Detailed Scheme and Syllabus

ACADEMIC YEAR 2023-2024

III - IV (2022-2026 BATCH) (160Credits)

Dr. Ambedkar Institute of Technology
Bangalore

Department Of
Artificial Intelligence & Machine Learning

Vision

- To create **D**ynamic, **R**esourceful, **A**dept and**I**nnovative **T**echnical professionals to meet global challenges.

Mission

- To offer state-of-the-art undergraduate, postgraduate and doctoral programmes in the fields of Engineering, Technology and Management.
- To generate new knowledge by engaging faculty and students in research, development and innovation
- To provide strong theoretical foundation to the students, supported by extensive practical training to meet industry requirements.
- To install moral and ethical values with social and professional commitment.

DEPARTMENT VISION AND MISSION

Vision:

- Imparting quality technical education and preparing professionals to meet Information Technological challenges globally.

Mission:

- Prepare highly capable Artificial Intelligence engineers through best practices.
- Encourage students to pursue higher education for further growth in the learning process and to promote research in the frontier areas ofAI&ML.
- Educate students to take up social and professional responsibilities with ethical values for the betterment of the society

Program Educational Objectives(PEOs)

The graduates of AI&ML program will be able to

PEO1: Pursue successful carriers in state/national/multinational companies as software developer/data analysts by following sound professional and ethical practices in various cadres in key areas like AI,ML,Data Science,Big data analytics, IoT, so on.
PEO2: Work effectively in multidisciplinary and multi cultural teams along good soft skills
PEO3: Pursue higher education for a successful carrier in academics/research.
PEO4: Pursue life long learning by anticipating trends in computer Science and Engineering to own a start up for a successful carrier as entrepreneur.

PROGRAMME OUTCOMES (POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: 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.
4. Conduct investigations of complex problems: 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.
5. Modern tool usage: 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.
6. The engineer and society: 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.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: 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.
11. Project management and finance: 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.
12. Life-long learning: 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examination effective from the Academic Year 2023-24

III AI SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	22MAT301AI	Mathematics for AI & ML	Maths	3	2	0		03	50	50	100	4
2	IPCC	22AIU302	Digital Design& Computer Organization	AI	3	0	2		03	50	50	100	4
3	IPCC	22AIU303	Operating Systems	AI	3	0	2		03	50	50	100	4
4	PCC	22AIT304	Data Structures and Application	AI	3	0	0		03	50	50	100	3
5	PCCL	22AIL305	Data Structures Lab	AI	0	0	2		03	50	50	100	1
6	ESC	22AIT306x	ESC/ETC/PLC		3	0	0		03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/SEC	22AIT308x or 22AIL308x	Ability Enhancement Course/Skill Enhancement Course– III		If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme(NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education(PE)(Sports and Athletics)	Physical Education Director									
		22YON310	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 ,S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation .K: The AI letter in the course code indicates common to all the streams of Engineering ESC: Engineering Science Course ,ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22XXT306x			
22AIT306A	**Functional Programming using Java**	**22AIT306C**	**Data Analytics with R**
22AIT306B	**Python Programming for AI&ML**		
Ability Enhancement Course–III22XXT308xOR2XXL308x			
22AIL308A	**PHP Programming**	**22AIT308C**	**Version controller with GIT**
22AIL308B	**Data Analytics with Excel**		

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as(3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters .Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score AI mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS,PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA ,but completion of the course is mandatory for the award of Degree.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examination effective from the Academic Year 2023-24

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22AIT401	Analysis & Design of Algorithms	AI	3	0	0		03	50	50	100	3
2	IPCC	22AIU402	Artificial Intelligence	AI	3	0	2		03	50	50	100	4
3	IPCC	22AIU403	Database Management Systems	AI	3	0	2		03	50	50	100	4
4	PCCL	22AIL404	Analysis & Design of Algorithms Lab	AI	0	0	2		03	50	50	100	1
5	ESC	22AIT405x	ESC/ETC/PLC	AI/	3	0	0		03	50	50	100	3
6	AEC/SEC	22AIT406x or 22AIL406x	Ability Enhancement Course/ Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory: 1	0	0		01	50	50	100	1
					If the course is a lab: 0	0	2		02				
7	BSC	22BIT407	Biology For Engineers	TD/PSB: BT, CHE,	2	0	0		03	50	50	100	2
8	UHV	22HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme(NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN410	Physical Education(PE) (Sports and Athletics)	Physical Education Director									
		22YON410	Yoga	Yoga Teacher									
Total										500	400	900	19

PCC:ProfessionalCoreCourse,PCCL:ProfessionalCoreCourselaboratory,UHV:UniversalHumanValueCourse,MC:MandatoryCourse(Non-credit),AEC:AbilityEnhancementCourse,SEC:SkillEnhancementCourse,L:Lecture,T:Tutorial,P:Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course(ESC/ETC/PLC)22XXT405x OR 22XXL405x			
22AIT405A	Discrete Mathematics (Maths Dept)	22AIT405C	Algorithmic Game Theory (Maths)
22AIT405B	Metric Spaces (Maths Dept)		
Ability Enhancement Course/Skill Enhancement Course –IV22XXT405x OR 22XXL406x			
22AIT406A	Green IT and Sustainability	22AIL406C	MERN(Lab)
22AIL406B	Technical writing using LATEX (Lab)		

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III semester

Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

Course Title	**Mathematics-1II for Computer Science and Engineering stream/AIML Probability and Statistical Inference.**							
Course Code	**22MAT301B**							
Category	**ASC (Applied Science Course)**							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	03	02	00	00	04	50	00	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks = 100**		**Duration of SEE: 03 Hours**			

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills to identify and solve real life problems in their field of study involving the application of the concepts of probability, statistical inferences and ANOVA testing.

