



ESTD : 1946

2022
OBE & CBCS

CURRICULUM

UNDER - GRADUATE PROGRAMME
Second Year

**Department of Computer Science
& Engineering
(2022 -2026)**

THE NATIONAL INSTITUTE OF ENGINEERING

(An Autonomous Institute under Visvesvaraya Technology University, Belagavi)

Recognized by AICTE, New Delhi

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The National Institute of Engineering, Mysuru

Department of Computer Science and Engineering

Vision

The department will offer, through best-in-class faculty and infrastructure, globally acceptable education in Computer Science and produce highly competent and value-based computer engineers.

Mission

1. To evolve into an outstanding department contributing significantly to teaching, research and consultancy in computer science in an integrated manner.
2. To develop state-of-the-art infrastructure and advanced computing facility in tune with requirement of industry and national projects.
3. To promote innovation and entrepreneurship to enhance competence of graduates of computer science.

Program Outcomes (POs)

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1: The ability to understand, analyze and develop software in the emerging areas for efficient use of computer –based systems of varying complexity.

PSO2: The ability to think logically and apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product.

Program Educational Objectives (PEOs)

PEO1: Acquire the necessary mathematical and scientific knowledge as well as basic managerial and financial procedures to analyze and solve real world problems within their work domain.

PEO2: Acquire the state-of-art knowledge in major areas of computing science like programming, networking, information security and algorithm development as well as technology solutions like cloud, database systems and mobile applications to enable them to succeed in pursuit of higher studies/ Industry/R&D activity.

PEO3: Have the ability and the mindset to continuously update and innovate.

PEO4: Have the necessary communication skills to be able to effectively communicate with technical experts and also non- technical end users.

The National Institute of Engineering

Scheme of Teaching and Examination

Effective from the Academic year 2023-24

Department: Computer Science and Engineering

B.E. in CSE (AI and ML) - 2022 Admitted Batch

Semester : III

Sl. No.	Type of Course	Course Code	Course Title	Teaching Department (TD)	Question Paper setting Board (PSB)	Teaching Hrs/Week				Examination				Credits
						L	T	P	S	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC/BSC	BCS301	Mathematics for Computer Science	TD: Maths	PSB: Maths	3	2	0	-	3	50	50	100	4
2	IPCC	BCS302	Digital Design & Computer Organization	TD: CS	PSB: CS	3	0	2	-	3	50	50	100	4
3	IPCC	BCS303	Operating Systems	TD: CS	PSB: CS	3	0	2	-	3	50	50	100	4
4	PCC	BCS304	Data Structures and Applications	TD: CS	PSB: CS	3	0	0	-	3	50	50	100	3
5	PCCL	BCSL305	Data Structures Laboratory	TD: CS	PSB: CS	0	0	2	-	3	50	50	100	1
6	ESC	BXX306X	ESC/ETC/PLC	TD: CS	PSB: CS	3	0	0	-	3	50	50	100	3
						OR								
						2	0	2	-					
7	UHV	BSCK307	Social Connect and Responsibility	TD: CS	PSB: CS	0	0	2	-	1	100	-	100	1
8	AEC/SEC	BXX358X	Ability Enhancement Course (AEC)	TD: CS	PSB: CS	If the course is a Theory					50	50	100	1
						1	0	0	-	1				
						If the course is a Laboratory								
						0	0	2	-	2				
9	MC	BNSK359	National Service Scheme (NSS)	NSS Coordinator		0	0	2	-	-	100	-	100	0
		BPEK359	Physical Education (PE) (Sports & Athletics)	PED										
		BYOK359	Yoga	Yoga Teacher										
Total											550	350	900	21

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K :This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

ESC/ETC/PLC		
(Note- Student should opt for the course which should not be similar to the course opted in 1st Year)		
Course Code	Course name	L:T:P:S
BCS306A	Object Oriented Programming with Java	2:0:2:0
BDS306B	Python Programming for Data Science	2:0:2:0
BDS306C	Data Analytics with R	2:0:2:0
BCS306C	Unix and Shell Programming	2:0:2:0
Ability Enhancement Course – III		
Course Code	Course name	L:T:P:S
BCS358A	Data Analytics with Excel	1:0:0:0 or 0:0:2:0
BAI358B	Ethics and Public Policy for AI	
BCS358C	Project Management with Git	
BAI358D	PHP Programming	
BCS358D	Data Visualization with Python	

Code: BCS301
Credits: 4
L:T:P – 3:2:0
SEE Hours: 3

Course: Mathematics for Computer Science
CIE: 50 Marks
SEE: 50 Marks
Total Marks: 100 Marks

Prerequisites if any	Mathematics1, Mathematics2
Learning objectives	1. To understand the concepts of Random Variables, Probability Distributions, Markov Chains and Queuing Systems. 2. To extract the maximum information about the population by examining the samples of the populations.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	To solve problems associated with discrete and continuous probability distributions of one or more variables	Apply
CO2	To solve problems associated with Markov chains and queuing systems	Apply
CO3	To study skewness and kurtosis for a given data and use the method of least squares to fit curves for a given data and solve problems on correlation and regression	Apply
CO4	To test the hypothesis for sampling distributions	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	-	-	-	3	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	1	-	-	-	-	-	-	-	-	2

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

Modules		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Combinatorics & Statistics				
1.1	Principles of Counting: The rules of Sum & Product, Permutations.	2	-	-
1.2	Combinations – Binomial & multinomial theorems	1	-	
1.3	Catalan Numbers, The Principle of Inclusion & Exclusion	1	-	
1.4	Derangements	1	-	
1.5	Measure of Skewness by Karl Pearson's	1	-	
1.6	Kurtosis moments, Skewness from third moment	1	-	
1.7	Curve Fitting – Straight line & exponential curves	1	-	
1.8	Correlation, Regression	1	1	
1.9	Multiple Correlation & Regression	1	1	
Module – 2: Basic Probability Theory				
2.1	Probabilistic models, conditional probability	2	1	-
2.2	Mutually Exclusive, Independence Events	1	-	
2.3	Total probability, Baye's theorem	1	1	
2.4	Counting Random Variables – Probability Mass Function	2	-	-
2.5	Mathematical Expectations, Moment Generating Functions	1	-	
2.6	Discrete distributions: Binomial, Poisson Distribution	3	-	

Module – 3: Random Variables				
3.1	Random Variable examples	1	1	-
3.2	Independence, Distribution functions	1	-	
3.3	Great expectations	1	-	
3.4	Linearity of expectations	1	1	
3.5	Really great expectations	1	-	
Module – 4: Markov Chains				
4.1	Markov chains – Probability vector	2	1	-
4.2	Stochastic matrix	2	-	
4.3	Transition probability matrix	1	-	
4.4	Concept of Queuing – M/M/1 Queuing System	3	1	
Module – 5: Sampling Theory				
5.1	Population & Sampling	2	-	-
5.2	Sampling distributions, statistical estimation	1	-	
5.3	Statistical decisions: TypeI & TypeII errors	1	1	
5.4	Level of Significance, One-Tailed Tests	1	-	
5.5	t-Distribution	1	-	
5.6	Chi-square distribution	1	1	
<i>Total No. of Lecture Hours</i>		40	-	
<i>Total No. of Tutorial Hours</i>			10	
<i>Total No. of Practical Hours</i>				00

Textbook:

1. Introductory probability and statistical applications, Paul L Meyer, Oxford and IBH publishing co.pvt. Ltd, New Delhi, 1965.
2. Mathematics for Computer Science, Eric Lehman, F. Thomson Lighton, Albert R Meyer, MIT, USA

Reference Book:

1. Probability and Stochastic processes, Roy D Yates, David J Goodman, Wiley publication, 3rd edition, 2022.
2. Advanced engineering mathematics, Erwin Kreyszig, 8th edition, Wiley publication, 2017.

