
	CO5	Understand the fundamentals of various big data analytics technique

Syllabus**UNIT-I****(15 Hours)**

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting. Data Science Components: Data Engineering, Data Analytics-Methods and Algorithm, Data Visualization – Evolution of Big Data - Sources of Big Data. Characteristics of Big Data - 6Vs in Big Data.

UNIT-II**(15 Hours)**

Mining data streams: Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform Application - Real Time Sentiment Analysis- Stock Market Predictions. Sources of Data: Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data – Data Evolution – Data Sources Data Science: Data Science-A Discipline – Data Science vs Statistics – Data Analytics Relation: Data Science, Analytics, Big Data Analytics

UNIT-III**(15 Hours)**

History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works- * Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features Hadoop environment.

UNIT-IV**(15 Hours)**

Frameworks: Applications on Big Data Using Pig and Hive – * **Data processing operators in Pig** – Hive services – Hive SQL – Querying Data in Hive - fundamentals of H-Base and Zookeeper - IBM Info sphere Big Insights and Streams.

UNIT-V**(15 Hours)**

Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications. Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.

* **Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Michael Berthold, David J. Hand (2007) “Intelligent Data Analysis”, Springer.
2. Tom White (2012) “Hadoop: The Definitive Guide” Third Edition, O’reilly Media.
3. Seema Acharya, SubhasiniChellappan (2015)"Big Data Analytics" Wiley.

Reference Books

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos(2012), “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw-Hill Publishing.
2. Bill Franks, (2012)“Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley& Sons.
3. Glenn J. Myatt (2007) “Making Sense of Data”, John Wiley & Sons.
4. Da Ruan, Guoqing Chen, Etienne E.Kerre, Geert Wets, (2007)“Intelligent Data Mining”, Springer.
5. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan,(2012) “Harness the Power of Big Data The IBM Big Data Platform”, Tata McGraw Hill Publications.
6. ArshdeepBahga, Vijay Madiseti, (2016) “Big Data Science & Analytics: A Hands On Approach “, VPT.
7. Bart Baesens(2014)“Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons.

MAPPING

PSO \ CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper: Allied Paper 3: Text and Predictive Analytics			
Batch 2021– 2022	Hours / Week 6/15	Total Hours 90	Credits 5

Course Objectives

1. To provide an overview of common text mining and social media data analytic activities.
2. To understand the complexities of processing text and network data from different data sources.
3. It introduces theoretical foundations, algorithms, methodologies, and Applications of streaming data and provide practical knowledge for handling and analyzing streaming data
4. It introduces theoretical foundations, algorithms, methodologies for analyzing data in various domains such Retail, Finance, Risk and Healthcare.
5. To optimize business decisions and create competitive advantage with text and Predictive Data analytics

Course Outcomes (CO)

K1 to K5	CO1	Work with data application platform Text and Predictive analytics techniques. Interpret the terminologies, metaphors and perspectives of social media analytics.
	CO2	Apply a wide range of classification, clustering, estimation and prediction algorithms on Textual data.
	CO3	Recognize challenges in dealing with data sets in domains such as finance, risk and healthcare.
	CO4	Identify real-world applications of machine learning in domains such as finance, risk and healthcare.
	CO5	Having an ability to design and conduct experiments, as well as to analyze and interpret data

Syllabus**UNIT –I****(18 Hours)**

Introduction to Text Mining: Text Representation- tokenization, stemming, stop words, TF-IDF, Feature Vector Representation, NER, N-gram modeling. Mining Textual Data: Text Clustering, Text Classification, Topic Modeling-LDA, HDP. Recent Trends in Text, Web and Social Media Analytics. Characteristics of the data streams, Challenges in mining data streams Requirements and principles for real time processing, Concept drift Incremental learning.

UNIT –II**(18 Hours)**

Basic Streaming Methods, Counting the Number of Occurrence of the Elements in a Stream, Counting the Number of Distinct Values in a Stream, Bounds of Random Variables, Poisson Processes, Maintaining Simple Statistics from Data Streams, Sliding Windows, Data Synopsis, Change Detection: Tracking Drifting Concepts, Monitoring the Learning Process

UNIT –III**(18 Hours)**

Retail Analytics: Understanding Customer: Profiling and Segmentation, Modelling Churn. Modelling Lifetime Value, Modelling Risk, Market Basket Analysis - Risk Analytics: Risk Management and Operational Hedging: An Overview, Supply Chain Risk Management, A Bayesian Framework for Supply Chain Risk Management, Credit Scoring and Bankruptcy Prediction- Financial Data Analytics: Financial News analytics: Framework, techniques, and metrics, News events impact market sentiment, relating news analytics to stock returns.

UNIT –IV**(18 Hours)**

Financial Time Series Analytics: Financial Time Series and Their Characteristics, Common Financial Time Series models, Autoregressive models, Markov chain models, Time series models with leading indicators, Long term forecasting- Introduction Healthcare Analytics: An Introduction to Healthcare Data Analytics, Electronic Health Records, Privacy-Preserving Data Publishing Methods in Healthcare, Clinical Decision Support Systems.

UNIT –V**(18 Hours)**

Healthcare Data Analytics: Natural Language Processing and Data Mining for Clinical Text: Core NLP Components, ***Information Extraction and Named Entity Recognition**, Social Media Analytics for Healthcare: Tracking of Infectious Disease Outbreaks, Readmission risk Prediction. Genomic Data Analytics: Microarray Data, Microarray Data Analysis, Genomic Data Analysis for Personalized Medicine, Patient Survival Prediction from Gene Expression Data, Genome Sequence Analysis

* **Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Method

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. BingLiu, (2011),“Web Data Mining Exploring Hyperlinks ,Contents, and Usage Data”, Springer, Second Edition.
2. Reza Zafarani, Mohammad Ali Abbasi and HuanLiu, (2014)“Social Media Mining-An Introduction”, Cambridge University Press.
3. Bing Liu, (2012) “Sentiment Analysis and Opinion Mining”, Morgan & Claypool Publishers.
4. Nitin Indurkha, FredJDamerau, (2010)“Handbook of Natural Language Process”, 2ndEdition,CRC Press.

Reference Books

1. Matthew A. Russell, (2013) “Mining the social web”, 2nd edition- O'Reilly Media.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman,(2009)”The Elements of Statistical Learning- Data Mining, Inference, and Prediction”,Second Edition , Springer Verlag.
3. Joao Gama, (2010) “Knowledge Discovery from Data Streams”, CRC Press.
4. David Luckham, (2002)“The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems”, Addison Wesley.
5. Charu C. Aggarwal, (2007) “Data Streams: Models and Algorithms”, Kluwer Academic Publishers.
6. James B. Ayersm, (2006) “Handbook Of Supply Chain Management” Auerbach Publications.
7. PanosKouvelis, Lingxiu Dong, OnurBoyabatli, Rong Li, (2012) "The Handbook of Integrated Risk Management in Global Supply Chains", Wiley.
8. Chris Chapman, Elea McDonnell Feit,(2015) "R for Marketing Research and Analytics", Springer.
9. Olivia Parr Rud, (2001) “Data Mining Cookbook: Modeling Data for Marketing, Risk, and Customer Relationship Management”, Wiley.
10. Chandan K. Reddy, Charu C. Aggarwal ,(2015) "Healthcare Data Analytics", CRC Press.
11. Rene Carmona, (2014) "Statistical Analysis of Financial Data in R", Springer.
12. PanosKouvelis, Lingxiu Dong, OnurBoyabatli, Rong Li,(2012) "The Handbook of Integrated Risk Management in Global Supply Chains", Wiley.

MAPPING

PSO \ CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 6: Python Programming			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 4

Course Objectives

1. To acquire programming skills in core Python and to learn and understand Python programming basics and paradigm
2. To Learn core Python scripting elements such as variables and flow control structures
3. To learn and understand python looping, control statements and string manipulations.
4. To learn how to use exception handling in Python applications for error handling.
5. To use Python data structures, lists, tuples, dictionaries.
6. To do input/output with files in Python.

Course Outcomes (CO)

K1 to K5	CO1	Develop algorithmic solutions to simple computational problems and Read, write, execute by hand simple Python programs
	CO2	Structure simple Python programs for solving problems
	CO3	Decompose a Python program into functions and Discover how to work with lists and sequence data
	CO4	Represent compound data using Python lists, tuples, dictionaries
	CO5	Read and write data from/to files in Python Programs.

Syllabus**Unit I****(15 Hours)**

Computer Hardware Architecture - Overview of Programming Languages - Overview of Programming Languages - Introduction to Python - Python Overview – Comments in Python - Python Identifiers - Reserved Keywords – Variables - Standard Data Types - Python Casting.

Unit II**(15 Hours)**

Python Operators – Types of Operators - Statement and Expressions - String Operations: Creating String in Python - Strings indexing and splitting - Reassigning Strings- Deleting the String - String Operators - Multiline Strings- Built-in String Methods-Boolean Expressions – Python List – Various List Operation – Loop List - List Methods.

Unit III**(15 Hours)**

Python Tuples – Various Tuples Operations – Loop Tuples -Tuple Methods – Python Set – Various Set Operations – Loop Set – Set Methods – Python Dictionaries – Various Dictionaries Operations –Nested Dictionaries – Dictionary Methods - Python Dates- Python Conditions and Python IF Statement- Python IF ELIF ELSE Statements - Python nested IF statements- The pass Statement.

Unit IV**(15 Hours)**

Python Loops - Python while Loop Statements-Infinite Loop- for Loop Statements- Iterating by Sequence Index - Python nested loops- Python Numbers- Mathematical Functions- Random Number Functions- Python Functions - Calling a Function - Pass by reference vs value - Function Arguments - The return Statement -Python Lambda functions.

Unit V**(15 Hours)**

Scope of Variables - Local Scope- Global Scope- Python Exceptions Handling - Assertions in Python - Handling an exception - Python String Formatting - Python User Input- Python Files I/O - File Handling- File Open- Read Only Parts of the File- Read Lines- Close Files- Python File Write- Create a New File -Delete File- Delete Folder- Python Matplotlib.

* Denotes Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Allen B. Downey, (2016) “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, (<http://greenteapress.com/wp/think/python/>) .
2. Guido van Rossum and Fred L. Drake Jr,(2011) “An Introduction to Python – Revised and updated for Python 3.2”, Network Theory Ltd.