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Probability Distributions:** Recap of Random Variables. Probability generating function, momentgenerating function, expectations. Discrete probability distributions-Binomial, Poisson and Geometricdistributions;Continuousprobabilitydistributions-Exponential, Normaland Weibull distributions. **Self-study:**Gammadistributions. **Applications**: Transmission errors in noise media. (RBT levels: **L1, L2, L3, L4**)	04	04
II	**Two dimensional Random variables:**Joint probability mass function, Marginal probability function,conditionalprobabilityfunction. **Random Process:** Classification of random process, description of random process, stationary randomprocess – first order, second order and Strict-sense stationary processes, Autocorrelation and Cross-correlationfunctions. **Self-study**:Jointdensityfunction,marginaldensityfunction,conditionalprobabilitydensityfunction, covariance, correlation coefficient. **Application**: Bayesian network. (RBT levels: **L1, L2, L3, L4**)	04	04
III	**Statistical Inference:** Introduction sampling distribution standard errors, level of significance, confidence limits for sampling of attributes, test of significance for large samples. Comparison of large samples, central limit theorem, confidence limit for unknown mean, testing of mean of large two samples, students *t*-distribution , chi-square distribution. **Self-study:** *F*-distribution. **Application:** Goodness of fitness (RBT levels: **L1, L2, L3, L4**)	04	04

IV	**Markov Chain:** Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states. **Self-study:** Regular stochastic matrices **Applications**: model the behaviour of stock prices, spread of a disease through a population, birth-death process. (RBT levels: **L1, L2, L3, L4**)	04	04
V	**Design of Experiments & ANOVA :** Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, basic principle of ANOVA, One way ANOVA, Two-way ANOVA. **Self-study**: latin-square design. **Applications**: to determine the best materials to use to build a product for a customer, to test effectiveness of different marketing strategies. (RBT levels: **L1, L2, L3, L4**)	04	04

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1	**Learn** a mathematical tool to estimate the life time for a system and also time of failure.
CO2	**Predict** most suitable distributions, happening of favorable event**.**
CO3	**Analyze** the statistical inferences and the basics of Hypothesis testing with emphasis on some commonly encountered hypothesis.
CO4	**Employ** the knowledge of probability, joint probability distributions, Markov chain in pattern recognition.
CO5	**Apply** ANOVA testingto determine significant effect of input on the system's response.

TEACHING – LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

Assignment: Python programmers on in Units-I to V to be given as assignment using the Textbook indicated in item 5 below.

Ptoblm

TEXTBOOKS

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers 44th Ed., 2018.
2. Kishore S. Trivedi, Probabilty and Statistics with Reliability, Queuing and Computer Science Applications, Wiely India publication, 2nd ED., 2008
3. Sundaran Pillai, Probabililty, Statistics and Queuing theory, PHI, 2009.
4. G. Haribaskaran, Prbabiltly Queuing Theory and Reliability Engineering, 2nd Ed., 2006.
5. Peter Bruce, Andrew Bruce and Peter Gedeck, Practical Statistics for Data Scientists, O'REILLY, 2Ed., 2020.

REFERENCE BOOKS

1. V. Ramana, Higher Engineering Mathematics, McGraw–Hill Education, 11th Ed., 2017.
2. Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. C. Ray Wylie, Louis C. Barrett**,** Advanced Engineering Mathematics, McGraw Hill Book Co., New York, 6th Ed., 2017.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication,

3rd Ed., 2014.

Web links and Video Lectures (e-Resources)

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

CO-PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	3										
Strength of correlation: Low-1, Medium-2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**DIGITAL DESIGN AND COMPUTER ORGANIZATION**						
Course Code	**22AIU302**						
Category	Integrated Professional Core Course (IPCC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**02**	**00**	**05**	**60**	**04**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To understand and apply minimization techniques for designing optimized digital
2. To analyze and design cost effective combinational and sequential circuits for given problems.
3. To understand basic structure of computer , instruction execution and addressing modes .
4. Gain knowledge of memory system

UNIT I **08 hours**

Boolean function Simplification : Karnaugh Map: Pairs, Quads, and Octets , Karnaugh Simplifications for 4 variables, Don't-care Conditions, Product-of-Sum, Product-of-sums Simplification, Quine McCluskey method .
Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, Encoders, Magnitude Comparator.Text book 1: Ch 3: 3.1 to 3.9. Ch 4:4.1,4.2,4.3,4.6,4.9,4.14

Laboratory Components:

Simplify given boolean function using K-Map method and verify the truth table.
Given any 4-variable logic expression, simplify using multiplexer IC and verify truth table.
Design full adder using 3-to-8 decoder IC and 4 input NAND gates and verify truth table.
Design 1 bit magnitude comparator and verify the truth table.