Online Resources:

1. <https://www.youtube.com/watch?v=KbB0FjPg0mw&list=P L2SOU6wwx B0uwwH80KT Q6ht66KWxbzTlo>

Code: BCS302
Credits: 4
L:T:P - 3:0:2
SEE Hours: 3

Course: Digital Design & Computer Organization
CIE: 50 Marks
SEE: 50 Marks
Total Marks:100

Prerequisites if any	Fundamentals of Logic
Learning objectives	<ol style="list-style-type: none"> 1. To provide the knowledge to explain the fundamentals of Logic circuits and combinational circuits. 2. To introduce the design of sequential circuit systems, Registers and Counters 3. The basics involved in number representation and arithmetic operations in the computer system. 4. Basic processor concept, instruction execution and Bus architecture, Memory architecture and mapping techniques.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Use logic minimization techniques and design combinational circuits using logic gates.	Apply
CO2	Design and analyze sequential circuits systems, Registers and Counters.	Apply
CO3	Use algorithms to perform fast multiplication, division and to represent floating point numbers in binary.	Apply
CO4	Explain the basic processing unit and design of control system, memory architecture and mapping techniques.	Understanding

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	1	1	-	1	-	2
CO2	3	3	2	1	1	-	-	-	1	1	-	1	-	2
CO3	3	2	2	-	-	-	-	-	2	2	-	1	-	3
CO4	3	2	2	-	-	-	-	-	2	2	-	1	-	3

Mapping Strength: **Strong- 3** **Medium - 2** **Low - 1**

Course Structure

Module 1-Combinational Circuits		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	Simplification of Boolean Functions: The Map Method, Two-and Three Variable Maps, Four- Variable Maps, Don't-Care Conditions	2	0	-
1.2	Combinational Logic: Adders, Subtractors	2	0	2
1.3	Binary Parallel Adder, Decimal Adder	3	0	1
1.4	Decoders, Multiplexer	3	0	2
Module 2-Sequential Circuits				
2.1	Sequential Logic: Introduction, Flip-Flops, Triggering of Flip Flops	2	0	2
2.2	Analysis of Clocked Sequential Circuits	2	0	-
2.3	State Reduction and Assignment	1	0	-
2.4	Design Procedure	1	0	-
2.5	Registers, Counters: Introduction, Registers	1	0	-
2.6	Shift Registers, Ripple-Counters	2	0	1
2.7	Synchronous & Asynchronous Counters.	1	0	2
Module 3-Arithmetic Unit				
3.1	Arithmetic unit: Multiplication of Positive numbers A signed operand multiplication	2	0	-
3.2	Bit pair recoding of multipliers, carry save addition of summands	3	0	-
3.3	Integer division, IEEE standard for floating point numbers.	2	0	-
Module 4-The Processor				
4.1	The Processor: Fundamental concepts	1	0	-
4.2	Execution of complete instruction, Multiple-Bus organization	2	0	-
4.3	Hardwired control unit and Micro programmed control unit	4	0	-

Module 5-Memory Unit				
5.1	Memory Unit: Basic concepts, Internal organization of memory chips, Structure of larger memory.	3	0	-
5.2	Cache memories, Mapping functions	3	0	-
<i>Total No. of Lecture Hours</i>		40	-	-
<i>Total No. of Tutorial Hours</i>			00	-
<i>Total No. of Practical Hours</i>				10

Integrated Lab Component: Digital Design & Computer Organization		
Sl. No	COs	<u>PART-A</u> <u>HARDWARE</u>
1.	CO1	a) Implement Half adder and Full adder using logic gates. b) Implement Half subtractor, Full subtractor using logic gates
2.	CO1	Implement BCD to Excess-3 using basic gates.
3.	CO1	Realize a full adder or any Boolean function using 3:8 decoder IC.
4.	CO1	Given any four variable logic expression, realize the simplified logic expression using 8:1 multiplexer
5.	CO2	Realize a JK master Slave Flip- Flop and verify its truth table.
6.	CO2	Realize mod-4 and mod-6 counter using Synchronous counter design
<u>PART-B</u> <u>SIMULATION USING XILINX</u>		
1.	CO1	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioural model.
2.	CO1	Write a VHDL code for a Half –Adder , Simulate and verify its working.
3.	CO1	Write a VHDL code for a Full –Adder , Simulate and verify its working.
4.	CO1	Write a VHDL code for a Full –Subtractor, Simulate and verify its working.
5.	CO1	Write a VHDL code for 2:1, 4:1 and 8:1 multiplexer , Simulate and verify its working.
6.	CO2	Write a VHDL code for a SR, D and JK flip flop , Simulate and verify its working.

Text Books:

1. **Digital Design:** M. Morris Mano, Pearson (2013), new print 5th edition
2. **Computer Organization:** C Hamacher, Z Vranesic, S Zaky:, Tata McGraw Hill, 5th Edition, 2011.

Reference Books:

1. **Computer Architecture A Quantitative Approach:** John L Hennessy, David A Patterson, Elsevier, 5th Edition 2012.
2. **The Elements of Computing System – Building the Modern Computer from First Principles:** Noam Nisan, Shimon Schocken, The MIT Press (2005).
3. **Digital Principles and Applications:** Donald P Leach, Albert Paul Malvino & Goutham Saha, TMH, 6th Edition, 2006.

Online Resources:

1. **NPTEL:** Switching Circuits and logic design
https://onlinecourses.nptel.ac.in/noc21_cs64
2. **NPTEL:** Computer Organization and Architecture A Pedagogical Aspect
https://onlinecourses.nptel.ac.in/noc19_cs04/preview
3. Edx: Computation Structures 3:Computer Organization
<https://www.edx.org/course/computation-structures-3-computer-mitx-6-004-3x0>
4. **Coursera:** Digital Systems - <https://www.coursera.org/learn/digital-systems>

Code: BCS303
Credits: 4
L:T:P - 3:0:2
SEE Hours: 3

Course: Operating Systems
CIE: 50 Marks
SEE: 50 Marks
Total Marks: 100

Prerequisites if any	None
Learning objectives	<ol style="list-style-type: none"> To demonstrate the need for Operating Systems. To discuss about Process Scheduling, Memory management and Deadlock concepts.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the process management policies, Process scheduling and the concepts of Process synchronization.	Understanding
CO2	Discuss various strategies of Memory Management; Paging and Segmentation.	Apply
CO3	Demonstrate the different Page Replacement Techniques and identify the design issues in paging.	Apply
CO4	Discuss suitable techniques to handle deadlock situations.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	2	2	2
CO2	2	2	2	-	2	-	-	-	-	-	-	2	2	2
CO3	3	2	2	-	2	-	-	-	-	-	-	2	2	2
CO4	2	3	2	-	2	-	-	-	-	-	-	2	2	2

Mapping Strength: **Strong- 3** **Medium - 2** **Low - 1**

Course Structure

Module – 1: Processes, Threads and Scheduling		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	Introduction: what is an operating system? The Operating system as an extended machine, The Operating system as a resource manager	1	-	-
1.2	System calls for process Management	1	-	1
1.3	Processes: The process model, Process creation, Process termination	1	-	-
1.4	Process hierarchies, Process states.	1	-	-
1.5	Threads: Thread Usage, Thread Model	1	-	-
1.6	Implementing threads in user space, implementing threads in the kernel. Hybrid implementations	1	-	-
1.7	Scheduling: Introduction to scheduling, Scheduling in Batch Systems (FCFS, SJF, SRTN)	2	-	1
1.8	Scheduling in interactive systems: Priority based Scheduling, Round robin Scheduling	1	-	2
1.9	Guaranteed, Lottery and Fair Share Scheduling	1	-	-
Module – 2: Interprocess Communication				
2.1	Interprocess communication: Race conditions, Critical regions	1	-	-
2.2	Mutual exclusion with busy waiting	1	-	-
2.3	Sleep and wakeup	1	-	-
2.4	Semaphores	1	-	1
2.5	Mutexes, Message Passing	1	-	-
2.6	Classical IPC problems: The dining philosophers' problem	1	-	-
2.7	The Readers and Writers problem.	1	-	-