Reference Books

1. John V Guttag, (2013) “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, (2016) “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.
3. Timothy A. Budd, (2015) “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.
4. Kenneth A. Lambert, (2012) “Fundamentals of Python: First Programs”, CENGAGE Learning.
5. Charles Dierbach, (2013) “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition.
6. Paul Gries, Jennifer Campbell and Jason Montojo, (2013) “Practical Programming: An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers, LLC.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Practical 6: Python Programming Laboratory			
Batch 2021-2022	Hours / Week 5/15	Total Hours 75	Credits 2

Course Objectives

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Read and write data from/to files in Python.
6. Learn Syntax and Semantics and create Functions in Python

Course Outcomes (CO)

K3 to K5	CO1	To develop proficiency in creating based applications using the Python Programming Language.
	CO2	To be able to understand the various data structures available in Python programming language and apply them in solving computational problems.
	CO3	To be able to do testing and debugging of code written in Python and To be able to draw various kinds of plots using PyLab.
	CO4	To be able to do text filtering with regular expressions in Python
	CO5	To be able to create socket applications in Python and to create GUI applications in Python

LIST OF PRACTICAL PROGRAMS

1. Develop programs to understand the control structures of python
2. Find the maximum of a list of numbers
3. Develop programs to learn different types of structures (list, dictionary, tuples) in python
4. Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)
5. Write a python program to implement List methods (Add, Append, Extend & Delete)
6. Develop programs to understand working of exception handling and assertions.
7. Develop programs for data structure algorithms using python – searching, sorting and hash tables.
8. Develop programs to learn regular expressions using python.
9. Develop chat room application using multithreading.
10. Write a python program to implement simple Chabot with minimum 10 conversations

11. Write a python program to plot different types of graphs using PyPlot.
12. Implement classical ciphers using python.
13. Draw graphics using Turtle.
14. Develop programs to learn GUI programming using Tkinter.
15. Find the most frequent words in a text read from a file

Text Books

1. Allen B. Downey, (2016) “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python-3, Shroff/O’Reilly Publishers, (<http://greenteapress.com/wp/think/python/>).
2. Guido van Rossum and Fred L. Drake Jr,(2011) “An Introduction to Python – Revised and updated for Python 3.2”, Network Theory Ltd.

Reference Books

1. John V Guttag, (2013) “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, (2016) “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.
3. Timothy A. Budd, (2015) “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.
4. Kenneth A. Lambert, (2012) “Fundamentals of Python: First Programs”, CENGAGE Learning.
5. Charles Dierbach, (2013) “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition.
6. Paul Gries, Jennifer Campbell and Jason Montojo, (2013) “Practical Programming: An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers, LLC.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:**Observation:** 15 Marks**Attendance:** 5Marks**One Model Practical:** 30 Marks.

MAPPING					
PSO					
CO \	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong		H – High		M – Medium	
				L – Low	

Programme Code : 23	B. Sc Computer Science with Data Analytics		
Title of the paper: Core Paper 7: Relational Database Management System			
Batch 2021-2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To develop the knowledge in various Database concepts, queries, normalization and reports.
2. To study the basics of PL/SQL and apply with different concepts.
3. To learn procedural interfaces using SQL queries and to gain knowledge about databases.
4. To Describe stored procedures and functions
5. Use PL/SQL programming constructs and conditionally control code flow (loops, control structures, and explicit cursors)

Course Outcomes (CO)

K1 to K5	CO1	Understanding the concepts of Database and RDBMS and applying types of SQL commands.
	CO2	Understanding the concepts of Normalization and ER Models.
	CO3	Analyzing Queries, joins, triggers, synonym and views using PL/SQL statements.
	CO4	Applying various types of database management systems for developing the program.
	CO5	Analyzing types of Databases.

Syllabus**UNIT I****(15 Hours)**

Introduction to Database Management Systems: Introduction-History of Information-Quality of Information-Information Processing-Database-Characteristics of data in database-DBMS-types of DBMS. Relational Database Management systems (RDBMS)-RDBMS Terminology-Relational Data Structure-Relational Data Integrity-Relational Data Manipulation-Codd's Rules. History of SQL-Characteristics of SQL-Types of SQL commands-DDL-DML-DQL-DCL-DAS-TCS. Arithmetic, Comparison and Logical Operators

UNIT II**(15 Hours)**

Data Normalization: 1NF, 2NF, 3NF, BCNF and 4NF. ER Modeling: Introduction- Components of ER Model-.ER Diagrams. Relational Data Integrity and Database Constraints-Transforming ER Models to relations-Foreign Keys-Mapping ER Model-Mapping Relationships- Aggregate Functions

UNIT III**(15 Hours)**

Queries and Sub queries- Joins: Theta joins- Equijoins and Non-equi joins-Where clause-Natural Joins-Self Join.

UNIT IV**(15 Hours)**

Basics of PL/SQL –Usage of Stored Functions and Procedures- Packages. Exception handling. Triggers-Types of Triggers-Combination of Triggers-Replacing and Dropping Triggers-Views-Synonyms.

UNIT V**(15 Hours)**

Introduction to Modern Databases: Distributes Database-Object Oriented DB-Object Relational DB-Active DB-Deductive DB-Multidimensional DB-Parallel DB-Temporal DB-Spatial DB-Multimedia DB-Web DB. Distributed DB-Components of distributed DB. SQL Database and *NoSQL Database.

* Denotes Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Alexis Leon, Mathews Leon, (2009) “ Fundamentals of Database Management Systems”, Vijay Nicole Pvt Ltd.
2. Alexis Leon, Mathews Leon, (1999) “ SQL A Complete Reference”, Tata McGraw Hill Publications.
3. Scot Urman, Ron Hardman, Michael McLaughlin, (2004) “Oracle Database 10g -PL/SQL Programming”, Tata McGraw Hill Publications.

Reference Books

1. Arun Majumdar and Pritimoy Bhattacharya, (2007), “Database Management System” TMH.

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code : 23	B. Sc Computer Science with Data Analytics		
Title of the Paper : Core Practical 7: Relational Database Management Systems Laboratory			
Batch 2021-2022	Hours / Week 5/15	Total Hours 75	Credits 2

Course Objectives

1. To understand the use of Structured Query Language (SQL) and its syntax.
2. To understand and apply the principles of data modeling using Entity Relationship and develop a good database design.
3. To study the concepts and techniques relating query processing using SQL engines.

Course Outcomes (CO)

K3 to K5	CO1	Designing the basic concepts of Database.
	CO2	Implementing data Integrity constraints in Database.
	CO3	Validating the various fundamental tasks to perform data Modeling.
	CO4	Implementing functions, packages, stored procedures and user defined exception.
	CO5	Applying various types of database management systems for developing the program.

LIST OF PRACTICAL PROGRAMS

1. Creating Tables and writing simple queries using
 - a) Comparison Operators
 - b) Arithmetic Operators
 - c) Set Operators
2. Use SQL commands to implement the concept of built in functions.
3. Implement the concept of Updating and altering tables using SQL Queries.
4. Design a PL/SQL block to prepare the Electricity Bill.
5. Implement the concepts of Joined relations to Database.
6. Create a Database Trigger to check the data validity of Record.
7. Implement the concept of Recursive function
8. Use SQL queries to manage Views, Sequences and Synonyms.
9. Create a Database Trigger to implement the Master - Detail Relationship.
10. Implement the concept of Stored Procedure with Parameters using SQL queries.
11. Implement the concept of Packages using Procedure and Function.
12. Design a PL/SQL program to handle User defined exception

Text Books

1. Alexis Leon, Mathews Leon, (2009) “ Fundamentals of Database Management Systems”, Vijay Nicole Pvt Ltd.
2. Alexis Leon, Mathews Leon, (1999) “ SQL A Complete Reference”, Tata McGraw Hill Publications.
3. Scot Urman, Ron Hardman, Michael McLaughlin, (2004) “Oracle Database 10g -PL/SQL Programming”, Tata McGraw Hill Publications.

Reference Books

1. Arun Majumdar & Pritimoy Bhattacharya, (2007), “Database Management System” TMH.
2. Sharad Maheshwari & Ruchin Jain, (2006), “Database Management Systems” Complete Practical Approach”, Second Edition.
3. Gerardus Blokdyk, (2020) “RDBMS Relational Database Management System A Complete Guide”, Second Edition.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/ Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:

Observation: 15 Marks

Attendance: 5 Marks

One Model Practical: 30 Marks.

MAPPING					
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong		H – High		M – Medium	
				L – Low	

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper: Allied Paper 4: Web and Social Network Analytics			
Batch 2021 – 2022	Hours / Week 6/15	Total Hours 90	Credits 5

Course Objectives

1. To optimize business decisions and create competitive advantage with web and social network Data analytics
2. To provide an overview of common text mining and social media data analytic activities.
3. To learn to analyze the data using intelligent techniques.
4. To understand the various search methods and visualization techniques for web and social network analytics.
5. To learn to use various techniques for data Analytics stream.
6. To Provide solutions to the emerging problems with social media such as behavior analytics and Recommendation systems.

Course Outcomes (CO)

K1 to K5	CO1	Familiarize the learners with the concept of social media analytics and understand its significance
	CO2	Familiarize the learners with the tools of social media analytics.
	CO3	Analyze technologies associated with big data with web and social networks analytics.
	CO4	Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes
	CO5	Apply state of the art web mining tools and libraries on realistic data sets as a basis for business decisions and applications.

Syllabus**UNIT I****(18 Hours)**

Introduction: Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations. Data Collection: Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

UNIT II**(18 Hours)**

Qualitative Analysis: Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys. Web Analytic fundamentals: Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues.

UNIT III

Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non-e-commerce sites): Improving bounce rates, Optimizing ad words campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.

UNIT IV

(18 Hours)

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization. Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. *Natural Language Processing Techniques for Micro-text Analysis.

UNIT V

(18 Hours)

Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites) Google Analytics: Brief introduction and working, Adwords, Benchmarking, and Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues. Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration.

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Matthew Ganis, AvinashKohirkar, (2016) “Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media” Pearson.
2. Jim Sterne, (2010) Social Media Metrics: “How to Measure and Optimize Your Marketing Investment”, Wiley, Latest edition.
3. Oliver Blanchard,(2011) Social Media ROI: “Managing and Measuring Social Media Efforts in Your Organization” (Que Biz-Tech), Que Publishing, Latest edition.

Reference Books

1. Marshall Sponder, (2011)“ Social Media Analytics”, McGraw Hill, Latest edition.
2. Tracy L. Tuten, Michael R. Solomon, (2017)“Social Media Marketing”, Sage, Latest edition.
3. Clifton B., (2012),“Advanced Web Metrics with Google Analytics”, Wiley Publishing, Inc. 2nd edition.
4. Kaushik A., (2009)“Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity”, Wiley Publishing, Inc. 1st edition.
5. Sterne J., (2002)“Web Metrics: Proven methods for measuring web site success”, John Wiley and Sons.