UNIT II **08 hours**

Flip-Flops: Flip-flops: RS FLIP-FLOPs, Gated FLIP-FLOPs ,Edge-triggered RS FLIP-FLOPs, Edge-triggered D FLIP-FLOPs,Edge-triggered JK FLIP-FLOPs, JK Master-slave FLIP-FLOPs; JK Master-slave FLIP-FLOP, Various Representations of FLIP-FLOPs,Conversion of FLIP-FLOPs:A Synthesis Example, HDL Implementation of Flip-flops.Text book 1:Ch 8:8.1 to8.8, 8.10,8.12
Registers: Types of Registers, Applications of Shift Registers and Implementation using VHDL.
Text book 1: Ch 9: 9.1,9.7

Laboratory Components:

Write the VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.

Write the VHDL code for JK Flip-Flop with negative -edge triggering. Simulate and verify it's working

3. Design and implement a ring counter using 4-bit shift register IC 7495.
4. Write VHDL code for switched tail counter. Simulate and verify it's working.

UNIT III **08 hours**

Counters: Asynchronous Counters ,Synchronous Counters, Decade Counters, Counter Design as a Synthesis problem.

T1:Ch10: 10.1,10.3,10.5,10.7,10.9

Laboratory Components:

Design and implement an asynchronous counter using decade counter IC 7490 to count up from 0 to 9 Display the count value on 7 segment LED display using BCD to 7 segment code converter IC.

Write VHDL code for mod-8 up counter. Simulate and verify it's working

UNIT IV **08 hours**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Instruction Set: CISC and RISC. Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language.Text book 2:Chapter 1-1.1,1.2,1.3,1.4,1.6.5 Chapter 2- 2.2,2.3,2.4,2.5,2.6

Laboratory Component:

1. Demonstration of parts of computer.

UNIT V **07 hours**

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.

Text book 2: Ch 5 – 5.1 to 5.7, 5.9.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Apply K-map/Quine McClusky minimization methods to simplify Boolean functions .

CO2: Design and analyze working of combinational /data processing circuits.

CO3 : Design and analyze working of sequential circuits & their VHDL implementation.

CO4: Analyze functional units of a computer, its operational concepts, addressing modes, internal organization of a system through an assembly language.

CO5: Analyze memory unit including SRAM, DRAM, cache mapping techniques and basics of virtual memory.

TEXT BOOKS:

1.Donald P Leach, Albert Paul Malvino & Goutam Saha: DigitalPrinciples and Applications,7thEdition,Tata McGraw Hill, 2011

2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition,TataMcGrawHill, 2002

REFERENCE BOOKS:

1. Stephen Brown, ZvonkoVranesic:FundamentalsofDigital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.

2. Charles H.Roth: Fundamentals of Logic Design, Jr., 5th Edition,Thomson,2004

EBOOKS/ONLINE RESOURCES

http://www.nptel.ac.in

http://freevideolectures.com/Course/2277/Computer-Organization#

SCHEME FOR EXAMINATIONS

The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).However, questions from the practical part of IPCC shall be Included in these question paper.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									
CO2		3	3	3								
CO3		3	3	3			2					
CO4	3	3										
CO5	2	3	3	3								
Strength of correlation: Low-1, Medium- 2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**OPERATING SYSTEMS**						
Course Code	22AIU303						
Category	Integrated Professional Core Course (IPCC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**02**	**00**	**05**	**60**	**04**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To analyze structure ,management, concepts of process scheduling and multithreading in operating system
2. To identify the various methods of causing deadlocks.
3. To describe the techniques for main memory management.
4. To analyze the file system interface, implementation and disk management.
5. To understand the Protection and security concepts in operating system.

UNIT I : **07 hours**

Introduction: What operating systems do, Computer-System Architecture, Operating System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security.
T1:1.1 to 1.9.

System Structures: Operating System Services, User Operating System Interface, System Calls, Types of System Calls, System Programs, Operating System Structure;
T1: 2.1 to 2.7.

Processes: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication; Multithreaded Programming: Multithreading Models;
T1: 3.1 to 3.4, 4.1 to 4.3.

Laboratory Component:

Implementation of basic UNIX commands using file APIs- Write a program to implement commands ls(-l option), cp, rm and mv using UNIX file APIs.
Process control system calls-Application to demonstrate use of fork, execve, wait, getpid, exit system calls

UNIT II **08 hours**

Process Synchronization: The Critical Section Problem, Peterson‟s Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples;
T1:5.1 to 5.9.

CPU Scheduling : Scheduling Criteria , Scheduling Algorithms , Thread Scheduling, Multiple-Processor Scheduling , Real-Time CPU Scheduling ,Operating-System Examples.
T1: 6.1 to 6.7.