Module – 3: Memory Management				
3.1	Memory Management: Background	1	-	-
3.2	Swapping	1	-	-
3.3	Contiguous Memory Allocation	1	-	1
3.4	Paging	1	-	-
3.5	Structure of the page Table	1	-	-
3.6	Segmentation.	1	-	-
3.7	Virtual Memory: Background; Demand Paging, copy-on write	1	-	-
3.8	Thrashing	1	-	-
Module – 4: Page replacement Algorithms and Design Issues				
4.1	Page Replacement Algorithms: The optimal page replacement algorithm	1	-	-
4.2	The not recently used page replacement algorithm	1	-	-
4.3	The first-in first-out.	1	-	1
4.4	The second chance page replacement algorithm	1	-	-
4.5	The clock page replacement algorithm, The least recently used page replacement Algorithm.	1	-	1
4.6	Design issues for paging systems: Local versus Global allocation policies, Load control, Page size	1	-	-
4.7	File system implementation: File System Layout, Implementing Files	1	-	-
4.8	Implementing Directories.	1	-	-
Module – 5: Deadlocks				
5.1	Deadlocks: Introduction to deadlocks: Conditions for deadlock, Deadlock modeling.	1	-	-
5.2	Deadlock detection and recovery: Deadlock detection with one resource of each type,	1	-	1
5.3	Deadlock detection with multiple resource of each type, Recovery from deadlock.	1	-	-
5.4	Deadlock avoidance: Resource trajectories, Safe and Unsafe States, The Banker's algorithm for a single resource,	1	-	1
5.5	The banker's algorithm for multiple resources.	1	-	1
5.6	Deadlock prevention: Attacking the Mutual-Exclusion Condition, Attacking the Hold-and-Wait condition, Attacking the No-Preemption condition, Attacking the Circular Wait condition	1	-	-
5.7	Issues: Two phase locking, Starvation	1	-	-
Total No. of Lecture Hours		40	-	-
Total No. of Tutorial Hours			00	-
Total No. of Practical Hours				10

Integrated Lab Programs:

Sl. No.	Programs	COs
1.	Implement the process system calls fork (), exec () and wait ()	CO1
2.	a) Implement FCFS (First Come First Serve) scheduling algorithm b) Implement SJF (Shortest Job First) scheduling algorithm.	CO1
3.	Implement Priority Scheduling algorithm.	CO1
4.	Implement Round Robin Scheduling algorithm.	CO1
5.	Write a program to implement Producer-Consumer Problem using semaphores.	CO1
6.	Implement Memory Allocation methods for Fixed partition using First Fit, Worst Fit, Best Fit	CO2
7.	Write a program to implement FIFO page replacement algorithm.	CO3
8.	Write a program to implement LRU page replacement algorithm.	CO3
9.	Write a program to detect Deadlock.	CO4
10.	Write a program to implement Banker's algorithm for Deadlock avoidance.	CO4

Textbooks:

1. **Modern Operating systems, 4th Edition**, Andrew S.Tanenbaum, Herbert Bos, Pearson Education Limited; Global Edition. (**MODULE1, MODULE 2, MODULE 4, MODULE 5**)
2. **Operating System Concepts** – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley- India, **8th edition (MODULE 3)**

Note: Refer **Text book no.2** for problems on Process scheduling and Page Replacement Algorithms

Reference Books:

1. Operating Systems, William Stallings, PHI, Fourth Edition
2. Operating Systems, Milan Kovic, Tata McGraw Hill, 2001.
3. Operating System Design: v. 1: The Xinu Approach (Prentice-hall Software) Douglas Comer.
4. TUNIX Operating Systems: A Practical Approach, Robert Switzer, Prentice-Hall, 1993.

Online Resources:

1. <http://www.nptel.ac.in/courses/106108101/>

Course Code: BCS304
Credits: 3
L:T:P: 3:0:0
SEE Hours: 3

Course: Data Structures and Applications
CIE: 50 Marks
SEE: 50 Marks
Total Marks: 100

Prerequisites if any	Problem Solving through Programming
Learning objectives	<ul style="list-style-type: none"> • Understand the fundamentals of data structures for problem solving, including linear structures like linked lists, stacks, and queues. • Apply non-linear data structures such as trees, sorting algorithms, and hash functions to solve real-world problems.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apply the concepts of pointers and structures in problem solving.	Apply
CO2	Use different types of linked lists to solve problems.	Apply
CO3	Demonstrate stack and queue data structures to solve problems.	Apply
CO4	Illustrate the operations performed on tree data structures, hash functions for problem solving.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	2	1	1
CO2	3	2	3	-	-	-	-	-	-	-	-	2	3	3
CO3	3	2	3	-	-	-	-	-	-	-	-	2	3	3
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	3

Mapping Strength: 3 – Strong 2 – Medium 1 – Low

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours
Module – 1 Pointers and Data Structures Fundamentals			
1.1	Pointers: Introduction	1	0
1.2	Structures, Nested Structures, Arrays of Structures	2	0
1.3	Structures and Functions, Self-Referential Structures	2	0
1.4	Introduction to Data Structures , Classification of data structures, Operations on data structures, Abstract data type	1	0
Module – 2 Linked Lists			
2.1	Linked Lists - Singly linked lists	3	0
2.2	Circular linked lists	2	0
2.3	Doubly linked lists	2	0
2.4	Circular doubly linked lists	2	0

Module – 3 Stacks and Queues			
3.1	Stacks: Introduction, Array Representation of Stacks	1	0
3.2	Operations on a Stack, Linked Representation of Stacks	1	0
3.3	Applications of Stacks: Conversion of an infix expression into a postfix expression, Evaluation of a postfix expression, Recursion.	3	0
3.4	Queues: Introduction, Array Representation of Queues, Linked Representation of Queues	2	0
3.5	Types Of Queues: Circular Queue, Priority Queues	2	0
Module – 4 Trees			
4.1	Trees: Introduction, Types of Trees	1	0
4.2	Traversing A Binary Tree,	1	0
4.3	Binary Search Trees, Operations on Binary Search Trees	3	0
4.4	Threaded Binary Trees: One-way Threading,	1	0
4.5	AVL Tree, Binary Heaps operations	3	0
Module – 5 Sorting and Hashing			
5.1	Sorting: Introduction to Sorting , Radix Sort , Heap Sort	2	0
5.2	Hashing and Collision: Introduction, Hash Tables, Different Hash Functions, Collisions, Pros and Cons of Hashing, Applications of Hashing	5	0
<i>Total No. of Lecture Hours</i>		40	
<i>Total No. of Tutorial Hours</i>			-

Text Books:

1. “**Data Structures using C**”, Reema Thareja, 2nd Edition, 2018, Oxford University Press.
2. “**Data Structures using C**”, Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, 2014, low price edition, Pearson education.

Reference Books:

1. Richar F Gilberg and Behronz A Forouzan, “**Data Structures, A Pseudocode Approach with C**”, 2nd Edition, 2012, Thomson.
2. Horowitz, Sahni, Anderson-Freed, “**Fundamentals of Data Structures in C**”, 2nd Edition, 2011, Universities Press.

Online Resources:

1. NPTEL: Programming and Data structures- <https://nptel.ac.in/courses/106/105/106105085/>
2. Coursera: Data Structures - <https://www.coursera.org/learn/data-structures>
3. Programming & Data structures: <http://nptel.ac.in/courses/106106130/>
4. Programming, Data structures and Algorithms: <http://nptel.ac.in/courses/106106133/>

Course Code: BCSL305
Credits: 1
L:T:P: 0:0:2
SEE Hours: 2

Course: Data Structures Laboratory
CIE: 50 Marks
SEE: 50 Marks
Total Marks: 100

Prerequisites if any	Fundamentals of C programming
Learning objectives	<ul style="list-style-type: none"> To gain proficiency in applying advanced C concepts, such as pointers and dynamic memory allocation, for analyzing and solving complex problems. To gain a comprehensive understanding of different data structures, including linked lists, stack, queue, binary trees, sorting algorithms, and hashing, enabling students to analyze, compare, and apply them effectively in various problem-solving contexts.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apply concepts, such as pointers and dynamic memory allocation, to analyze and solve complex problems.	Apply
CO2	Create and evaluate different types of linked lists to develop robust and efficient applications.	Apply
CO3	Demonstrate the ability to analyze, compare, and apply stack, queue, binary tree, sorting, and hashing data structures for problem-solving in various contexts.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	1	-	-	-	2	1	1
CO2	3	2	3	-	-	-	-	1	-	-	-	2	3	3
CO3	3	2	3	-	-	-	-	1	-	-	-	2	3	3

Mapping Strength : 3 – Strong 2 – Medium 1 – Low

List of Experiments

SL.No	CO	Experiment
1.	CO1	(a) Write a program to accept 3 integers and find the maximum among 3 numbers using functions and pointers. (b) Write a C program using pointer for searching the desired element from the array using pointers. (c) Write a program to find the maximum element in each row of the matrix using pointers.