6. Michael Beasley, (2013) “Practical Web Analytics for User Experience: How Analytics can help you Understand your Users”, Morgan Kaufmann.
7. Bing Liu, (2011) “Web Data Mining: Exploring Hyperlinks, Content, and Usage Data”, 2nd Edition, Springer.
8. Justin Cutroni, (2016) “Google Analytics”, O’Reilly, 2010. 6. Eric Fettman, Shiraz Asif, FerasAlhlou , “Google Analytics Breakthrough”, John Wiley & sons.

MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 8: R Programming			
Batch 2021 – 2022	Hours / Week 6/15	Total Hours 90	Credits 4

Course Objectives:

1. To expose the student to learn the fundamental concepts of R Programming
2. This course is to equip the students to visualize and analyses the data using R and to communicate statistical results in correct manner.

Course Outcomes (CO)

K1 to K5	CO1	Establish an efficient scientific computing environment
	CO2	Understand the basics in R programming in terms of constructs, control statements, string functions
	CO3	Create reports using R design and write efficient programs using R (and similar high-level languages) to perform routine and specialized data manipulation/management and analysis tasks
	CO4	Document analytical workflow using R, markdown languages, and version control
	CO5	Apply probability and statistics in real life problems and Draw scientific inference from data using R

Syllabus**Unit I****(18Hours)**

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names

Unit II**(18 Hours)**

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

Unit III**(18 Hours)**

Creating Data Frames – Matrix-like operations in frames – Merging Data frames – Applying functions to Data Frames - Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – ***Math and Simulation in R.**

Unit IV**(18 Hours)**

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.

Unit V**(18 Hours)**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Norman Matloff, (2011) “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press.
2. Jared P. Lander, (2013) “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data & Analytics Series.

Reference Books

1. Golemund G, (2014) “Hands-on programming with R: write your own functions and simulations”, O’ Reilly Media Inc.
2. James G., Witten D, Hastie T., & Tibshirani R, (2013) ” An introduction to statistical learning: with Applications in R”, Springer.
3. Mark Gardner, (2013) “Beginning R – The Statistical Programming Language”, Wiley.
4. Robert Knell (2013), “Introductory R: A Beginner’s Guide to Data Visualization, Statistical Analysis and programming in R”, Amazon Digital South Asia Services Inc. Richard Cotton, (2013). Learning R, O’ Reilly Media.
5. Gupta S. C, & Kapoor V. K, (2018) “Fundamental of Mathematical Statistics”, Sultan Chand & Sons.
6. Teetor P, R cookbook (2011):” Proven recipes for data analysis, statistics, and graphics”, O’ Reilly Media Inc.
7. Crawley M. J, (2011) “The R book”, John Wiley & Sons.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Practical 8: R Programming Laboratory			
Batch	Hours / Week	Total Hours	Credits
2021-2022	6/15	90	3

Course Objectives

1. Perform analytics using R programming.
2. Manipulate data within R and to create simple graphs and charts used in introductory statistics
3. Perform and interpret different distribution using R
4. Use R Graphics and Tables to visualize results of various statistical operations on data

Course Outcomes (CO)

K3 to K5	CO1	Understand the basics in R programming in terms of constructs, control statements, string functions
	CO2	To be able to understand the various data structures available in R programming language and apply them in solving computational problems.
	CO3	Understand the use of R for Big Data analytics.
	CO4	Extract data from files and other sources and perform various data manipulation tasks on them.
	CO5	Apply the R programming from a statistical perspective

LIST OF PRACTICAL PROGRAMS

1. Create a vector in R and perform operations on it.
2. Create integer, complex, logical, character data type objects in R and print their values and their class using print and class functions.
3. Write code in R to demonstrate sum(), min(), max() and seq() functions.
4. Write code in R to manipulate text in R using grep(), toupper(), tolower() and substr() functions.
5. Grouping, loops and conditional execution, Functions Exploratory data analysis
6. Range, summary, mean, variance, median, standard deviation, histogram, box plot, scatterplot
7. Expressions and Data Structures
8. Manipulation of vectors and matrix
9. Operators on Factors in R
10. Data Frames in R
11. Lists and Operators
12. Graphs in R

13. 3D plots in R
14. Building tables with aggregate
15. Reading and Writing different types of Datasets

Textbooks

1. Field, A, J. Miles, and Z. Field. 2012. Discovering Statistics using R. Sage Publications Ltd, London.
2. Michael, W. Trosset. 2009. An Introduction to Statistical Inference and its Application with R. A Chapman & Hall Book, CRC Press. Boca Raton, Florida.
3. Muenchen, R. A. 2011. R for SAS and SPSS Users. 2nd Edition. Springers, New York.
4. William N. Venables, D. M. Smith, and the R Development Core Team. 2009. An Introduction to R. 2nd edition. Network Theory, Ltd.

Reference Books

1. Mark Gardner, “Beginning R – The Statistical Programming Language”, Wiley, 2013.
2. Robert Knell, “Introductory R: A Beginner’s Guide to Data Visualization, Statistical Analysis and programming in R”, Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O’Reilly Media.
3. Garret Golemund (2014). Hands-on Programming with R. O’Reilly Media, Inc.
4. Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.
5. Hothorn, T. and B. S. Everitt. 2014. A handbook of statistical analysis using R. 3rd edition. CRC Press, Boca Raton, Florida.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:**Observation:** 15 Marks**Attendance:** 5Marks**One Model Practical:** 30 Marks.

MAPPING							
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5		
CO1	S	S	S	H	M		
CO2	S	S	M	H	H		
CO3	S	H	H	S	M		
CO4	H	S	M	H	M		
CO5	S	H	H	S	S		
S – Strong		H – High		M – Medium		L – Low	

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 9: Design and Analysis of Algorithms			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 4

Course Objectives

1. To understand and apply the algorithm analysis techniques.
2. To critically analyze the efficiency of alternative algorithmic solutions for the same problem
3. To understand and implement different algorithm design techniques.
4. To understand the limitations of Algorithmic power

Course Outcomes (CO)

K1 to K5	CO1	Design algorithms for various computing problems.
	CO2	Analyze the time and space complexity of algorithms.
	CO3	Critically analyze the different algorithm design techniques for a given problem.
	CO4	Modify existing algorithms to improve efficiency
	CO5	Ability to implement techniques in solving real time problems

Syllabus

Unit I

(15 Hours)

Introduction and Analysis: Fundamentals of algorithmic Problem solving – Important problem types; Recursive algorithms, - Fundamentals of the Analysis of Algorithm Efficiency: Analysis framework -Asymptotic notations and basic complexity classes – recurrences.

Unit II

(15 Hours)

Divide and Conquer strategy -- Merge sort - Quicksort -- Multiplication of large integers and Strassen's matrix multiplication – closest pairs Greedy strategy – Huffman coding – ***shortest paths algorithms** – minimum-cost spanning tree algorithms –disjoint sets

Unit III

(15 Hours)

Dynamic Programming: Computing binomial coefficient – Knapsack problem and memory functions – ordering of matrix multiplications -Marshall's and Floyd's algorithm State-space approach – exhaustive search: DFS, BFS, Iterative deepening

Unit IV

(15 Hours)

Backtracking and permutations – N-queens problem – Hamilton circuits – best-first search -- Iterative Improvement: Stable marriage - Maximum matching in bipartite graphs – maximum flow - Branch and Bound: Knapsack problem - ***Traveling salesman problem**

Unit V

(15 Hours)

Introduction to intractability -- Polynomial reductions – SAT and 3-SAT – NP-complete and NP Hard problems -- Approximation algorithms: Traveling salesman problem -- Knapsack problem – Introduction to randomized and parallel algorithms

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Anany Levitin, (2012) "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education.
2. Jon Kleinberg and Eva Tardos , (2006) "Algorithm Design", Pearson Education.

Reference Books

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, (2012) "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited.
2. Steven S Skiena, (2008) "The Algorithm Design Manual", 2nd Edition, Springer.
3. S Dasgupta , C H Papadimitriou, U V Vazirani, (2017) "Algorithms",1st Edition, McGraw Hill Education.
4. S. Sridhar, (2015) "Design and Analysis of Algorithms", Oxford University Press.
5. Sara Baase and Allen Van Gelder ,(2000) "Computer Algorithms", Third Edition, Pearson Education.
6. Dexter C. Kozen ,(1992) " The Design and Analysis of Algorithms", Springer-Verlag.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 10: Database Design and Management			
Batch 2021 – 2022	Hours / Week 6/15	Total Hours 90	Credits 4

Course Objectives

1. To introduce database development life cycle and conceptual modelling
2. To learn SQL for data definition, manipulation and querying a database
3. To learn relational database design using conceptual mapping and normalization
4. To learn transaction concepts and serializability of schedules
5. To learn data model and querying in object-relational and No-SQL databases

Course Outcomes (CO)

K1 to K5	CO1	Understand the database development life cycle and apply conceptual modeling
	CO2	Apply SQL and programming in SQL to create, manipulate and query the database
	CO3	Apply the conceptual-to-relational mapping and normalization to design relational database
	CO4	Determine the serializability of any non-serial schedule using concurrency techniques
	CO5	Apply the data model and querying in Object-relational and No-SQL databases

Syllabus**Unit I****(18 Hours)**

CONCEPTUAL DATA MODELING: Database environment – Database system development lifecycle – Requirements collection – Database design - Entity-Relationship model – Enhanced-ER model – UML class diagrams.

Unit II**(18 Hours)**

RELATIONAL MODEL AND SQL: Relational model concepts - Integrity constraints - SQL Data manipulation – SQL Data definition – Views - SQL programming.

Unit III**(18 Hours)**

RELATIONAL DATABASE DESIGN AND NORMALIZATION: ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – ***Inference rules** – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

Unit IV**(18 Hours)**

TRANSACTION MANAGEMENT: Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two phase locking techniques.

Unit V**(18 Hours)**

OBJECT RELATIONAL AND NO-SQL DATABASES : Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypes and supertypes – User-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations

* Denotes Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Textbooks

1. Thomas M. Connolly, Carolyn E. Begg , (2015) “Database Systems – A Practical Approach to Design, Implementation, and Management”, Sixth Edition, Global Edition, Pearson Education.
2. Ramez Elmasri, Shamkant B. Navathe,(2007)” Fundamental of Database Systems”, 7th Edition.