Dead locks: System Model, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance and detection, Recovery from Deadlock

Laboratory Component:

Process/Thread synchronization - Application to demonstrate process/thread synchronization using semaphores and mutex.
Implement Dining philosophers problem, reader-writer and producer-consumer.
Write a program that implements the Bankers' algorithm for deadlock avoidance. The program should check for safe sequence and resource request algorithm
To write a program for implementation of Priority scheduling algorithms.
write a program for implementation of FCFS and SJF scheduling algorithms.

UNIT III **09 hours**

Memory Management Strategies:

Main Memory: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.
T1: 8.1 to 8.6.

Virtual Memory Management: Background, Demand Paging, Copy on Write, Page Replacement, Allocation of frames, Allocating Kernel Memory.
T1: 9.1 to 9.8

Laboratory Component:

Memory management: Write a program to simulate Buddy memory allocation algorithm.
write a program to implement IPC using shared memory.
write a program to implement LRU page replacement algorithm.

UNIT IV **07 hours**

File System: File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection;
T1: 11.1 to 11.6.

File-System Implementation: File System Structure , File System Implementation, Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery.
T1: 12.1 to 12.7.

Mass storage structures, protection: Mass storage structures; Disk structure; Disk attachment, Disk scheduling; Disk management; Swap space management.
T1: 10.1 to 10.6

Laboratory Component:
Write a program to organize the file using single level directory.
Write a program for sequential file for processing the student information.

UNIT V **08 hours**

Protection and Security: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.
T1: 14.1 to 14.8

The Security Problem, Program Threats ,System and Network Threats, Cryptography as a Security Tool , User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications
T1:15.1 to 15.8

Laboratory Component:

1. Write a program to Simulate disk scheduling algorithms- Scan,C-Scan.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Analyze thefundamental principles and concepts of operating systems.
CO2: Identify, analyze various synchronization technique, deadlocks.
CO3: Identify, analyze, apply the various algorithms for memory management.
CO4: Analyze Storage Structures and Implement Customized Case study
CO5: Apply various protection and security techniques.

TEXT BOOK:

1. Abraham Silberschatz Peter Baer Galvin, Greg Gagne **- Operating System concepts,** , 9th edition, Wiley-India, 2012.

REFERENCE BOOKS:

1. D.M Dhamdhere – **Operating Systems:A Concept Based Approach**, 2nd Edition, Tata McGraw-Hill, 2002.
2. P.C.P. Bhatt **- Operating Systems**, 2nd Edition, PHI, 2006.
3. Harvey M Deital **- Operating Systems** –, 3rd Edition Wesley, 1990.

SCHEME FOR EXAMINATIONS:

The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).However, questions from the practical part of IPCC shall be Included in these question paper.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2							2
CO2	2	2	2		2	2						
CO3			2		2	2						
CO4	2	2	2	2	2							2
CO5	2	2	2	2	2							2
Strength of correlation: Low-1, Medium- 2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

Course Title	**Data Structures and Application**						
Course Code	**22AIT304**						
Category	Professional Core Course (PCC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**39**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. Explain the fundamentals of data structures and their applications essential for implementing solutions to problems..
2. Illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.
3. Design and Develop Solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists..
4. Explore usage of Trees and Graph for application development..

5. Apply the Hashing techniques in mapping key value pairs.

UNIT I : 08 hours **Introduction** Data Structures, Classifications (Primitive & Non-Primitive), Data structure operations (Traversing, inserting, deleting, searching, and sorting). Review of Arrays. Structures: Array of structures Self-Referential Structures. Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, dynamically allocated arrays and Multidimensional Arrays. Demonstration of representation of Polynomials and Sparse Matrices with arrays. **Textbook 1: Chapter 1: 1.2, Chapter 2: 2.2 - 2.7, Text Textbook 2: Chapter 1: 1.1 - 1.4, Chapter 3: 3.1 - 3.3, 3.5, 3.7, Chapter 4: 4.1 - 4.9, 4.14 Textbook 3: Chapter 1: 1.3**
UNIT II 08 hours **Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Different representation of expression. Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion. **Queues:** Definition, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues. **Textbook 1: Chapter 3: 3.1 -3.4, 3.6 Textbook 2: Chapter 6: 6.1 -6.4, 6.5, 6.7-6.13**
UNIT III 08 hours **Linked Lists:** Definition, classification of linked lists. Representation of different types of linked lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting, and Concatenation Operations on Singly linked list, Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples. **Textbook 1: Chapter 4: 4.1 – 4.4, 4.5.2, 4.7, 4.8, Textbook 2: Chapter 5: 5.1 – 5.9**
UNIT IV 08 hours **Trees 1:** Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, and Searching operation on Binary search tree. Application of Trees-Evaluation of Expression. **Textbook 1: Chapter 5: 5.1 –5.5, 5.7; Textbook 2: Chapter 7: 7.1 – 7.9**
UNIT V 07 hours **Trees 2:** AVL tree, Red-black tree, Splay tree, B-tree. **Graphs**: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth FirstSearch. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. **Textbook 1: Chapter 10:10.2, 10.3, 10.4, Textbook 2:7.10 – 7.12, 7.15 Chapter 11: 11.2, Textbook 1: Chapter 6 : 6.1–6.2, Chapter 8 : 8.1-8.3, Textbook 2: 8.1 – 8.3, 8.5, 8.7** **Textbook 3: Chapter 15:15.1, 15.2,15.3, 15.4,15.5 and 15.7**

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO 1. Identify different data structures and their applications.