2.	CO1	<p>(a) Write a C program to read and display the Time in specified format. Create a structure called TIME with hour (int), minute(int), second(int) and next(self-referencing pointer) as its members. Dynamically create two variables of structure TIME and link the first variable to the second one and display it. Write a Display function that takes address of first TIME variable and displays both times in the format h:m:s.</p> <p>(b) Write a C program to read and display the student details. Define a structure 'Student' with fields name(string) , usn(int), marks of 3 subjects (int) and average(float) in it. Store the details of n students in an array of structure 'Student'. Display the details of all students in the descending order their total marks.</p>
3.	CO2	<p>(a) Write a C program using dynamic variables and pointers, to construct a singly linked list. The operations to be supported are:</p> <ol style="list-style-type: none"> i) Insert at the front of a list. ii) Insert at any position in the list. iii) Deleting a node based on specified value. iv) Searching a node based on specified value. v) Displaying all the nodes in the list. <p>(b) Write a C program to reverse a linked list elements.</p>
4.	CO2	<p>Write a C program to support the following operations on a doubly linked list where each node consists of integers.</p> <ol style="list-style-type: none"> i) Create a doubly linked list by adding each node at the front. ii) Insert a new node to the left of the node whose key value is read as an input. iii) Delete the node of a given data, if it is found, otherwise display appropriate message. iv) Display the contents of the list.
5.	CO3	<p>Write a program to design, Develop and Implement a menu- driven program in C for the following operations on STACK of integers (Array implementation of the stack with maximum size MAX = 4).</p> <ol style="list-style-type: none"> i) Push an element on to stack. ii) Pop an element from the stack. iii) Check Overflow and Underflow situations on the stack. iv) Display the contents of stack. v) Exit. <p>Support the program with appropriate functions for each of the above operations.</p>
6.	CO3	<ol style="list-style-type: none"> a) Write a C program to convert an expression given in “infix” form to “postfix” form using stack concept. b) Check whether a given string is a palindrome or not by using a stack. c) Write a program to find the nth term in the Fibonacci series using recursion.
7.	CO3	<ol style="list-style-type: none"> a) Write a C program to simulate the working of a queues using an array provide and implement the following operations: <ol style="list-style-type: none"> i) Insert ii) Delete iii) Display Assume that the size of the queue is 5. b) Write a C program to implement a circular queue using linked lists.
8.	CO3	<ol style="list-style-type: none"> a) Write a C program to construct a binary search tree of integers and also display the elements in the tree using Inorder, Preorder and Postorder traversals. b) Write a C program to find the number of leaf nodes in a BST c) Write a C program to print all root to leaf paths of a BST.
9.	CO3	<ol style="list-style-type: none"> a) Write a C program to sort set of integers using radix sorting technique. b) Write a C program to search using closed hashing.

Text Books:

1. **“Data Structures using C”**, Reema Thareja, 2nd Edition, 2018, Oxford University Press.
2. **“Data Structures using C”**, Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, 2014, low price edition, Pearson education.

Reference Books:

1. Aaron M Tenenbaum, YedidyahLangsam and Moshe J Augenstein, **“Data Structures using C”**, 2014, low price edition,Pearson education,.
2. Richar F Gilberg and Behronz A Forouzan, **“Data Structures, A Pseudocode Approach with C”**, 2nd Edition,2012, Thomson.
3. Horowitz, Sahni, Anderson-Freed, **“Fundamentals of Data Structures in C”**, 2nd Edition 2011, Universities Press.

Online Resources:

1. NPTEL: Programming and Data structures- <https://nptel.ac.in/courses/106/105/106105085/>
2. Coursera: **Data Structures** - <https://www.coursera.org/learn/data-structures>
3. **Programing & Data structures:** <http://nptel.ac.in/courses/106106130/>
4. **Programming, Data structures and Algorithms:** <http://nptel.ac.in/courses/106106133/>

ENGINEERING SCIENCE COURSE (ESC/ ETC/ PLC)

Code: BCS306A
Credits: 3
L:T:P - 2:0:2
SEE Hours: 3

Course: Object Oriented Programming with Java
CIE: 50 Marks
SEE: 50 Marks
Total Marks: 100

Prerequisites if any	C programming
Learning objectives	<ol style="list-style-type: none"> 1. Distinguish Object-Oriented programming paradigm from Procedure-Oriented Programming 2. Use the Java programming language for various programming technologies.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Develop Java programs using Object-Oriented paradigm	Understanding
CO2	Demonstrate Java code utilities in packages, interfaces and String class	Apply
CO3	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	1	-	-	-	-	-	-	-	3	-
CO2	3	3	3	2	1	-	-	-	-	-	-	-	2	2
CO3	3	3	2	1	1	-	-	-	-	-	-	-	3	1

Mapping Strength: **Strong- 3** **Medium - 2** **Low - 1**

Course Structure

Module – 1: Introduction to Object Oriented development		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	What is Object Orientation? What is OO development? OO themes	1	-	-
1.2	Evidence for usefulness of OO development; OO modeling history	1	-	-
1.3	Modeling as Design Technique: Modeling; abstraction	1	-	-
1.4	The three models. Class Modeling: Object and class concepts	1	-	2
1.5	Link and associations concepts; Generalization and inheritance	1	-	-
Module – 2: Java & JDK				
2.1	Java's magic: Byte code; Java Development Kit(JDK)	1	-	-
2.2	The Java Buzzwords, Simple Java programs	1	-	-
2.3	Datatypes, arrays, Control Statements	1	-	1
2.4	Classes :Classes fundamentals; Declaring objects	1	-	1
2.5	Constructors	1	-	1
2.6	This keyword, garbage collection	1	-	-
Module – 3: Inheritance				
3.1	Inheritance: inheritance basics, using super	1	-	1
3.2	Creating multi-level hierarchy, method overriding	2	-	1
Module – 4: Packages & Interfaces				
4.1	Packages	1	-	1
4.2	Access Protection in packages	1	-	1
4.3	Importing Packages	1	-	1

4.4	Interfaces: references and variables, Default Interface methods	2	-	1
4.5	Exception handling in Java - fundamentals	1	-	-
Module – 5: Threads				
5.1	Multi-Threaded Programming: What are threads?	1	-	1
5.2	How to make the classes ‘threadable’	1	-	1
5.3	Extending threads; Implementing ‘runnable’	1	-	1
5.4	Thread Synchronization	2	-	1
<i>Total No. of Lecture Hours</i>		25	-	-
<i>Total No. of Tutorial Hours</i>			00	-
<i>Total No. of Practical Hours</i>				15

Integrated Lab Programs:

Sl. No.	Programs	COs
1.	Develop basic Java programs using command-line arguments.	CO1
2.	Demonstrate Object-Oriented concepts in Java.	CO1
3.	Illustrate various forms of inheritance, method overloading and overriding.	CO1
4.	Create, import packages and use access protection.	CO2
5.	Demonstrate use of interfaces.	CO2
6.	Illustrate exception handling mechanism.	CO3
7.	Create customized exceptions.	CO3
8.	Demonstrate multithreaded programming.	CO3
9.	Illustrate usage of String class.	CO2

Textbook:

1. Herbert Schildt, *Java The Complete Reference-Eleventh Edition*, McGraw Hill; 11th Edition.

Reference Book:

1. Dr. R. Nageswara Rao, Core Java, An Integrated Approach, Dream tech Press, 2016.
2. Mahesh Bhawe and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008
3. Rajkumar Buyya, S Thamarai selvi, xing chenchu, Object oriented Programming with java, Tata McGraw Hill Education Private Limited, 2009
4. Richard A Johnson, An Introduction to Java Programming and Object-Oriented Application Development, Delmar Cengage Learning, 2007.
5. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education/ PHI, 2007.

Online Resources:

1. Udacity Free Course
<https://www.udacity.com/course/java-programming-basics--ud282>
 - Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu):
 - <https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/>
 - Java Tutorial: <https://www.w3schools.com/java/>
 - Java Tutorial: <https://www.javatpoint.com/java-tutorial>
 - Java Tutorial: <https://www.geeksforgeeks.org/java/>

Code: BDS306B**Course: Python Programming for Data Science****Credits: 3****CIE: 50 Marks****L:T:P - 2:0:2****SEE: 50 Marks****SEE Hours: 3****Total Marks: 100**

Prerequisites if any	Mathematics and Statistics Fundamentals
Learning objectives	<ul style="list-style-type: none"> To understand Python constructs and use them to build the programs. To analyse different conditional statements and their applications in programs. To learn and use basic data structures in python language. To learn and demonstrate array manipulations by reading data from files To understand and use different data in a data analytics context.