Reference Books

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish , (2011) “DATABASE MODELING AND DESIGN - Logical Design”, Fifth Edition, Morgan Kaufmann Publishers.
2. Carlos Coronel, Steven Morris, and Peter Rob , (2012) “Database Systems: Design, Implementation, and Management”, Ninth Edition, Cengage learning.
3. Abraham Silberschatz, Henry F Korth, S Sudharshan ,(2011) “Database System Concepts”, 6th Edition, Tata Mc Graw Hill.
4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom,(2009) "Database Systems:The Complete Book", 2nd edition, Pearson.
5. S Sumathi, S Esakkirajan ,(2007) “ Fundamentals of Relational Database Management Systems ”, (Studies in Computational Intelligence), Springer-Verlag.
6. Raghuram Ramakrishnan ,(2010) “Database Management Systems”, 4th Edition, Tata Mc Graw Hill.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 11: Artificial Intelligence and its Applications			
Batch 2021 – 2022	Hours / Week 6/15	Total Hours 90	Credits 4

Course Objectives

1. To learn the concepts of Artificial Intelligence.
2. Create awareness of informed search and exploration methods.
3. To demonstrate AI techniques for knowledge representation, planning and uncertainty Management.
4. Develop general-purpose problem solving agents, logical reasoning agents, and agents that reason under uncertainty
5. Choose appropriate algorithms for solving given AI problems

Course Outcomes (CO)

K1 to K5	CO1	Understanding the concept of AI
	CO2	Analyzing and evaluate informed search and exploration methods.
	CO3	Applying AI techniques for knowledge representation, planning and uncertainty Management.
	CO4	Analyzing and developing knowledge of decision making and learning methods for real time application
	CO5	Employ AI techniques to solve some of today's real world problems.

Syllabus**UNIT I****(18 Hours)**

Introduction to Artificial Intelligence: What Is AI? -The Foundations of Artificial Intelligence -The History of Artificial Intelligence - The State of the Art - Intelligent Agents: Agents and Environments-Good Behavior: The Concept of Rationality-The Nature of Environments - The Structure of Agents.

UNIT II**(18 Hours)**

Problem-solving :Solving Problems by Searching Problem-Solving Agents - Example Problems: Toy problems- * 8-Puzzle- Sliding-block- 8-Queens problem- Real-world problems: Route-finding - Touring problem - Traveling salesperson problem - Searching for Solutions - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions - Beyond Classical Search - Local Search Algorithms and Optimization Problems -Local Search in Continuous Spaces - Searching with Nondeterministic Actions - Searching with Partial Observations -Online Search Agents and Unknown Environments.

UNIT III

(18 Hours)

Adversarial Search: Games : Optimal Decisions in Games - Alpha–Beta Pruning -Imperfect Real-Time Decisions - Stochastic Games - Partially Observable Games - State-of-the-Art Game Programs - Alternative Approaches - Constraint Satisfaction Problems - Defining Constraint Satisfaction Problems - Constraint Propagation: Inference in CSPs - Backtracking Search for CSPs - Local Search for CSPs -The Structure of Problems

UNIT IV

(18 Hours)

Knowledge, reasoning, and planning:- Logical Agents - Knowledge-Based Agents - The Wumpus World - Logic - Propositional Logic: A Very Simple Logic -Propositional Theorem Proving -Effective Propositional Model Checking -Agents Based on Propositional Logic -
First-Order Logic: Representation Revisited -Syntax and Semantics of First-Order Logic -Using First-Order Logic -Knowledge Engineering in First-Order Logic - Inference in First-Order Logic: Propositional vs. First-Order Inference -Unification and Lifting - Forward Chaining - Backward Chaining

UNIT V

(18 Hours)

Robotics: Introduction- Robot Hardware-Robotic Perception -Planning to Move - Planning Uncertain Movements -Moving - ***Robotic Software Architectures** -Application Domains

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Book

1. Stuart Russell, Peter Norvig, (2009) “Artificial Intelligence – A Modern Approach”, Third Edition, Pearson Education / Prentice Hall of India.
2. Elaine Rich, Kevin Knight, Shivashankar.B.Nair, (2009) “Artificial Intelligence”, Tata Mc Graw Hill Publishing Company Limited. Third Edition.

Reference Books

1. Nils J. Nilsson,(2000) “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd.
2. George F. Luger, (2002) “Artificial Intelligence-Structures and Strategies for Complex Problem Solving”, Pearson Education / PHI.
3. Patrick H. Winston, (2006) “Artificial Intelligence”, Third edition, Pearson Edition.
4. Deepak Khemani, (2013) “Artificial Intelligence”, Tata McGraw Hill Education.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Practical 09: Artificial Intelligence and Machine Learning Laboratory			
Batch	Hours / Week	Total Hours	Credits
2021-2022	6/15	90	3

Course Objectives

1. To design and implement different techniques to develop simple autonomous agents that make effective decisions in fully informed, and observable, settings.
2. To apply appropriate algorithms for solving given AI problems.
3. To Design and implement logical reasoning agents
4. To understand the theoretical and practical aspects of probabilistic graphical models.
5. To get practical knowledge on implementing machine learning algorithms in real time problem for getting solutions

Course Outcomes (CO)

K3 to K5	CO1	Implement simple PEAS descriptions for given AI tasks
	CO2	Ability to Implement simple reasoning systems using either backward or forward inference mechanisms
	CO3	Understand the implementation procedures for the machine learning algorithms.
	CO4	Design C/C++/Java/Python/R programs for various Learning algorithms.
	CO5	Identify and apply Machine Learning algorithms to solve real world problems.

LIST OF PRACTICAL PROGRAMS

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, and type of EB connection (i.e. domestic or commercial). Compute the bill amount using the following tariff.

If the type of the EB connection is domestic, calculate the amount to be paid as follows:

- First 100 units - Rs. 1 per unit
- 101-200 units - Rs. 2.50 per unit
- 201 -500 units - Rs. 4 per unit
- 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- First 100 units - Rs. 2 per unit
- 101-200 units - Rs. 4.50 per unit
- 201 -500 units - Rs. 6 per unit
- > 501 units - Rs. 7 per unit

2. Develop and Implement backtracking algorithms for CSP
3. Develop and Implement local search algorithms for CSP
4. Develop and Implement basic search strategies for selected AI applications

5. Develop and Implement classical planning algorithms
6. Write and execute word count, word search and pattern search problems from large text files
7. Write Python Program to find the most frequent words in a text read from a file
8. Implementation of divide-and-conquer sorting algorithms
9. Detecting Spam mails using Support vector machine
10. Develop and Implement best machine learning algorithm to implement online fraud detection

Text Books

1. Anany Levitin, (2012) “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education.
2. Sebastain Raschka, (2019)“Python Machine Learning”, Packt publishing (open source).
3. Ethem Alpaydin, (2020) “Introduction to Machine Learning”, MIT Press, Fourth Edition.
4. Stuart Russel and Peter Norvig, (2020) “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education.

Reference Books

1. Allen B. Downey, (2016) “Think Python: How to Think like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, (<http://greenteapress.com/wp/think.python/>) .
2. Guido van Rossum and Fred L. Drake Jr, (2011) “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.

Tools: C, C++, JAVA, Python and R Programming with ML and AL Packages

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (**3 Hours / 50 Marks**)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:**Observation:** 15 Marks**Attendance:** 5Marks**One Model Practical:** 30 Marks.

MAPPING					
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong		H – High		M – Medium	
				L – Low	

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Core Paper 12: Machine Learning			
Batch 2021 – 2022	Hours / Week 6/15	Total Hours 90	Credits 4

Course Objectives

1. To understand the basics of Machine Learning (ML)
2. To understand the methods of Machine Learning
3. To know about the implementation aspects of machine learning
4. To understand the concepts of Data Analytics and Machine Learning
5. To understand and implement use cases of ML

Course Outcomes (CO)

K1 to K5	CO1	Understand the basics of ML
	CO2	Understand various Machine Learning methods and its application
	CO3	Demonstrate various ML techniques using standard packages.
	CO4	Explore knowledge on Machine learning and Data Analytics
	CO5	Apply ML to various real time examples

Syllabus**Unit I****(18 Hours)**

Machine Learning Basics : Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

Unit II**(18 Hours)**

Machine Learning Methods: Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Futurization

Unit III**(18 Hours)**

Machine Learning in Practice: Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine learning libraries – Amazon’s Machine Learning Tool Kit: Sage maker

Unit IV**(18 Hours)**

Machine Learning and Data Analytics: Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics

Unit V**(18 Hours)**

Applications of Machine Learning: Image Recognition – Speech Recognition – ***Email spam and Malware Filtering** – Online fraud detection – Medical Diagnosis

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Ameet V Joshi, (2020) “Machine Learning and Artificial Intelligence”, Springer Publications.
2. John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, (2015) “Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies”, MIT press.
3. Tom M. Mitchell, (2013) “Machine Learning”, McGraw-Hill Education.
4. Aurelien Geron, (2019) “Hands-on Machine Learning with Scikit-Learn &Tensor Flow” , O’Reilly, Shroff Publishers and Distributors Pvt. Ltd.

Reference Books

1. Christopher M. Bishop,(2011) “Pattern Recognition and Machine Learning”, Springer Publications.
2. Stuart Jonathan Russell, Peter Norvig, John Canny, (2020) “Artificial Intelligence: A Modern Approach”, Prentice Hall.
3. John Paul Muller, Luca Massaron (2021) “Machine Learning Dummies”, Wiley Publications.
4. EthemAlpaydin,(2013) “Introduction to Machine Learning”, PHI Learning Pvt. Ltd, 2nd Edition.
5. T. Hastie, R. Tibshirani, J. H. Friedman, (2001) “The Elements of Statistical Learning”, Springer, 1st edition.
6. Manaranjan Pradhan, U Dinesh kumar, (2019) “Machine Learning using Python” Wiley.
7. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das,(2020) “Machine Learning”, Pearson.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Project & Viva voce			
Batch 2021 – 2022	Hours / Week 4/15	Total Hours 60	Credits 5

Course Objectives

1. To acquire the knowledge about selecting the task based on their course skills.
2. To get the knowledge about analytical skill for solving the selected task.
3. To get confidence by implementing the task in a real time projects.