CO 2. Apply stack and queues in solving problems.

CO 3. Demonstrate applications of linked list.

CO 4. Explore the applications of trees and graphs to model and solve the real-world problem.

CO 5. Make use of Hashing techniques and resolve collisions during mapping of key value pairs

TEXT BOOK:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

REFERENCE BOOKS

1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications,2nd Ed, McGraw Hill, 2013
3. A M Tenenbaum, Data Structures using C, PHI, 1989
4. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.

SCHEME FOR EXAMINATIONS:

The theory part shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3	3			3		3	3		
CO2		3	3	3					3			3
CO3		3	3	3					3			3
CO4		3	3	3					3			3
CO5		3	3	3					3			3
Strength of correlation: Low-1, Medium- 2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**Data Structures Lab**						
Course Code	**22AIL305**						
Category	Professional Core Course Laboratory (PCCL)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	**00**	**02**	**00**	**02**	**26**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. Explain the fundamentals of data structures and their applications essential for implementing solutions to problems.
2. Illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.
3. Design and Develop Solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists
4. Explore usage of Trees and Graph for application development..
5. Apply the Hashing techniques in mapping key value pairs

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List of Programs

1. Design, Develop and Implement a menu driven Program in C for the following Array Operations
a. Creating an Array of N Integer Elements
b. Display of Array Elements with Suitable Headings
c. Exit.
Support the program with functions for each of the above operations.
2. Design, Develop and Implement a menu driven Program in C for the following Array operations
a. Inserting an Element (ELEM) at a given valid Position (POS)
b. Deleting an Element at a given valid Position POS)
c. Display of Array Elements
d. Exit.
Support the program with functions for each of the above operations.
https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
https://ds1-iiith.vlabs.ac.in/data-structures-1/List%20of%20experiments.html
3. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
a. Push an Element on to Stack
b. Pop an Element from Stack
c. Demonstrate Overflow and Underflow situations on Stack
d. Display the status of Stack
e. Exit
Support the program with appropriate functions for each of the above operations
4. Design, Develop and Implement a Program in C for the following Stack Applications
a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^
b. Solving Tower of Hanoi problem with n disks
https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
5. Singly Linked List (SLL) of Integer Data
a. Create a SLL stack of N integer.
b. Display of SLL
c. Linear search. Create a SLL queue of N Students Data Concatenation of two SLL of integers.
6. Design, Develop and Implement a menu driven Program in C for the following operationson Doubly Linked List (DLL) of Professor Data with the fields: ID, Name, Branch, Area of specialization
a. Create a DLL stack of N Professor's Data.
b. Create a DLL queue of N Professor's Data
Display the status of DLL and count the number of nodes in it.
https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
7. Given an array of elements, construct a complete binary tree from this array in level order fashion. That is, elements from left in the array will be filled in the tree level wise starting from level 0. Ex: Input :
arr[] = {1, 2, 3, 4, 5, 6}
Output : Root of the following tree
1
/ \

2 3
/ \ /\
4 5 6
8. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers
a. Create a BST of N Integers
b. Traverse the BST in Inorder, Preorder and Post Order
https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
9. Design, Develop and implement a program in C for the following operations on Graph (G) of cities
a. Create a Graph of N cities using Adjacency Matrix.
b. Print all the nodes reachable from a given starting node in a diagraph using DFS/BFS method.
10. Design and develop a program in C that uses Hash Function H:K->L as H(K)=K mod m(reminder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:
CO 1. Identify different data structures and their applications.
CO 2. Apply stack and queues in solving problems.
CO 3. Demonstrate applications of linked list.
CO 4. Explore the applications of trees and graphs to model and solve the real-world problem.
CO 5. Make use of Hashing techniques and resolve collisions during mapping of key value pairs
SCHEME FOR EXAMINATIONS:

The theory part shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3	3			3		3	3		
CO2		3	3	3					3			3
CO3		3	3	3					3			3
CO4		3	3	3					3			3
CO5		3	3	3					3			3
Strength of correlation: Low-1, Medium- 2, High-3												

Category	Engineering Science Course-(ESC/ETC/PLC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**39**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To understand the object oriented concepts.
2. To understand the concepts of java.
3. To understand the concept of inheritance and exception handling.
4. To understand the concept of event handling and threads.
5. To design and write a applet and swing programs.

UNIT I : **07 hours**

Introduction to Java, Classes,: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The.? Operator; Operator Precedence; Logical expression; Type casting; Strings Control Statements: Selection statements, iteration statements, Jump Statements. Classes: Classes fundamentals; Declaring objects

T1:Ch1,2,3,4,5,6

UNIT II **08 hours**

Classes: Constructors, this keyword, garbage collection.