Course Outcomes:*On the successful completion of the course, the student will be able to*

COs	Course Outcomes	Bloom's level
CO1	Demonstrate proficiency in Python programming concepts, including data types, variables, control structures, and functions, enabling them to write clean and efficient code for AI and ML tasks.	Understanding
CO2	Apply Python libraries and frameworks, such as NumPy, Pandas, and Scikit-learn, to preprocess data, extract features, train machine learning models, and evaluate model performance for AI and ML applications.	Apply
CO3	Design and develop end-to-end AI and ML solutions using Python, including data acquisition, data preprocessing, model implementation, and deployment.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	3	3	3	-	-	-	-	-	-	3	3	3
CO3	2	2	3	3	3	-	-	-	-	-	-	3	3	3

Mapping Strength: Strong – 3 Medium – 2 Low – 1**Course Structure**

No.	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1 – Introduction to Python				
1.1	Introduction to python., data types in python	1	-	-
1.2	Elements of python language, python block structure, variables and assignment statement	2	-	2
1.3	Operations, simple input/output print statements	1	-	3
1.4	Formatting print statement.	1	-	-
Module – 2: AI and Machine Learning with Python				
2.1	Decision structure: forming conditions, if statement, the if-else and nested if-else	1	-	2
2.2	looping statements: introduction to looping	2	-	2
2.3	python built in functions for looping	1	-	1
2.4	Loop statements, jump statement.	1		
Module – 3: Advanced Topics in Python for AI & ML				
3.1	Lists: lists, operation on list	1	-	3
3.2	Tuples: introduction, creating, indexing and slicing	1	-	1
3.3	Operations on tuples. sets: creating, operation in sets	1	-	1
3.4	introduction dictionaries, creating, operations	1	-	-
3.5	Nested dictionary, looping over dictionary.	1	-	-
Module – 4: Introduction to NumPy				
4.1	The NumPy Library: Nddarray: the heart of the library, Basic operations, indexing, slicing and iterating,	1	-	-

4.2	Conditions and boolean arrays, array manipulation, general concepts, reading and writing array data on files.	1	-	-
4.3	The pandas Library: an introduction to Data structure	1	-	-
4.4	Other functionalities on indexes	1	-	-
4.5	Operations between data structures function application and mapping.	1	-	-
Module – 5: Introduction to Pandas				
5.1	The pandas : Reading and Writing data: i/o API tools, CSV and textual files,	1	-	-
5.2	Reading data in CSV or text files, reading and writing HTML files, reading data from XML files, Microsoft excel files, JSON data, and Pickle python object serialization.	1	-	-
5.3	Pandas in Depth: data manipulation: data preparation, concatenating data transformation discretization binning	1	-	-
5.4	Permutation, string manipulation, data aggregation group iteration.	2	-	-
Total No. of Lecture Hours		25	-	-
Total No. of Tutorial Hours			00	-
Total No. of Practical Hours				15

Practical Component

Sl.NO	COs	List of Experiments
1	CO1	<p>Introduction to Python:</p> <p>(a) Write a program that takes user input for their name and age and displays a personalized greeting message along with their age after 10 years.</p> <p>(b) Create a program that generates a random password for the user, combining uppercase and lowercase letters, numbers, and special characters. The user should be able to specify the length of the password.</p>
2	CO1	<p>Control Flow and Data Structures:</p> <p>(a) Write a program that prompts the user to enter a list of numbers and determines the sum of all even numbers in the list.</p> <p>(b) Create a program that reads a sentence from the user and determines the frequency of each word in the sentence. Display the word frequency in descending order.</p>
3	CO1	<p>Functions and Modules:</p> <p>(a) Write a program that defines a function to calculate the factorial of a given number and then asks the user for input to compute and display the factorial.</p> <p>(b) Create a program that imports the `numpy` library and defines a function to calculate the mean and standard deviation of a list of numbers. The program should ask the user for input and display the mean and standard deviation of the entered numbers.</p>
4	CO2	<p>Introduction to AI and ML:</p> <p>(a) Write a program that uses a decision tree algorithm to classify whether a given email is spam or not based on features like word frequency and email metadata.</p> <p>(b) Develop a program that predicts the price of a used car based on features like mileage, brand, and age using a regression algorithm.</p>
5	CO2	<p>Data Preprocessing and Visualization:</p> <p>(a) Create a program that reads a dataset of student scores, removes any missing values, and normalizes the scores to a common scale.</p> <p>(b) Write a program that visualizes the distribution of ages in a dataset of survey responses using a histogram.</p>
6	CO3	<p>Machine Learning Algorithms in Python:</p> <p>(a) Implement a program that uses the K-means clustering algorithm to group a dataset of customer purchases into different market segments.</p> <p>(b) Develop a program that performs dimensionality reduction on a dataset of images using Principal Component Analysis (PCA).</p>
7	CO3	<p>Deep Learning and Neural Networks:</p> <p>(a) Write a program that uses a feed forward neural network to classify handwritten digits from the MNIST dataset.</p> <p>(b) Develop a program that trains a convolutional neural network (CNN) to classify images from the CIFAR-10 dataset.</p>
8	CO3	<p>Natural Language Processing:</p> <p>(a) Create a program that performs sentiment analysis on a collection of tweets, classifying them as positive, negative, or neutral.</p> <p>(b) Write a program that extracts named entities from a given text using a named entity recognition (NER) model.</p>

9	CO3	<p>AI and ML Model Deployment:</p> <p>(a) Implement a program that deploys a trained ML model as a web API using Flask, allowing users to make predictions through HTTP requests.</p> <p>(b) Develop a program that deploys a sentiment analysis model as a chatbot, enabling users to interact with the model through a user-friendly interface.</p>
10	CO3	<p>Project-based experiments (Students can choose any one of the following)</p> <p>(a) Sentiment Analysis on Movie Reviews: Implement a program that performs sentiment analysis on a collection of movie reviews. Use a dataset of labeled movie reviews and build a machine learning model to classify the sentiment (positive or negative) of each review. Display the overall sentiment analysis results and provide insights on the sentiment distribution.</p> <p>(b) Image Classification with Custom Dataset: Create a program that allows users to build an image classifier for a custom dataset. The program should provide functionalities to collect and organize images into different classes or categories. Train a machine learning model, such as a convolutional neural network (CNN), on the custom dataset. Allow users to test the trained model on new images and display the predicted classes.</p> <p>(c) Text Generation with Recurrent Neural Networks: Develop a program that generates text based on a given input. Use recurrent neural networks (RNNs), such as LSTM or GRU, to learn patterns from a large text corpus. Train the model on the text data and allow users to input a few starting words or phrases. Generate and display a continuation of the text based on the learned patterns.</p>

Textbook:

1. Python for Data Analysis, Wes McKinney, O'Reilly, 2nd Edition, 2017.
2. Python Data Science Handbook, Jake VanderPlas, O'Reilly, 1st Edition, 2016.

Online Resources:

1. <https://wesmckinney.com/book/>
2. <https://jakevdp.github.io/PythonDataScienceHandbook/>

Code: BCS306C
Credits: 3
L:T:P - 2:0:2
SEE Hours: 3

Course: Unix and Shell Programming
CIE: 50 Marks
SEE: 50 Marks
Total Marks:100

Prerequisites if any	Programming Fundamentals and Operating System Knowledge
Learning objectives	<ol style="list-style-type: none"> 1. Develop a solid understanding of Unix fundamentals, including the file system structure, navigation, and permissions, enabling efficient interaction with the Unix environment. 2. Acquire proficiency in shell scripting and system administration tasks, empowering the ability to automate processes, manage users and groups, and utilize advanced shell features for practical applications.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apply effective navigation and interaction skills within the Unix operating system, demonstrating comprehension of its file system hierarchy, file types, and permissions.	Apply
CO2	Create and execute proficient shell scripts, employing variables, control structures, and conditional statements for automated task execution.	Analyze
CO3	Execute system administration tasks, manage user accounts, implement process management techniques, and employ networking commands in a Unix environment, showcasing the application of advanced skills.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	3	1	-	2	-	-	-	-	1	1
CO2	2	2	-	3	3	-	-	-	-	-	-	-	2	2
CO3	2	-	-	2	3	-	-	-	-	-	-	-	2	2