Course Outcomes (CO)

K3 to K5	CO1	Applying programming skill for solving the project.
	CO2	Analyzing the task and to collect the necessary information and software development
	CO3	Evaluating and Testing the task based on the software.
	CO4	Implementing the software for getting the Report.
	CO5	Implementing and analyzing real time project

Guidelines to the Distribution of Marks

CIA	Project Review	45	50
	Regularity	5	
ESE	Project Report	35	50
	Viva – Voce	15	
Grand Total			100

Teaching Methods: Power Point Presentation/Project Demo/ Discussion

MAPPING					
PSO					
CO \	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong		H – High		M – Medium	
				L – Low	

Major Elective Papers I & II

Programme Code:23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Major Elective :Internet of Things			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To Study Fundamental Concepts of Iot.
2. To Understand Roles of Sensors In Iot
3. To Learn Different Protocols Used For Iot Design
4. Understand The Role of Iot In Various Domains Of Industry.

Course Outcomes (CO)

K1 to K5	CO1	Understand The Various Concepts, Terminologies and Architecture of Iot Systems
	CO2	Use Sensors and Actuators for Design of Iot.
	CO3	Understand and Apply Various Protocols for Design Of Iot Systems
	CO4	Use Various Techniques of Data Storage And Analytics In Iot
	CO5	Understand Various Applications of Iot

Syllabus

Unit I

(15 Hours)

Fundamentals of Iot: Introduction, Definitions & Characteristics of Iot, Iot Architectures, Physical and Logical Design of Iot, Enabling Technologies In Iot, ***History of Iot**, About Things In Iot, The Identifiers In Iot, About The Internet In Iot, Iot Frameworks, Iot and M2m.

Unit II

(15 Hours)

Sensors Networks: Definition, Types of Sensors, Types of Actuators, Examples and Working, Iot Development Boards: Arduino IDE and Board Types, Raspberripi Development Kit, RFID Principles and Components, Wireless Sensor Networks: History and Context, The Node, Connecting Nodes, Networking Nodes, WSN And Iot.

Unit III

(15 Hours)

Wireless Technologies for Iot: Wpan Technologies for Iot: IEEE 802.15.4, Zigbee, Hart, Nfc, Z-Wave, Ble, Bacnet, Modbus. IP Based Protocols for Iot Ipv6, 6lowpan, Rpl, Rest, Ampq, Coap, Mqtt. Edge Connectivity and Protocols

Unit IV

(15 Hours)

Data Handling& Analytics: Introduction, Big data, Types of Data, Characteristics of Big Data, Data Handling Technologies, Flow of Data, Data Acquisition, Data Storage, Introduction to Hadoop. Introduction to Data Analytics, Types Of Data Analytics, Local Analytics, Cloud Analytics and Applications

Unit V**(15 Hours)**

Applications of Iot: Home Automation, ***Smart Cities**, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial Iot, Legal Challenges, Iot Design Ethics, Iot in Environmental Protection.

* **Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. HakimaChaouchi, (2010) “The Internet of Things Connecting Objects to the Web” Isbn: 978-1-84821-140-7, Wiley Publications.
2. Olivier Hersent, David Boswarthick, and Omar Elloumi(2012) — “The Internet Of Things: Key Applications And Protocols”, Wileypublications.
3. Vijay Madiseti and Arshdeepbahga , (2014) — “Internet of Things (A Hands-On-Approach)”, 1 st Edition.
4. J. Biron and J. Follett, (2016) "Foundational Elements of an Iot Solution", O”Reilly Media.

Reference Books

1. Pethuru Raj AndAnupama C. Raman,(2017) "The Internet Of Things: Enabling Technologies, Platforms, And Use Cases", Crc Press.
2. Keysight Technologies, (2016) “The Internet of Things: Enabling Technologies and Solutions for Design and Test”, Application Note.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong**H** – High**M** – Medium**L** – Low

Programme Code: 23		B.Sc. Computer Science with Data Analytics	
Title of the paper : Major Elective: Software Testing and Quality Assurance			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To understand the basics of testing, test planning & design and test team organization
2. To study the various types of test in the life cycle of the software product.
3. To build design concepts for system testing and execution
4. To learn the software quality assurance , metrics, defect prevention techniques

Course Outcomes (CO)

K1 to K5	CO1	Perform functional and non-functional tests in the life cycle of the software product.
	CO2	Understand system testing and test execution process.
	CO3	Identify defect prevention techniques and software quality assurance metrics.
	CO4	To learn the techniques for quality assurance and applying for applications.
	CO5	Apply techniques of quality assurance for typical applications.

Syllabus

Unit I

(15 Hours)

Role of Testing- Verification and Validation-Failure, Error, Fault and Defect – Objectives of Testing-What is a test case? –Expected outcome –Concept of Complete Testing – Central issue in testing –Testing Activities – Test levels – Sources of information for test case selection.

Unit II

(15 Hours)

White Box and Black Box testing –Test planning and Design – Monitoring and Measuring Test Execution – Test tools and Automation – Concept of Unit Testing- Static Unit Testing- Defect Prevention-Dynamic Unit Testing-Debugging.

Unit III

(15 Hours)

System Integration Testing: Concept of Integration Testing- Different types of Interfaces and Interface Errors-System Integration Techniques-Basic Tests-Functionality tests- Robustness Tests:-Boundary value tests –Performance Tests-***Scalability Tests.**

Unit IV

(15 Hours)

The Software Quality challenge :The Uniqueness of Software Quality Assurance –The Environments for which SQA methods are developed – Software Quality Definition- Software quality assurance : definition and Objectives - The SQA system – an SQA architecture- Software project life cycle components- Management ***SQA components-** SQA standards, system certification, and assessment components.

Unit V**(15 Hours)**

Software quality metrics: Objectives of quality measurement- Classification of software quality metrics- Process metrics- Product metrics- Limitations of software metrics- Objectives of cost of software quality metrics- The classic model of cost of software quality - Problems in the application of cost of software quality metrics-Top management’s quality assurance activities-Department management responsibilities for quality assurance-Project management responsibilities for quality assurance.

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. KshirsagarNaik and PriyadarshiTripathy, (2008) “Software Testing & Quality Assurance Theory and Practice”, Wiley Student edition.
2. Daniel Galin, (2004) “Software Quality Assurance From theory to implementation”, Pearson Publication.

Reference Books

1. Jeff Tian, John Wiley & Sons, Inc., (2005) “Software Quality Engineering: Testing, Quality , Assurance , and Quantifiable Improvement” Hoboken, New Jersey.
2. MilindLimaye ,(2011) “ Software Quality Assurance”, TMH , New Delhi.
3. KshirasagarNaik, PriyadarshiTripathy, (2008) “Software Testing And Quality Assurance-Theory and Practice” John Wiley & Sons Inc.
4. Daniel Galin, (2004) “Software Quality Assurance - From Theory to Implementation”, Pearson Education Ltd UK.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Major Elective : Cloud Computing Fundamentals			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To define Cloud Computing
2. To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
3. To motivate students to do programming and experiment with the various cloud computing environments
4. To shed light on the Security issues in Cloud Computing
5. To introduce about the Cloud Standards

Course Outcomes (CO)

K1 to K5	CO1	Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
	CO2	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
	CO3	Explain the core issues of cloud computing such as security, privacy, and interoperability.
	CO4	Provide the appropriate cloud computing solutions and recommendations according to the applications used.
	CO5	Collaboratively research and write a research paper, and present the research online.

Syllabus

Unit I

(15 Hours)

Introduction: Defining a Cloud- A closer look –The Cloud Computing Reference Model –Characteristics and benefits of Cloud Computing –Challenges. Historical developments: Distributed systems- Virtualization - Web 2.0. - Service-oriented computing- Utility-oriented computing. Building cloud-computing environments: Application development- Infrastructure and system development - Computing platforms and technologies.

Unit II

15 (Hours)

Cloud Computing Architecture: Introduction - The cloud reference model- Architecture- Infrastructure- and hardware-as-a-service- Platform as a service - Software as a service- Types of clouds- Public clouds- Private clouds- Hybrid clouds- Community clouds- Economics of the cloud- Open challenges.

Unit III

(15 Hours)

Exploring Cloud Infrastructures: Managing the Cloud - Administrating the Clouds- Cloud Management Products- *Understanding Cloud Security- Securing the Cloud - Securing Data- Moving Applications to the Cloud- Applications in the Clouds.

Unit IV**(15 Hours)**

High-Throughput Computing: Task computing- Task-based application models. Data-Intensive Computing: What is data-intensive computing? - Characterizing data-intensive computations- Challenges ahead- Historical perspective- ***Technologies for data-intensive computing**- Storage systems- Programming platforms

Unit V**(15 Hours)**

Cloud Platforms in Industry: Amazon web Services -compute services, Storage Services, Communication Services, Google App Engine- Architecture and core concepts, Application Life Cycle, cost model, Microsoft Azure core concepts, ***SQL Azure**, Windows Azure platform appliance

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, (2013) “Mastering Cloud Computing: Foundations and applications programming” , Elsevier Morgan Kaufmann.

Reference Books

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, (2012) “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier.
2. Barrie Sosinsky,(2010) “ Cloud Computing Bible” John Wiley & Sons.
3. Tim Mather, Subra Kumaraswamy, and Shahed Latif, (2009) “Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance”, O’Reilly.

MAPPING

PSO \ CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong**H** – High**M** – Medium**L** – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Major Elective: Digital Forensics			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To introduce the principle and concepts of digital forensic
2. To detail about the various investigation procedures like data acquisition and evidence gathering
3. To understand the basics of digital forensics and the techniques for conducting the forensic examination on different digital devices.
4. To understand how to examine digital evidences such as the data acquisition, identification analysis.
5. To understand the various categories of tools and procedures used in the digital forensic process

Course Outcomes (CO)

K1 to K5	CO1	Analysing the digital evidences and arriving at conclusions
	CO2	Examine the Volatile and Non-volatile Digital Evidence
	CO3	Apply various techniques of digital forensics for the systematic crime investigation
	CO4	Apply the cyber-crime techniques to data acquisition and evidence collection
	CO5	Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.

Syllabus

Unit I

(15 Hours)

Basics of Digital Forensics: Digital Forensics- Introduction, Objective and Methodology, Rules of Digital Forensics, Good Forensic Practices, Daubert's Standards, Principles of Digital Evidence. Overview of types of Computer Forensics – Network Forensics, Mobile Forensics, Social Media Forensics and E-mail Forensics. Services offered by Digital Forensics. First Responder – Role, Toolkit and Do's and Don'ts

Unit II

(15 Hours)

Cyber Crime Investigation : Introduction to Cyber Crime Investigation, Procedure for Search and seizure of digital evidences in cyber-crime incident- Forensics Investigation Process- Pre search consideration, Acquisition, Duplication & Preservation of evidences, Examination and Analysis of evidences, Storing of Evidences, Documentation and Reporting, Maintaining the Chain of Custody.