Inheritance: inheritance basics, using super, creating multi-level hierarchy, method overriding. **Exception handling:** Exception handling in Java. **T1: T1 :Ch 6 , Ch 7, Ch 8 , Ch10**

UNIT III **08 hours**

Packages and Interfaces, Multi-Threaded Programming:Packages, Access Protection, Importing Packages, Interfaces. Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread;read-write problem,
producer consumer problems.**T1** : Ch 9 , Ch 11

UNIT IV **08 hours**

Event Handling: Two event handling mechanisms; The delegation event model; Event classes;
Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

Introducing the AWT: Working with Windows, Graphics, and Text: Introduction the AWT:
Working with Windows, Graphics and Text AWT Classes, Window Fundamentals, Working with Frame Windows, Introducing Graphics, Working with Color **T1:**Ch 22 , Ch 23

UNIT V **08 hours**

Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

T1: Ch 29, Ch 30

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:
CO1:Develop JAVA programs using OOPs principles.
CO2: Develop computer programs to solve real world problems in Java.
CO3: Develop simple GUI interfaces for a computer program to interact with users, and to comprehend the event-based GUI handling principles using Applets and swings.
CO4: Develop the procedure to store and retrieve data using AWT
CO5:Build the simple swings module using Jlist, Jcombobox as GUI

TEXT BOOK:

1. Herbert Schildt: Java - The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
(Chapters 1, 2, 3, 4, 5, 6, 8, 10, 11, 21, 22, 29, 30, 31)

REFERENCE BOOKS

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806
2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.
3. Stanley B.Lippmann, JoseeLajore, C++ Primer, 4th Edition, Pearson Education, 2005.
4. RajkumarBuyya,SThamarasiselvi, xingchenchu, Object oriented Programming with java, Tata McGraw Hill education private limited.
5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies

SCHEME FOR EXAMINATIONS:

The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).However, questions from the practical part of IPCC shall be Included in these question paper.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2							
CO2	2	2	2		2	2						
CO3			2		2	2						
CO4	2	2	2	2	2							
CO5	2	2	2	2	2							
Strength of correlation: Low-1, Medium- 2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	Python Programming for AI & ML						
Course Code	22AIT306B						
Category	Engineering Science Course**(ESC/ETC/PLC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**39**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE:

1. To acquire programming skills in core Python.
2. To present Object Oriented concepts and implementation skills in Python.
3. To develop the skills of designing Graphical user Interfaces in Python.
5. To develop the ability to write database and threaded applications in Python.

UNIT I **07 Hours**

Introduction to Python: Features of Python, Python Virtual Machine (PVM), Writing Our First Python Program, Executing a Python Program, Getting Help in Python, Comments in Python, Doc Strings. **Datatypes in Python:** Built-in datatypes, The None Type, bool Datatype, Sequences in Python, Sets, Literals in Python, Determining the Datatype of a Variable, Characters in Python, User-defined Datatypes, Constants in Python, Identifiers and Reserved words, Naming Conventions in Python. **Operators in Python**: Arithmetic Operators, Assignment Operators, Unary minus Operator, Relational Operators, Logical Operators, Boolean Operators, Membership Operators, Identity Operators, Operator Precedence and Associativity, Mathematical Functions. **Input and Output:** Output statements, Various formats of The print(), Input Statements, Command Line Arguments. **Control Statements**: If Statement, If … else Statement, If … elif … else Statement, While Loop, For Loop, Infinite Loops, Nested Loops, Else Suite, Break Statement, Continue Statement, Pass Statement, Assert Statement, Return Statement.

Text Book1: Ch 1, Ch 2, Ch 3, Ch 4,Ch 5 , Ch 6

UNIT II **07 Hours**

Arrays in Python: Creating an Array, Importing the Array Module, Indexing and Slicing on Arrays, Types of Arrays, Working with Arrays using numpy, Creating Arrays using linspace, logspace, arrange function, Creating Arrays using zeros() and ones() Functions, Mathematical Operations on Arrays, Comparing Arrays, Aliasing the Arrays, Slicing and Indexing in numpy Arrays, Dimensions of Arrays, Attributes of an Array, Reshape() Method, Flatten() Method, Working with Multi-dimensional Arrays, The array() Function, The ones() and zeros() Functions, The eye() Function, The reshape() Function, Matrices in numpy. **Strings and Characters**: Creating Strings, Length of a String, Indexing in Strings, Repeating the Strings, Concatenation of Strings, Checking Membership, Comparing Strings, Finding Sub Strings, Strings are Immutable, Replacing a String with another String, Splitting and Joining Strings, Checking Starting and Ending of a String, String Testing Methods, Formatting the Strings, Sorting Strings. **Functions**: Defining a Function, Calling a Function, Returning Results from a Function, Returning Multiple Values from a Function, Positional Arguments, Default Arguments, Variable Length Arguments, Local and Global Variables, The Global Keyword, Passing a Group of Elements to a Function, Recursive Functions, Lambdas, Using Lambdas with filter(),map(),reduce() Function, Function Decorators, Generators. Structured Programming: Creating Own Modules in Python,Special Variable __name__,

Text Book1:Ch 7,Ch 8,Ch 9

UNIT III **09 Hours**

Lists and Tuples: Creating Lists using range() Function, Updating the Elements of a List, Concatenation of Two