Mapping Strength: Strong- 3 Medium - 2 Low - 1

Course Structure

Module – 1: Introduction and File Systems		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1.1	Background and Basic Commands, Introduction: Why UNIX, The UNIX environment, UNIX structure, Accessing UNIX, basic commands, other useful commands	2	-	1
1.2	File Systems: File names, File Types, Regular files, Directories, File System Implementation, Operations unique to directories, Operations unique to Regular files, Operations common to both.	3	-	2
Module – 2: Security and filters				
2.1	Security and File Permission: Users and groups, Security levels, Changing Permissions, User Masks, Changing Ownership and Group. Introduction to Shell	2	-	1
2.2	Filters: Filters and Pipes, Concatenating Files, Display Beginning and End of Files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words, or Lines	3	-	2
Module – 3: Regular expressions				
3.1	Communications: User Communication, Electronic Mail, File Transfer.	2	-	1
3.2	Regular Expressions and grep: Atoms, Operators, Operations, grep family, Examples, Searching for file content.	2	-	1
3.3	Awk: Execution, Fields and Records, Scripts, Operations, Patterns, Actions	2	-	1
Module – 4: Shell Scripting				

4.1	SHELL Scripting: Basic Script Concepts, Expressions, Decision Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.	4	-	3
Module – 5: Advanced programming				
5.1	Advanced Programming: Variable evaluation and Substitution, String Manipulation, Here Document, Functions, Arrays, Signals, Built-in Commands, Scripting Techniques, Shell Environment and Script.	5	-	3
<i>Total No. of Lecture Hours</i>		25	-	-
<i>Total No. of Tutorial Hours</i>			00	-
<i>Total No. of Practical Hours</i>				15

SL.NO	COs	List of Experiments
1.	CO1	Introduction to Unix Commands (a)Write a shell script that displays your name and student ID when executed. (b)Use the 'ls' command to list files in a directory and apply different options to modify the output
2.	CO1	Basic File Manipulation and Permissions (a)Create a directory structure with nested subdirectories using 'mkdir'. (b)Copy files from one directory to another and modify file permissions using 'cp' and 'chmod'.
3.	CO2	Simple Shell Scripting (a)Write a shell script to calculate the sum of a series of numbers provided as command-line arguments. (b)Develop a script that prompts the user for their name and greets them using a personalized message.
4.	CO2	Process Management and Job Control (a)Use 'ps' and 'kill' commands to list and terminate processes. (b)Experiment with background and foreground job execution using '&' and 'fg' commands.
5.	CO2	Shell Scripting with Control Structures (a)Implement a script that checks if a given number is even or odd using conditional statements. (b)Create a script that generates the Fibonacci sequence within a specified range using loops.
6.	CO3	Text Processing with 'sed' and 'awk' (a)Use 'sed' to replace a specific word in a text file with another word. (b)Write an 'awk' script to extract and print specific columns from a CSV file.
7.	CO3	User Management and Permissions (a)Create a new user account and set user-specific environment variables. (b)Modify group memberships and observe the changes in user access.
8.	CO3	Shell Scripting for System Tasks (a)Write a script to display information about system memory usage. (b)Develop a script that monitors disk space utilization and sends an email alert if it exceeds a threshold.
9.	CO3	Shell Customization and Aliases (a)Create aliases for commonly used commands and demonstrate their usage. (b)Customize the shell prompt to display the current working directory and username.
10.	CO1, CO2, CO3	Project-based experiments (Students can choose any one of the following) (a)Automation Script for File Management Develop a shell script that automates the process of organizing files in a specified directory. The script should categorize files based on their extensions and move them to respective subdirectories. Provide options for users to specify source and destination directories and implement error handling for cases of missing directories or invalid inputs. (b)System Monitoring and Reporting Tool Create a comprehensive shell script that functions as a system monitoring and reporting tool. The script should gather information about system resources such as CPU usage, memory utilization, disk space, and network activity. Present this information in a readable format with clear headings and appropriate formatting. Allow users to specify reporting intervals and provide an option to save the report to a text file for later analysis.

Textbook:

1. UNIX and Shell Programming – A Textbook by Behrouz A Forouzan, Richard F Gilberg, Cengage Learning, 1st Edition, 2003.

Reference Book:

1. The Complete Reference UNIX by Kenneth Rosen, Douglas Host, James Farber and Richard Rosinski, Tata McGraw- Hill, Edition 2000.

Online Resources:

1. E-book: Shell Scripting – Expert Recipes for Linux, Bash and More by Steve Parker, Wrox Publications.
2. E-book: Linux Shell Scripting Cookbook by ShantanuTushar and SharathLakshman, 2nd edition, Packt Publications, 2013.

Code: BDS306C
Credits: 03
L:T: P - 2:0:2
SEE Hours: 3

Course: Data Analytics with R
CIE: 50 Marks
SEE Marks: 50 Marks
Total Marks: 100

Prerequisites if any	Basics of any programming language and knowledge of statistics and mathematics.
Learning objectives	1. Understand the basics of data analytics and its importance in decision-making processes. 2. Utilize the R programming language for data manipulation and analysis tasks.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe the structures of R Programming.	Analyze
CO2	Illustrate the basics of Data Preparation with real world examples.	Analyze
CO3	Apply the Graphical Packages of R for visualization.	Apply
CO4	Apply various Statistical Analysis methods for data analytics.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	-	-	-	3	3	3
CO2	2	-	-	-	2	-	-	-	-	-	-	3	3	3
CO3	2	1	-	-	2	-	-	-	2	1	-	3	2	1
CO4	2	3	-	1	-	2	-	-	2	-	-	-	1	2

Mapping Strength: Strong – 3 Medium – 2 Low – 1

Course Structure

Sl. No.	Module	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1 Basics of R				
1.1	Basics of R Introducing R, Initiating R.	1	-	-
1.2	Packages in R.	1	-	-
1.3	Environments and Functions.	1	-	2
1.4	Flow Controls, Loops.	1	-	2
1.5	Basic Data Types in R, Vectors	1	-	1
Module – 2 Arrays and Strings				
2.1	Basics of R Continued Matrices and Arrays	1	-	-
2.2	Lists	1	-	-
2.3	Data Frames	1	-	2
2.4	Factors	1	-	1
2.5	Strings, Dates and Times	1	-	2
Module-3 Data Preprocessing				
3.1	Data Preparation Datasets	1	-	1
3.2	Importing and Exporting files	1	-	-
3.3	Accessing Databases	1	-	-
3.4	Data Cleaning	1	-	1

3.5	Transformation	1	-	-
Module-4 Exploratory Data Analysis and Graph Plots				
4.1	Graphics using R Exploratory Data Analysis	1	-	-
4.2	Main Graphical Packages, Pie Charts	1	-	-
4.3	Scatter Plots, Line Plots	1	-	1
4.4	Histograms, Box Plots, Bar Plots	1	-	-
4.5	Other Graphical packages	1	-	-
Module-5 Statistical Analysis using R				
5.1	Statistical Analysis using R Basic Statistical Measures,	1	-	1
5.2	Normal distribution, Binomial distribution	1	-	-
5.3	Correlation Analysis	1	-	-
5.4	Regression Analysis-Linear	1	-	1
5.5	Regression Analysis of Variance	1	-	-
Total No. of Lecture Hours		25	-	-
Total No. of Tutorial Hours			-	-
Total No. of Practical Hours				15

Practical Component:

SLNO	COs	List Of Experiments
1	CO1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays
2	CO1	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. Note: a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data.
3	CO1	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication
4	CO1	Develop a program to find the factorial of given number using recursive function calls.
5	CO1	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6	CO2	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference.

7	CO2	Develop R program to create a Data Frame with following details and do the following operations.																
		<table border="1"> <thead> <tr> <th>itemCode</th> <th>itemCategory</th> <th>itemPrice</th> </tr> </thead> <tbody> <tr> <td>1001</td> <td>Electronics</td> <td>700</td> </tr> <tr> <td>1002</td> <td>Desktop Supplies</td> <td>300</td> </tr> <tr> <td>1003</td> <td>Office Supplies</td> <td>350</td> </tr> <tr> <td>1004</td> <td>USB</td> <td>400</td> </tr> <tr> <td>1005</td> <td>CD Drive</td> <td>800</td> </tr> </tbody> </table> <p>a) Subset the Data frame and display the details of only that item whose price is greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies” c) Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames</p>	itemCode	itemCategory	itemPrice	1001	Electronics	700	1002	Desktop Supplies	300	1003	Office Supplies	350	1004	USB	400	1005
itemCode	itemCategory	itemPrice																
1001	Electronics	700																
1002	Desktop Supplies	300																
1003	Office Supplies	350																
1004	USB	400																
1005	CD Drive	800																
8	CO3	<p>Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.</p> <p>a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Add Density curve to the histogram</p>																
9	CO3	<p>Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.</p> <p>a) Find the total number rows & columns b) Find the maximum salary c) Retrieve the details of the employee with maximum salary d) Retrieve all the employees working in the IT Department. e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file “output.csv”</p>																
10	CO4	<p>Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors</p> <p>Develop R program, to solve the following:</p> <p>a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e) Which pair of variables has the highest Pearson correlation?</p>																
11	CO4	<p>Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.</p>																

Textbook:

1. **Data Analytics Using R by Seema Acharya, MC GRAW HILL INDIA**, © Published: April 20, 2018.