Unit III

(15 Hours)

Data Acquisition and Evidence Gathering: Data Acquisition of live system, Shutdown Systems and Remote systems, servers. E-mail Investigations, Password Cracking. Seizing and preserving mobile devices. Methods of data acquisition of evidence from mobile devices. Data Acquisition and Evidence Gathering from Social Media. Performing Data Acquisition of encrypted systems. ***Challenges and issues in cyber-crime investigation.**

Unit IV**(15 Hours)**

Analysis of Digital Evidences: Search and Seizure of Volatile and Non-volatile Digital Evidence, Imaging and Hashing of Digital Evidences, Introduction to Deleted File Recovery, Steganography and Steg analysis, Data Recovery Tools and Procedures, Duplication and Preservation of Digital Evidences, Recover Internet Usage Data, Recover Swap files/Temporary Files/Cache Files. Software and Hardware tools used in cyber-crime investigation – Open Source and Proprietary tools. Importance of Log Analysis in forensic analysis. Understanding Storage Formats for Digital Evidences – Raw Format, Proprietary Formats, ***Advanced Forensic Formats.**

Unit V**(15 Hours)**

Windows and Linux Forensics: Windows Systems Artifacts: File Systems, Registry, Event logs, Shortcut files, Executables. Alternate Data Streams (ADS), Hidden files, Slack Space, Disk Encryption, Windows registry, startup tasks, jump lists, Volume Shadow, shell bags, LNK files, Recycle Bin Forensics (INFO, \$i, \$r files). Forensic Analysis of the Registry – Use of registry viewers, Regedit. Extracting USB related artifacts and examination of protected storages. Linux System Artifact: Ownership and Permissions, Hidden files, User Accounts and Logs.

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Nina Godbole and SunitBelapore; (2011) “Cyber Security: Understanding CyberCrimes, Computer Forensics and Legal Perspectives”, Wiley Publications.
2. Bill Nelson, Amelia Phillips and Christopher Steuart,(2010 BBS) “Guide to ComputerForensics and Investigations” – 3rd Edition, Cengage.
3. Shon Harris,(2013) “All in One CISSP Guide, Exam Guide Sixth Edition”,McGraw Hill.

Reference Books

1. Peter Hipson,(2002) “Mastering Windows XP Registry”, Sybex.
2. Harlan Carvey,(2012) “Windows Forensic Analysis Toolkit”, Syngress.
3. Anthony Reyes, Jack Wiles,(2007) “The Best Damn Cybercrime and DigitalForensic Book”,Syngress, USA.
4. Warren G. Kruse II and Jay G. Heiser,(2002) “Computer Forensics: Incident Response Essentials”, Addison Wesley.
5. Bill Nelson, Amelia Phillips, F.Enfinger and Christopher Stuart,(2006) “Guide to Computer Forensics and Investigations”, 2nd edition. Thomson Course Technology.
6. John R. Vacca, Computer Forensics,(2005) “Computer Crime Scene Investigation”,2nd Ed, Charles River Media.
7. Bill Nelson, Amelia Phillips, F.Enfinger and Christopher Stuart, (2010) “Guide to Computer Forensics and Investigations, 4th ed., Thomson Course Technology.
8. Anthony T. S. Ho and Shujun Li,(2015) “Handbook of Digital forensics of Multimedia Data and Devices”, IEEE Press, John Wiley & Sons.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Major Elective: Natural Language Processing			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To apply the NLP techniques to IR applications

Course Outcomes (CO)

K1 to K5	CO1	To tag a given text with basic Language features
	CO2	To design an innovative application using NLP components
	CO3	To implement a rule based system to tackle morphology/syntax of a language
	CO4	To design a tag set to be used for statistical processing for real-time applications
	CO5	To compare and contrast the use of different statistical approaches for different types of NLP applications.

Syllabus

Unit I

(15 Hours)

Introduction - Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance- Applications of NLP .

Unit II

(15 Hours)

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models. Advantages of NLP - Disadvantages of NLP -Components of NLP - How to build an NLP pipeline- Phases of NLP -Why NLP is Difficult- NLP APIs - NLP Libraries - ***Difference between Natural language and Computer language**

Unit III

(15 Hours)

Syntactic Analysis : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Unit IV**(15 Hours)**

Semantics and Pragmatics: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, sectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Unit V**(15 Hours)**

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, ***Multilingual and Cross lingual Language Modeling**

*** Denotes Self Study and questions for examinations may be taken from the self-study portions also.**

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Daniel Jurafsky, James H. Martin,(2014) “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication.
2. Steven Bird, Ewan Klein and Edward Loper, (2009) “Natural Language Processing with Python”, First Edition, O’Reilly Media.
3. Breck Baldwin,(2015) “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher.
4. Richard M Reese, (2015) “Natural Language Processing with Java”, OReilly Media.
5. Nitin Indurkhya and Fred J. Damerau, (2010) “Handbook of Natural Language Processing”, Second Edition, Chapman and Hall/CRC Press.

Reference Books

1. Daniel M. Bikel and ImedZitouni (2012)“Multilingual natural Language Processing Applications: From Theory to Practice “, Pearson Publication.
2. Daniel Jurafsky& James H Martin (2000),“Speech and Natural Language Processing” Pearson Publications.
3. Tanveer Siddiqui, U.S. Tiwary, (2008) “Natural Language Processing and Information Retrieval”, Oxford University Press.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong**H** – High**M** – Medium**L** – Low

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Major Elective : Deep Learning			
Batch 2021 – 2022	Hours / Week 5/15	Total Hours 75	Credits 5

Course Objectives

1. To introduce students to the basic concepts and techniques of deep Learning.
2. To get the knowledge about deep learning skill for solving the selected task.
3. To learn the fundamentals of reinforcement learning.

Course Outcomes (CO)

K1 to K5	CO1	Understand the basic concepts and techniques of Deep Learning
	CO2	To understand and apply the Machine learning principles
	CO3	To study the deep learning architectures
	CO4	Examine the foundations of neural networks
	CO5	Explore and create deep learning applications with tensor flow

Syllabus

Unit I

(15 Hours)

Basics of Neural Network: The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – Soft max output layers. Variables & Operations – Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization

Unit II

(15 Hours)

CNN: Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer – *Applications. RNN: Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM - Memory augmented Neural Networks – NTM– *Applications.

Unit III

(15 Hours)

Reinforcement Learning: Reinforcement Learning – MDP – Q Learning – *Applications

Unit IV

(15 Hours)

Deep Learning Algorithms For AI : Artificial Neural Networks – Linear Associative Networks – Perceptrons -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Back prop Networks- Autoencoders

Unit V

(15 Hours)

Data Science and Deep Learning Data science fundamentals and responsibilities of a data scientist - life cycle of data science – Data science tools - Data modeling, and futurization - How to work with data variables and data science tools - How to visualize the data -*How to work with machine learning algorithms and Artificial Neural Networks.

* Denotes Self Study and questions for examinations may be taken from the self-study portions also.

Teaching Methods

Chalk and Talk/ Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ Video presentation /Podcast /Materials from NDLI/Class blended learning/ flipped class

Text Books

1. Nikhil Buduma, Nicholas Locascio, (2017) “Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms”, O'Reilly Media.
2. Ian Good fellow, YoshuaBengio, Aaron Courville, (2017)”Deep Learning (Adaptive computation and Machine Learning series”, MIT Press.

Reference Books

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, (2016) ”Deep Learning”, MIT Press.
2. Stone, James. (2019). “Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning”, Sebtel Press, United States.
3. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), (2021)“Deep Learning Applications”, Volume 3, Springer Publications.
4. Charu C. Aggarwal, (2018) “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing.

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong

H – High

M – Medium

L – Low

Skill Based Subjects

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the paper : Skill Based Subject 1: Cyber Security			
Batch 2021 – 2021	Hours / Week 2/15	Total Hours 30	Credits 3

Course Objectives

1. To study the basics of Cyber security.
2. To know about the security aspects operating systems and networks.
3. To explore Cryptography , IDS and IPS
4. To study the privacy principles and policies.
5. To know about the Security management and incidents.

Course Outcomes (CO)

K1 to K5	CO1	Explain the basic concepts of computer security
	CO2	Devise methods for Security in operating system & networks
	CO3	Differentiate the various security counter measures.
	CO4	Devise Privacy principles and policies
	CO5	Manage the Cyber space.

Syllabus**Unit I****6 Hours**

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls – Authentication Access Control and Cryptography - Web-User Side - Browser Attacks - Web Attacks- Targeting Users - Obtaining User or Website Data - Email Attacks.

Unit II**6 Hours**

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

Unit III**6 Hours**

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

Unit IV**6 Hours**

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.

Unit V**6 Hours**

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cybercrime - Cyber Warfare and Home Land Security.

Teaching Methods: Chalk and Talk, Presentation, Seminar, Quiz, Discussion & Assignment

Text Book

1. Jan L.Harrington (2005),”Network Security – A Practical Approach”, Morgan Kaufmann Publishers –An Imprint of Elsevier.
2. William Stallings (2005), “Cryptography and Network Security – Principles and Practice”, Pearson Education Asia, Fourth Edition.

Reference Books

1. Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed, “Fundamental of Cyber Security”, BPB Publications, 1st Edition, 2017.
2. Anand Shinde, “Introduction to Cyber Security-Guide to the world of Cyber Security”, Notion Press, 2021.
3. Paul Grishman, “Cyber Terrorism- The use of the Internet for Terrorist Purpose”,Axis Publication,1st Edition 2010.
4. Shilpa Bhatnagar, “Encyclopaedia of Cyber and Computer Hacking”, Anmol Publications, 1st Edition 2009.
5. Edward Amoroso, “Cyber Security”, Silicon Press, 2006.
6. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015.
7. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
8. Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015.
9. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

Web References:

1. <http://deity.gov.in/> - Department of Electronics and Information Technology, Govt. of India.
2. <http://cybercellmumbai.gov.in/> - Cybercrime investigation cell.
3. <http://ncrb.gov.in/> - National Crime Records Bureau.
4. <http://catindia.gov.in/Default.aspx> - Cyber Appellate Tribunal.
5. <http://www.cert-in.org.in/> - Indian Computer Emergency Response Team.
6. <http://cca.gov.in/rw/pages/index.en.do> - Controller of Certifying Authorities.
7. www.safescrypt.com – Safescrypt.
8. www.nic.in – National Informatics Centre.
9. <https://www.kaspersky.com/resource-center/definitions/what-is-a-digital-footprint>.
10. <https://geekflare.com/digital-footprint/>

Mapping

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	H
CO2	H	S	S	H	S
CO3	M	H	M	S	H
CO4	S	H	H	M	H
CO5	H	S	S	H	S

S – Strong

H – High

M – Medium

L – Low

Programme Code: 23	Bachelor of Computer Science with Data Analytics		
Title of the Paper : Skill Based Subject 2: Web Design Laboratory			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2/15	30	3

Course Objectives

1. To design and develop websites using fundamental web languages, technologies, and tools.
2. To implement the concepts in visual design and content structuring
3. To develop an ability to design and implement static and dynamic website
4. To develop skills in analyzing the usability of a web site.
5. To demonstrate the role of languages like HTML, CSS, JavaScript, PHP and protocols in the workings of the web and web applications.