Lists, Repetition of Lists, Membership in Lists, Aliasing and Cloning Lists, Methods to Process Lists, Nested Lists, List Comprehensions, Tuples, Creating Tuples, Accessing the Tuple Elements, Basic Operations on Tuples, Functions to Process Tuples, Nested Tuples, **Dictionaries:** Operations on Dictionaries, Dictionary Methods, Using for Loop with Dictionaries, Sorting the Elements of a Dictionary using Lambdas, Converting Lists into Dictionary, Converting Strings into Dictionary, Ordered Dictionaries. **Introduction to OOPS**: Problems in Procedure Oriented Approach, Features of Object Oriented Programming System (OOPS), Classes and Objects, Encapsulation, Abstraction, Inheritance, Polymorphism, Classes and Objects, Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods, Passing Members of One Class to Another Class, Inner Classes, **Inheritance and Polymorphism**: Constructors in Inheritance, Overriding Super Class Constructors and Methods, Super() Method, Types of Inheritance, Method Resolution Order (MRO), Operator Overloading, Method Overloading, Method Overriding, Abstract Classes and Interfaces in Python.

Text Book1: Ch 10,Ch 11,Ch12,Ch13,Ch14,Ch15

UNIT IV **09 Hours**

Exceptions: Errors in a Python Program, Exceptions, Exception Handling, Types of Exceptions, The Except Block, Assert Statement, User-Defined Exceptions, Logging the Exceptions. **Files in Python**: Types of Files in Python, Working with Text Files, Working with Binary Files, Pickle in Python, seek() and tell() Methods, Random Accessing of Binary Files using mmap, Running Other Programs from Python Program. **Regular Expressions in Python**: Sequence Characters in Regular Expressions, Quantifiers in Regular Expressions, Special Characters in Regular Expressions, Using Regular Expressions on Files, Data Structures in Python. **Python's Database Connectivity**: Advantages of a DBMS over Files, Working with MySQL Database, Operations on rows of a Table, Creating Database Tables through Python, Working with Oracle Database in Python, Stored Procedures,

Text Book1: Ch 16,Ch 17, Ch 18 ,Ch 19, Ch 24

UNIT V **07 hours**

Pandas: Series, Dataframe, Importing csv, Exporting csv, Groupby Describe, Info Iloc, loc Filtering Slicing, **Matplotlib**:Line plot Scatter plot Histogram Box plot. **Seaborn**: Heatmap, **Data Pre-Processing Using Python**: Data Cleaning,Data Integration,Data Reduction. **DescriptiveStatistics theory:** Central tendency, Standard deviation, Interquartile range, Histograms, Distributions, Skew, Kurtosis, Correlation

Text Book1:Ch 21, Ch 22, Ch 23,Ch 24

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Demonstrate the understanding and usage of python scripting elements, python constructs, data types.

CO2 : Demonstrate the understanding and usage of functions ,lists, tuples and dictionaries.

CO3: Demonstrate the understanding and usage of modules, files, exceptions and regular expressions.

CO4: Implement object oriented concepts, database applications.

CO5: Apply the knowledge of python and use the language scripting elements and constructs to develop threaded and GUI applications.

Textbooks:

1. Dr. R. NageswawaRao,CorePython Programming, Dreamtech press, 2nd Edition 2018 (ChapterNumbers: 3,4,5,6,7, 8,9,10,11,16,17,18,22).

ReferenceBooks:

1. Gowrishankar S. Veena A,Introduction to Python Programming,CRC Press Taylor &Francis Group, 1st Edition 2019.
2. Michael Urban and Joel Murach, Mike Murach Elizabeth Drake, Python Programming, 1st Edition, 2016.

EBOOKS/ONLINE RESOURCES

1. http://www.w3schools.com
2. http://docs.python.org
3. http://www.tutorialspoint.com
4. https://towardsdatascience.com/a-guide-to-pandas-and-matplotlib-for-data-exploration-56fad95f951c

MAPPING of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	2	2	--	--	--	--	--	--	--
CO2	1	1	2	2	2	--	--	--	--	--	--	--
CO3	2	2	3	1	3	--	--	--	--	--	--	--
CO4	3	3	3	3	3	--	--	--	--	--	--	--
CO5	1	1	2	2	2	--	--	--	--	--	--	--
Strength of correlation: Low-1, Medium- 2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

Course Title	**DATAANALYTICSWITHR**						
Course Code	**22AIT306C**						
Category	**Engineering Science Course-(ESC/ETC/PLC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**39**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSEOBJECTIVES:

1. To describe the R programming language and its programming environment&explain thefundamentalconcepts associated withprogramming in R.
2. To apply R Programming in statistical calculation and data visualization portions ofdataanalysis.
3. To apply quantitative modeling and data analysis techniques to the solution of real-worldbusiness problems, communicate findings.
4. Toeffectivelypresentresultsusingdatavisualizationtechniques.
5. To demonstrate an understanding of the basic formatting R Markdown to createstructureandemphasize content.