Reference Book:

1. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2013

Online Resources:

1. <https://dokumen.pub/data-analytics-using-r-paperback-jan-01-2018-seema-acharya-9352605241-9789352605248.html>

Course Code: BSCK307
Credits: Non- Credit Mandatory Course
L:T:P - 1:0:0

Course: Social Connect and Responsibility
CIE: 100 Marks
Total Marks: 100

Prerequisites if any	NIL
Learning objectives	<ul style="list-style-type: none"> To make students understand and appreciate the important societal/ environmental issues like conservation/ sustainability/ waste management and the like and inculcate ethical responsibility towards the same. Provide a formal platform for students to communicate and connect to their surroundings and enable them to have a responsible connection with society.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand social responsibility	Understand
CO2	Practice sustainability and creativity	Apply
CO3	Demonstrate planning and organizational skills	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	1	3	1	1	-	2	1	1
CO2	-	-	-	-	-	2	1	3	2	2	-	2	1	1
CO3	-	-	-	-	-	2	1	3	3	3	-	1	2	1

S – Strong (3) M – Medium (2) L – Low (1)

Course Structure

Nos.	Module Name	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Plantation /Heritage Walk				
1.1	Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.E. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature	01	0	04
OR				
1.1	Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsmen, photo blog and documentary on evolution and practice of various craft forms.	01	0	04
Module – 2: Organic farming/Food walk				

2.1	Organic farming and waste management: usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.	01	0	04
OR				
2.2	Food Walk; City's culinary practices, food lore, and indigenous materials of the region used in cooking.	01	0	04
Module – 3: Water Conservation				
3.1	Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices	01	0	04
Total No. of Hours		15		

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. **Share the experience of Social Connect:** Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

Pedagogy:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion and a course project.

Applying and synthesizing information from these sources to define the social problem to address and try to arrive at the solution through the course project, of your group.

Social immersion with NGOs/social sections will be a key part of the course.

Guideline for Assessment Process: Continuous Internal Evaluation (CIE)

After completion of the social connect, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learnt in the social connect period. The report should be signed by the mentor.

The course shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed / based on the rubrics approved by the DC.

Components	Marks
Marks allotted for the diary	10
Planning and scheduling the social connect	05
Information/Data collected during the social connect-	10
Analysis of the information/data and report writing	15
Final presentation	10
Total	50

ABILITY ENHANCEMENT COURSE

Code: BCS358A

Credits: 1

L:T:P - 1:0:0

SEE Hours: 1

Course: Data Analytics with Excel

CIE: 50 Marks

SEE: 50 Marks

Total Marks:100

Prerequisites if any	Basic Computer Skills, Fundamental Excel Skills
Learning objectives	The learning objectives for a data analytics course with Excel typically revolve around equipping students with the knowledge and skills to effectively analyze and interpret data using Excel as a tool

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	To familiarize oneself with Excel's Basic features	Understanding
CO2	To gain skills on data visualization for data analysis using MS Excel.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	3	-	-	1	-	-	-	2	3	2

Mapping Strength: Strong- 3 Medium - 2 Low - 1

Course Structure

Sl. No	Module	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: I Basics of MS Excel				
1.1	Features of MS	2	-	-
1.2	Excel Worksheets and Workbooks: Labeling and Naming Worksheets and Workbooks, Adding, Deleting and Saving Worksheets and Workbooks, Reposition Worksheets, Inserting, Deleting, and Renaming Worksheets, Copy Worksheets, Printing a Workbook, Formatting a Worksheet, Adding Elements to a Workbook, Protecting Worksheet and Workbook.	2	-	-
Module – 2: Data Representation using MS Excel				
2.1	Import external data, Creating a Table, Sorting Data into a Table, Data Validation, Consolidation	1	-	-
2.2	Defining Names in MS Excel, Macros: View Macros, Record Macros	2	-	-
2.3	Formulas and Functions: Creating a Formula, Formula Auditing, Meaning and Advantages of functions, Insert function, Use relative References, Mathematical Functions, Statistical Functions, Date & Time Functions	2	-	-
Module – 3: Data Visualization and Analysis				
3.1	Charts: Chart elements: Titles, legend, data labels, creating a New Chart, Formatting the Chart, Types of charts, Using Chart Templates	2	-	-
3.2	PivotTables: Creating a PivotTable, Filtering and Sorting a PivotTable, Using Slicers to manipulate PivotTables, Creating a PivotChart	2	-	-

3.3	Filtering Data: Creating a Custom AutoFilter, Using an Advanced Filter. Data Group, Ungroup and Subtotals	2	-	-
<i>Total No. of Lecture Hours</i>		15	-	-
<i>Total No. of Tutorial Hours</i>			00	-
<i>Total No. of Practical Hours</i>				00

Textbook:

1. "Microsoft Excel 2019 Step by Step" by Curtis Frye
2. "Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walkenbach

Reference Book:

1. "Microsoft Excel Data Analysis and Business Modeling" by Wayne L. Winston:
2. "Excel 2019 All-in-One For Dummies" by Greg Harvey:

Online Resources:

1. https://www.academia.edu/42074058/Excel_2019_BIBLE
2. <https://ptgmedia.pearsoncmg.com/images/9780735681019/samplepages/9780735681019.pdf>

Code:BCS358C
Credits: 01
L:T:P -1:0:0
SEE Hours: 1

Course: Project Management with GiT
CIE: 50 Marks
SEE Marks: 50 Marks
Total Marks:100

Prerequisites if any	NIL
Learning objectives	To make the students understand the basic concepts related to Version controller with Git. To provide knowledge of Installation procedure and basic commands in Git.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe basic concepts related to Version controller with GiT.	Understanding
CO2	Explain Installation procedure and basic commands in GiT.	Understanding

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	1	-	-	-	-	-	-	-	2	1
CO2	2	2	-	-	1	-	-	-	-	-	-	-	2	1

Mapping Strength: Strong- 3 Medium - 2 Low - 1

Course Structure

Sl. No	Module	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction to Project Management and Git				
1.1	Introduction: Version Control system-need and types, Background and The Birth of Git	01	-	-
1.2	Precedents,Time Line,What's in a Name?	01	-	-
1.3	GitRepository,Bare Repository in Git	01	-	-
1.4	Git Ignore and how to use it? GiT README file, GiT Hub levels	01	-	-
1.5	Sub Git, Environment Setup, Using Git on Command line	01	-	-
1.6	Setting up and working on Repository	01	-	-
1.7	Difference betweenGit and Git Hub	01	-	-
1.8	Use of Submodules in Git Hub, Pack files, garbage collection	01	-	-
Module – 2: GIT Commands				
2.1	Basic Git commands with examples	01	-	-
2.2	Difference between “add -A”, “add -u”, “add .” , and “add *” ,Git Debugging	02	-	-
2.3	Examining Git, How to Add Code on GitHub Repository? it-Checkout And Merge, Git Tag, Branch, fetch	02	-	-
2.4	Overturing Changes In Git, Git Push, Pull, Merge, Using Patches in Git, Clone, Git Remote	02	-	-
Total No. of Lecture Hours		15	-	-
Total No. of Tutorial Hours			00	-
Total No. of Practical Hours				00

Textbook:

1. Git: Version Control for Everyone Beginner's Guide Copyright © 2013 Packt, Publishing-Ravishankar Somasundaram.

Reference Book:

1. Version Control with Git by Jon Loeliger, Copyright © 2009 Jon Loeliger. All rights reserved.
Printed in the United States of America. ISBN: 978-0-596-52012-0 [M]1242320486

Online Resources:

1. <https://www.udemy.com/course/introduction-to-version-control-with-git-and-github/>

Code: BAI358D
Credits: 1
L:T:P - 1:0:0
SEE Hours: 1

Course: Ethics and Public Policy for AI
CIE: 50 Marks
SEE Marks: 50 Marks
Total Marks:100