Course Outcomes (CO)

K3 to K5	CO1	Understanding the use of HTML tags.
	CO2	Create web pages using HTML and Cascading Stylesheets and Develop dynamic web pages using JavaScript.
	CO3	Use cascading style sheets to design web pages
	CO4	Use JavaScript and HTML to create web pages with advanced interactivity
	CO5	Understand, analyze and build web applications using PHP and Integrate HTML forms to PHP scripts.

LIST OF PRACTICAL PROGRAMS

1. Design a page having suitable background colour and text colour with title "My First Web Page" using all the attributes of the Font tag and Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register Number, Class] aligned in proper order using alignment attributes of Paragraph tag.
2. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style.
3. Write HTML code to create a Web Page that contains an Image at its center and description of the image.
4. Use table tag to format web page and also create the Time Table of your class using table
5. Create your profile page i.e. educational details, Hobbies, Achievement, My Ideals etc.
6. Develop and demonstrate the usage of inline, internal and external style sheet using CSS
7. Write an HTML page that contains a selection box with a list of FIVE countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

8. A web application that takes name and age from an HTML page. If the age is less than 18, it should send a page with “Hello, you are not authorized to visit the site” message, where should be replaced with the entered name. Otherwise, it should send “Welcome to this site” message.
9. Design a web page for your Department.
10. Design the following static web pages required for an online bookstore web site.
 - 1) HOME PAGE: The static home page must contain three frames.
 - 2) LOGIN PAGE
 - 3) CATALOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table.
 - 4) REGISTRATION PAGE
11. Write JavaScript to validate the following fields of the Registration page.
 1. First Name (Name should contains alphabets and the length should not be less than 6 characters).
 2. Password (Password should not be less than 6 characters length).
 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
 4. Mobile Number (Phone number should contain 10 digits only).
 5. Last Name and Address (should not be Empty).
12. Write PHP program to upload registration form into database and Display the Registration form from the database.

Text Books

1. Jon Duckett (2000) – “Beginning Web Programming With HTML, XHTML AND CSS”, – Second Edition, Wiley India Pvt. Ltd.
2. Bootstrap for Quick Start: A Beginner's Guide to Building Responsive Layouts with Bootstrap.

Reference Books

1. Thomas A. Powell, “The Complete Reference HTML”, – Second Edition Tata McGraw Hill Publication.
2. Chris Bates - “Web Programming Building Internet Applications”, Second Edition, John Wiley & Sons, Ltd.

Teaching Methods

Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Assignment, Video Lectures

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:**Observation:** 15 Marks**Attendance:** 5Marks**One Model Practical:** 30 Marks.

MAPPING					
PSO					
CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong		H – High		M – Medium	
				L – Low	

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Skill based Subject 3 : Ethical Hacking			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2	30	3

Course Objectives

1. To introduce the concepts of security and various kinds of attacks
2. To explain about system hacking and penetration testing

Course Outcomes (CO)

K1 to K5	CO1	Analyze the importance of security and various types of attacks
	CO2	Understand the concepts of scanning and system hacking
	CO3	Understand about various penetration testing and its methodology
	CO4	Identify the various programming languages used by security professional
	CO5	Analyze and understand the concept of penetration testing.

Syllabus**UNIT I****(6 Hours)**

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range – Meta Search Engines.

UNIT II**(6 Hours)**

Scanning and Enumeration: Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

UNIT III**(6 Hours)**

System Hacking : Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges – Executing Applications – Key loggers and Spyware.

UNIT IV**(6 Hours)**

Programming For Security Professionals: Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for identifying Vulnerabilities – Countermeasures.

UNIT V**(6 Hours)**

Penetration Testing : Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing – Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools.

Text Books

1. EC-Council, (2009) "Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning.
2. Jon Erickson,(2008) "The Art of Exploitation Hacking", 2nd Edition, No Starch Press Inc.
3. Michael T. Simpson, Kent Beckman, James E. Corley,(2013) "Hands-On Ethical Hacking and Network Defense", Cengage Learning.

Reference Books

1. Patrick Engebretson, (2013) "The Basics of Hacking and Penetration Testing –Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier.
2. Rafay Boloch, (2014) "Ethical Hacking and Penetration Testing Guide", CRC Press.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	S
CO2	S	H	S	H	M
CO3	S	H	M	H	S
CO4	S	M	S	M	H
CO5	S	H	H	H	S

S – Strong

H – High

M – Medium

L – Low

Environmental Studies

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Part IV: Environmental Studies			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2/15	30	2

Course Objectives

1. To inculcate knowledge and create awareness about ecological and environmental concepts, issues and solutions to environmental problems.
2. To shape students into good “eco citizens” thereby catering to global environmental needs.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENT (6 hours)

Definition scope and importance – Need for public awareness - Natural resources – Types of resources – Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

UNIT II ECOSYSTEMS (6 hours)

Concept of an ecosystem – Structure and functions of an ecosystem – Procedures, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food web and ecological pyramids – Structure and function of the following ecosystem – Forest Ecosystem – Grassland Ecosystem – Desert Ecosystem – Aquatic Ecosystem.

UNIT III BIODIVERSITY AND ITS CONSERVATION (6 hours)

Introduction – Definition – Genetic – Species and ecosystem diversity- Bio geographical classification of India – Value of biodiversity – Biodiversity at global, national and local levels – India as a mega - diversity Nation - Hot spot of biodiversity – Threats to biodiversity - Endangered and endemic species of India – Conservation of Biodiversity – insitu Conservation of Biodiversity – exsitu Conservation of Biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION (6 hours)

Definition - Causes, effects and control measures of Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution – Solid Waste Management Causes, effects, control measures of urban and industrial wastes – Role of individual in prevention of pollution – Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution – Disaster Management – Food, Drought, Earthquake, Tsunami, Cyclone and Landslide.

UNIT - V SOCIAL ISSUES AND THE ENVIRONMENT (6 hours)

Sustainable Development – Urban problems related to energy – Water Conservation Rain Water Harvesting and Watershed Management – Resettlement and rehabilitation of people, its problems and concerns, case studies Narmatha Valley Project – Environmental ethics, issues and possible solutions – Climate change, global warming, ozone layer depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl – Consumerism and waste products – Environmental Protection Act – Air Pollution Act (Prevention and Control) – Water Pollution Act (Prevention and control) – Wild Life Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness – Human Population and the environment – Population Growth and Distribution – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health.

Teaching Methods

Chalk and Talk, Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Seminar, Quiz

Text Book

1. P. Arul, A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar street, Velachery main road, Velachery, Chennai – 42, First Edition, Nov.2004.

Reference Books

1. Purohit Shammi Agarwal, A text Book of Environmental Sciences, Publisher Mrs. Saraswati Prohit, Student Education , Behind Naswan Cinema Chopansi Road, Jodhpur.
2. Dr.Suresh and K.Dhameja, Environmental Sciences and Engineering , Publisher S.K. Kataria & Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi -110 006.
3. J.Glynn Henry and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India Private Ltd., New Delhi – 110 001.

Value Education

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Part- IV Value Education : Moral and Ethics			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2/15	30	2

Course Objectives

1. To impart Value Education in every walk of life.
2. To help the students to reach excellence and reap success.
3. To impart the right attitude by practicing self-introspection.
4. To portray the life and messages of Great Leaders.
5. To insist the need for universal brotherhood, patience and tolerance.
6. To help the students to keep them fit.
7. To educate the importance of Yoga and Meditation.

Syllabus**UNIT I****(4 Hours)**

Moral and Ethics: Introduction – Meaning of Moral and Ethics – Social Ethics – Ethics and Culture – Aim of Education.

UNIT II**(6 Hours)**

Life and Teachings of Swami Vivekananda: Birth and Childhood days of Swami Vivekananda – At the Parliament of Religions – Teachings of Swami Vivekananda.

UNIT III**(4 Hours)**

Warriors of our Nation: Subhas Chandra Bose – Sardhar Vallabhai Patel – Udhham Singh – V. O. Chidambaram Pillai – Bhagat Singh – Tiruppur Kumaran – Dheeran Chinnamalai – Thillaiyadi Valliammai – Velu Nachiyar – Vanchinathan.

UNIT IV**(8 Hours)**

Physical Fitness and Mental Harmony : Simplified Physical Exercise – Hand Exercises – Leg Exercises Neuro Muscular Breathing Exercises – Eye Exercises – Kabalabathi – Maharasana A & B – Massage - Acupressure – Relaxation – Kayakalpa Yogam - Life Force – Aim & Objectives – Principle – Methods. Introspection – Analysis of Thoughts – Moralization of Desires – Neutralization of Anger – Eradication of Worries.

UNIT V**(8 Hours)**

Yoga and Meditation – The Asset of India : Yogasanam – Rules & Regulations – Surya Namaskar – Asanas –Sitting – Stanging – Prone - Supine - Pranayama – NaadiSudhi – Ujjayi – Seethali – Sithkari - Benefits. Meditation – Thanduvassudhi - Agna – Shanthi – Thuriyam – Benefits.

Text Book

1. Value Based Education – Moral and Ethics – Published by Kongunadu Arts and Science College (Autonomous), First Edition (2020).

Reference Books

1. Swami Vivekananda – A Biography, Swami Nikhilananda, Advaita Ashrama, India, 24th Reprint Edition (2010).
2. Gandhi, Nehru, Tagore and other eminent personalities of Modern India, Kalpana Rajaram, Spectrum Books Pvt. Ltd., revised and enlarged edition (2004).
3. Freedom Fighters of India, Lion M.G. Agrawal, Isha Books Publisher, First Edition (2008).
4. Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication (2000).
5. Yoga Practices - 1 – The World Community Service Centre – Vethathiri Publications, Sixth Edition (2017), Erode.
6. Yoga Practices - 2 – The World Community Service Centre – Vethathiri Publications – Eighth Edition (2017), Erode.

Non Major Elective Papers

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Non Major Elective 1: Human Rights			
Batch 2021-2022	Hours / Week 2/15	Total Hours 30	Credits 2

Objectives:

1. To prepare for responsible citizenship with awareness of the relationship between Human Rights, democracy and development.
2. To impart education on national and international regime on Human Rights.
3. To sensitive students to human suffering and promotion of human life with dignity.
4. To develop skills on human rights advocacy
5. To appreciate the relationship between rights and duties
6. To foster respect for tolerance and compassion for all living creature.

UNIT – I

Definition, Meaning, Concept ,Theories and Kinds of Human Rights- Evaluation and Protection of Human Rights in India- Development of Human Rights under the United Nations.

UNIT – II

United Nations Charter and Human Rights - U.N.Commission on Human Rights- Universal Declaration of Human Rights - International Covenant on

- Civil & Political Rights
- Economic, Social and Cultural Rights

UNIT – III

Human Rights and Fundamental Rights (Constitution) - Enactments regarding Human Rights Laws in India - National Human Rights Commission and State Human Rights Commission.

UNIT – IV

Aged persons and their Human Rights - Human Rights of Persons with Disabilities - Tribal Human Rights in India - Three Generation Human Rights.

UNIT – V

Rights of Women, Child, Refugees and Minorities - Media and Human Rights - NGO's in protection of Human Rights - Right to Election.

Books for Study:

1. Human Rights (2019) Published by Kongunadu Arts and Science College, Coimbatore –29.

Book for Reference:

1. Human Rights, (2018) Jaganathan, MA., MBA., MMM., ML., ML., Humanitarian Law and J.P. Arjun Proprietor, Usha Jaganathan Refugee Law law series, 1st floor, Narmatha Nanthi Street, Magathma GandhiNagar, Madurai – 625014.

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Non Major Elective: 2 Women's Rights			
Batch 2021-2022	Hours / Week 2/15	Total Hours 30	Credits 2

OBJECTIVES:

- To know about the laws enacted to protect women against violence.
- To impart awareness about the hurdles faced by women.
- To develop a knowledge about the status of all forms of women to access to justice.
- To create awareness about women's rights.
- To know about laws and norms pertaining to protection of women.
- To understand the articles which enables the women's rights.
- To understand the Special Women Welfare laws.
- To realize how the violence against women puts an undue burden on health care services.

Syllabus**Unit I****(6 Hours)****Women's Studies:**

Basic concepts of Women's studies in Higher education, Women's studies perspectives- Socialization- Patriarchy- Women's studies as an academic discipline- Growth and development of Women's studies as a discipline internationally and in India

Unit II**(6 Hours)****Socio-Economic Development of Women:**

Family welfare measures, role of Women in economic development, representation of Women in media, status of Women land rights, Women Entrepreneurs, National policy for the empowerment of women.

Unit III**(6 Hours)****Women's Rights – Access to Justice:**

Crime against Women, domestic violence – physical abuse- verbal abuse – emotional abuse - economic abuse – minorities, dowry- harassment and death, code of conduct for work place, abetment of suicide.

Unit IV

(6 Hours)

Women Protective acts:

Protective legislation for Women in the Indian constitution- Anti dowry, SITA, PNDDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act.

Unit V

(6 Hours)

Women and Child welfare:

Safety provisions - various forms of mass media, radio, visual, internet, cyber space, texting, SMS and smart phone usage. Healing measures for the affected Women and child society by private and public sector, NGO and society.

Text Book:

1. Women's Rights (2021), Published by Kongunadu Arts & Science College, Coimbatore – 641 029.

Reference Books:

1. "Rights of Indian Women" by Vipul Srivatsava. Publisher: Corporate Law Advisor, 2014.
2. "Women's security and Indian law" by Harsharam Singh. Publisher: Aabha Publishers and Distributors, 2015.
3. "Women's Property Rights in India" by Kalpaz publications, 2016.

Programme Code: 23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : Non- Major Elective 3: Consumer Affairs			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2/15	30	2

Course Objectives

1. To familiarize the students with their rights and responsibilities as a consumer.
2. To understand the procedure of redress of consumer complaints.
3. To know more about decisions on Leading Cases by Consumer Protection Act.
4. To get more knowledge about Organizational set-up under the Consumer Protection Act.
5. To impart awareness about the Role of Industry Regulators in Consumer Protection.
6. To understand Contemporary Issues in Consumer Affairs.

Course Outcomes (CO)

K1 to K5	CO1	Able to know the rights and responsibility of consumers.
	CO2	Understand the importance and benefits of Consumer Protection Act.
	CO3	Apply the role of different agencies in establishing product and service standards.
	CO4	Analyze to handle the business firms' interface with consumers.
	CO5	Assess Quality and Standardization of consumer affairs

Unit I

[6 Hours]

Conceptual Framework - Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behavior: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

Unit II

[6 Hours]

The Consumer Protection Law in India - Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, and restrictive trade practice. Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

Unit III

[6 Hours]

Grievance Redressal Mechanism under the Indian Consumer Protection Law - Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

Unit IV

[6 Hours]

Role of Industry Regulators in Consumer Protection

- i. Banking: RBI and Banking Ombudsman
- ii. Insurance: IRDA and Insurance Ombudsman
- iii. Telecommunication: TRAI
- iv. Food Products: FSSAI
- v. Electricity Supply: Electricity Regulatory Commission
- vi. Real Estate Regulatory Authority

Unit V

[6 Hours]

Contemporary Issues in Consumer Affairs - Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energyratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview.

Note: Unit 2 and 3 refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified.

Teaching Methods

Smart Class Room/Power point presentation/Seminar/Quiz/Discussion/Flipped Class

SUGGESTED READINGS:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :- www.consumereducation.in
8. Empowering Consumers e-book, www.consumeraffairs.nic.in
9. ebook, www.bis.org
10. The Consumer Protection Act, 1986 and its later versions.

Question Paper Pattern

(External only)

Duration: 3 hours

Max: 75 marks

Section A

(5X5=25)

Short notes

Either – Or/ Type - Question from each unit

Section B

(5X10=50)

Essay type

Either – Or/ Type - Question from each unit

Extra Departmental Course

Programme Code:23	B.Sc. Computer Science with Data Analytics		
Title of the Paper : EDC: Internet Basics and Advanced Excel Laboratory			
Batch	Hours / Week	Total Hours	Credits
2021-2022	2/15	30	3

Course Objectives

1. Introduce the fundamentals of Internet and the Web functions.
2. Impart knowledge and essential skills necessary to use the internet and its various components.
3. Find, evaluate, and use online information resources.
4. Use Google Apps for education effectively and to Create and develop various forms in Google
5. To understand the concepts MS-Excel in advance

Course Outcomes (CO)

K3 to K5	CO1	Understand features of Internet and email
	CO2	Understanding and remember various menus in office automation
	CO3	Implementing the concepts of Internet techniques
	CO4	Using advanced formulas to crunch data and analyses it to get simpler answers.
	CO5	Interpretation and Analysis of Data and Visual Reporting

LIST OF PRACTICAL LIST

1. Create an email account in Gmail. Using the account created compose a mail to invite other college students for your college fest, enclose the invitation as attachment and send the mail to at least 50 recipients. Use CC and BCC options accordingly.
2. Create and share a folder in Google Drive using „share a link“ option and set the permission to access that folder by your friends only.
3. Create a registration form for your Department Seminar or Conference using Google Forms.
4. Create a online quiz with multiple-choice types of questions for a subject of your choice, using Google Forms.
5. Create student’s mark statement and share the Google sheets via link.
6. Create a Excel program to Perform Data Validation in Excel like Filters, Grouping, Sorting
7. Create a Excel program to Perform Various built in functions in Excel

8. To Perform IF and Nested Functions in Excel
9. To Perform AND, OR & NOT Logical
10. Create Sheet and Charts in Excel to analysis Student Mark of your Class
11. Create a mail merge using MS-Word.
12. Payroll calculation using MS-Excel.

Teaching Methods

Smart Classroom, PowerPoint Presentations, Discussions, Flipped Class, Assignment, Video Lectures

Guidelines to the distribution of marks for practical Examinations

Two questions will be given for each student (3 Hours / 50 Marks)

1. **Record Work:** 05 Marks.
2. **Algorithm, Program, Typing and Execution:** 45 Marks.

Particulars	Program I (Marks)	Program II (Marks)
Algorithm	5	5
Program Writing	15	10
Typing and Execution	5	5

Internal Mark Split up for 50 Marks:

Observation: 15 Marks

Attendance: 5Marks

One Model Practical: 30 Marks.

MAPPING					
PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	M
CO2	S	S	M	H	H
CO3	S	H	H	S	M
CO4	H	S	M	H	M
CO5	S	H	H	S	S
S – Strong H – High M – Medium L – Low					

Programme Code:23		B.Sc. Computer Science with Data Analytics		
Title of the Paper : Internship Training				
Batch: 2021-2022	Semester -	Hours / Week -	Total Hours -	Grade

Course objective

1. To provide an opportunity to work in industry/institute under the mentorship of an industrialpersonnel
2. To develop key skill sets that are industry relevant for future placements
3. To have a flavor of corporate life in an industry sector
4. To build strength, sprit of team work and self confidence
5. To prepare the students to comprehend industrial problem

Working Instructions

- The tutor of the respective class shall identify a list of industries/institutes at the beginning of the fourth semester and the same shall be approved by the HoD
- The tutor shall prepare a letter of request with the name of the student who will be placed in a particular industry and send the same or concurrence from the industry
- The class tutor shall ensure not more than four students allotted to a particular industry or institute
- The class tutor shall ensure that a daily log book provided to all the students while they leave for the internship during the summer vacation (The format of the log book will be available with the HoD)
- The tutor shall also ensure that the following documents are received from the students before they leave for the internship
 - i. The letter of undertaking from the concerned student
 - ii. A letter of undertaking from a parent/guardian indicating the willingness for permittingfor his/her ward to the internship either in Coimbatore or other places
 - iii. During the internship the student must be in contact with the tutor and shall send weeklyreport
 - iv. After the internship is completed the log books have to be submitted to the tutor whichhas to be verified

The tutor shall arrange for an evaluation in consultation with the HoD and grades be allotted.

Mark breakup for Evaluation

Component	Marks
Log book submission	20
Report	50
Review & Evaluation	30
Total	100

The students shall undergo Internship training / field work for a minimum period of 2 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the respective Faculty. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85 – 100	O
70 – 84	D
60 – 69	A
50 – 59	B
40 – 49	C
< 40	U (Reappear)