Prerequisites if any	NIL
Learning objectives	To provide students with the knowledge and need for ethics and policies for public in designing an AI machine

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Demonstrate knowledge of philosophical issues involved in ethics of Artificial Intelligence	Understand
CO2	Understand the laws and policies required to design AI machines used in the society	Understand

Mapping with POs and PSOs:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	1	-	2	-	3	1	1	3	-	-	-	-	1	-
CO 2	1	-	2	-	2	-	-	3	-	-	-	-	1	-

Mapping Strength: Strong- 3 Medium - 2 Low - 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Ethics for Artificial Intelligence				
1.1	What is ethics of AI? - Benefits & risks of artificial intelligence	1	-	-
1.2	The singularity - Can we build AI without losing control over it?	1	-	-
1.3	The value alignment problem - What happens when our computers get smarter than we are?	1	-	-
1.4	Racist AI - The era of blind faith in big data must end	1	-	-
1.5	Autonomous weapons - Killer Robots in War and Civil Society	1	-	-
1.6	Humans need not apply - Will automation take away humans jobs?	1	-	-
1.7	Good and bad robots – The Ethical Robot, How to build a moral robot?	1	-	-
1.8	Principles for creating safer AI	1	-	-
1.9	Who lives and who drives? Designing Autonomous vehicles, Machine intelligence makes human morals more important	1	-	-
1.10	Robot Rights - A.I. Ethics: Should We Grant them Moral and Legal Personhood?	1	-	-
Module – 2: Public Policy for Artificial Intelligence				
2.1	The risks of using AI for Government work	1	-	-
2.2	Values , Principles and Rules, Ethics and Regulations	1	-	-
2.3	Law for Artificial Intelligence – Need of the day, Law and Ethics	1	-	-
2.4	Global perspectives :public policy globally on emerging technology -AI	1	-	-
2.5	Artificial intelligence policy in India: The limits of data-driven decision-making	1	-	-
Total No. of Lecture Hours		15	-	-

<i>Total No. of Tutorial Hours</i>	00	-
<i>Total No. of Practical Hours</i>	00	

Textbook:

1. N. Bostrom and E. Yudkowsky. 'The ethics of artificial intelligence'. In W. M. Ramsey and K. Frankish, editors, *The Cambridge Handbook of Artificial Intelligence*, pages 316–334. Cambridge University Press, Cambridge, 2014.

Online Resources:

1. Center for Human-Compatible AI.
2. Ethics + Emerging Sciences Group
3. Ethics of AI conference at NYU streamed video discussions from October 2016.
4. Future of Humanity Institute is the other big UK centre.
5. Future of Life Institute
6. Leverhulme Centre for the Future of Intelligence
7. Research publications of The Machine Intelligence Research Institute

Code: BAI358D
Credits: 1
L:T:P – 0:0:2
SEE Hours: 2

Course: PHP Programming
CIE: 50 Marks
SEE Marks: 50 Marks
Total Marks: 100

Prerequisites if any	NIL
Learning objectives	To provide students with the knowledge and need for ethics and policies for public in designing an AI machine

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	To introduce the PHP syntax, elements, and control structures	Apply
CO2	To make use of PHP Functions and File handling	Apply
CO3	To illustrate the concept of PHP arrays and OOPs	Apply

Mapping with POs and PSOs:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	1	-	2	-	3	1	1	3	-	-	-	-	1	-
CO 2	1	-	2	-	2	-	-	3	-	-	-	-	1	-
CO 3	1	2	3	-	-	-	-	2	-	-	-	-	2	1

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Practical Component:

SI NO.	List of Experiments
1	a. Develop a PHP program to calculate areas of Triangle and Rectangle. b. Develop a PHP program to calculate Compound Interest.
2	Demonstrating the various forms to concatenate multiple strings Develop program(s) to demonstrate concatenation of strings: (i) Strings represented with literals (single quote or double quote) (ii) Strings as variables (iii) Multiple strings represented with literals (single quote or double quote) and variables (iv) Strings and string variables containing single quotes as part string contents (v) Strings containing HTML segments having elements with attributes
3	a. Develop a PHP Program(s) to check given number is: (i) Odd or even (ii) Divisible by a given number (N) (iii) Square of a another number b. Develop a PHP Program to compute the roots of a quadratic equation by accepting the coefficients. Print the appropriate messages.
4	a. Develop a PHP program to find the square root of a number by using the newton's algorithm. b. Develop a PHP program to generate Floyd's triangle.
5	a. Develop a PHP application that reads a list of numbers and calculates mean and standard deviation. b. Develop a PHP application that reads scores between 0 and 100 (possibly including both 0 and 100) and creates a histogram array whose elements contain the number of scores between 0 and 9, 10 and 19, etc. The last "box" in the histogram should include scores between 90 and 100. Use a function to generate the histogram.
6	a. Develop PHP program to demonstrate the date() with different parameter options. b. Develop a PHP program to generate the Fibonacci series using a recursive function.

7	Develop a PHP program to accept the file and perform the following (i) Print the first N lines of a file (ii) Update/Add the content of a file.
8	Develop a PHP program to read the content of the file and print the frequency of occurrence of the word accepted by the user in the file.
9	Develop a PHP program to filter the elements of an array with key names. Sample Input Data: 1st array: ('c1' => 'Red', 'c2' => 'Green', 'c3' => 'White', c4 => 'Black') 2nd array: ('c2', 'c4') Output: Array ([c1] => Red [c3] => White)
10	Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp_ID, Emp_Dept, Emp_Salary, and Emp_DOJ.
11	a. Develop a PHP program to count the occurrences of Aadhaar numbers present in a text. b. Develop a PHP program to find the occurrences of a given pattern and replace them with a text.
12	Develop a PHP program to read the contents of a HTML form and display the contents on a browser

Textbook:

1. N. Bostrom and E. Yudkowsky. 'The ethics of artificial intelligence'. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.

Online Resources:

1. Center for Human-Compatible AI.
2. Ethics + Emerging Sciences Group
3. Ethics of AI conference at NYU streamed video discussions from October 2016.
4. Future of Humanity Institute is the other big UK centre.
5. Future of Life Institute
6. Leverhulme Centre for the Future of Intelligence
7. Research publications of The Machine Intelligence Research Institute

Code: BCS358D
Credits: 1
L:T:P - 1:0:0
SEE Hours: 1

Course: Data Visualization with Python
CIE: 50 Marks
SEE: 50 Marks
Total Marks:100

Prerequisites if any	Introduction to python programming
Learning objectives	To understand the basics of data visualizations techniques To understand the different plotting libraries and apply in real world scenarios.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the basics of data visualization techniques and libraries	Understanding
CO2	Apply the data visualization techniques in the real-world problems	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	1	2	-	-	-	-	-	-	-	2	1
CO2	-	-	-	-	3	-	-	-	-	-	-	-	2	1

Mapping Strength: **Strong- 3** **Medium - 2** **Low - 1**

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: The Importance of Data Visualization in Business Intelligence				
1.1	Why Is Data Visualization Important? Why Do Modern Businesses Need Data Visualization? The Future of Data Visualization, How Data Visualization Is Used for Business Decision-Making, Introducing Data Visualization Techniques	3	-	-
1.2	Data Gathering and Cleaning, Cleaning Data, Checking for Missing Values, Handling the Missing Values, Reading and Cleaning CSV Data, Merging and Integrating Data	2	-	-
Module – 2: Data Exploring and Analysis				
2.1	Series Data Structures, Data Frame Data Structures	2	-	-
2.2	Data Analysis, Statistical Analysis, Data Grouping, Iterating Through Groups, Aggregations, Transformations, Filtration	3	-	-
Module – 3: Data Visualization				
3.1	Direct Plotting, Seaborn Plotting System	3	-	-
3.2	Matplotlib Plot	2	-	-
Total No. of Lecture Hours		15	-	-
Total No. of Tutorial Hours			00	-
Total No. of Practical Hours				00

Textbook:

1. Data Analysis and Visualization Using Python, Dr. Ossama Embarak, 2018
2. Python for Data Analysis by Wes McKinney, 2nd Edition, October 2017, O'Reilly Media Publisher

Online resources

1. <https://doi.org/10.1007/978-1-4842-4109-7>
2. <https://www.oreilly.com/library/view/python-for-data/9781491957653/>
3. <https://www.oreilly.com/library/view/interactive-data-visualization/9781449340223/>