Unit1 **7 Hrs** **Chapter1: IntroductiontoR** Introduction, Data Types in R, Few Commands for Data Exploration, Challenges of Analytical DataProcessing,Expression,VariablesandFunctions,MissingValuesTreatment-Vectors-Matrices-Factors–List..
Unit2 **8 Hrs** **Chapter2: LinearRegressionusingR** Regression - Model Fitting - Linear Regression - Assumptions of Linear Regression - Validating LinearAssumption. Logistic Regression : Introduction to Generalized Linear Models - Logistic Regression - BinaryLogisticRegression-DiagnosingLogistic Regression-MultinomialLogisticRegressionModels
Unit3 **8 Hrs** **Chapter3:DecisionTree** Introduction-DecisionTreeRepresentationinR-AppropriateProblems forDecisionTreeLearning-BasicDecisionTreeLearning Algorithm-MeasuringFeatures-Issuesin DecisionTreeLearning.

Unit4 **8 Hrs** **Chapter4: Clustering** Basic Concepts in Clustering, Distance Measures, Clustering Validation, Clustering Techniques.FrequentPatternMining:FrequentItemsets,AssociationRules,BehindSupportandConfidence,Other Typesof Pattern.
Unit5 **8 Hrs** **Chapter5: Text Mining** TextMining:FewChallenges-TextMininginR-GeneralArchitectureofTextMiningSystems–Pre-processingofDocumentsinR-CoreTextMiningOperations-TextMiningQueryLanguages-MiningFrequent Patterns.

TEACHINGLEARNINGPROCESS: ChalkandTalk,Powerpointpresentation, videos

COURSEOUTCOMES: Oncompletionofthe course,studentshouldbeable:

CO1: To Utilize R programming to perform text mining and parallel computingCO2: To Solvetheproblems onregressionandtime series usingR.
CO3: To Apply machine learning algorithms on real-time data analytics problems in R.CO4: To Developsimpleapplicationsand performdata visualizationinR.

TEXTBOOK

1. BhartiMotwani,"DataAnalyticswithR",WileyIndiaPrivateLimited,2019.
2. Seema Acharya, "Data Analytics Using R", McGraw Hill Education (India) Private Limited,2018.

REFERENCEBOOKS

1. EricMayor,"LearningPredictiveAnalyticswithR",PacktPublishingLimited,2015.
2. SimonWalkowiak,"BigDataAnalyticswithR",PacktPublishingLimited,2016.
3. UmeshR.HodeghattaandUmeshaNayak,"BusinessAnalyticsUsingR-APracticalApproach",Apress,2017.
4. ViswaViswanathan,"DataAnalyticswithR:AHands-onApproach",InfivistaInc.,2ndedition,2015.

MAPPINGofCOswithPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**3**	**2**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**
Strengthofcorrelation: Low-1,Medium-2,High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

Course Title	**PHP PROGRAMMING**						
Course Code	**22AIT308A**						
Category	**AbilityEnhancementCourse –III**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	01	**00**	**00**	**00**	**01**	**15**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 02 Hours**		

Course Objectives:

1. Learn PHP Evaluation and its datatypes ,variable and looping
2. Write basic PHP scripts using functions, arrays and strings
3. Explain the connection between HTML forms and PHP scripts
4. Learn Session ,cookie and Interface a PHP script with an MySQL database

UNIT I : 03 hours Introduction to PHP Evaluation of Php, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression. Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html.
UNIT II 03 hours Function What is a function, Define a function, Call by value and Call by reference, Recursive function, String Creating and accessing, String Searching & Replacing String, Formatting String, String Related Library function Array Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(), Some useful Library function..
UNIT III 03 hours Handling Html Form with Php Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission. Working with file and Directories Understanding file& directory, Opening and closing, a file, Coping, renaming and deleting a file, working with directories, Creating and deleting folder, File Uploading & Downloading.
UNIT IV 03hours Session and Cookie Introduction to Session Control, Session Functionality What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session.
UNIT V 03 hours Database Connectivity with MySql Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.)

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Learnt PHP datatypes, variables

CO2: Evaluate HTML code using functions, array

CO3: Design web page using HTML forms and PHP scripts
CO4:Analyse the concept of Session and Cookies.
CO5: Create Interactive Web Applications with PHP and **MySQL**

TEXT BOOK:

Learning PHP, MySQL & JavaScript, 6th Edition by Robin NixonReleased July 2021Publisher(s): O'Reilly Media, Inc.ISBN: 9781492093824

REFERENCE BOOKS

1. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
2. PHP: The Complete Guide for Beginners, Intermediate and Advanced Detailed Approach To Master PHP Programming
3. The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications With PHP and MySQL Paperback – 4 December 2015
4. Beginning PHP and MySQL From Novice to Professional" by W Jason Gilmore.
5. PHP 7 Programming Cookbook by Doug Bierer Released August 2016 Publisher(s): Packt Publishing ISBN: 9781785883446

SCHEME FOR EXAMINATIONS:

The theory part of the AEC shall be evaluated both by CIE and SEE.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO1	3	2	2		2								
CO2	2	2	2		2	3							
CO3			2		2	3							
CO4	2	2	2	2	2								
CO5	2	3	2	3	2								
Strength of correlation: Low-1, Medium- 2, High-3													

Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

Course Title	**DataAnalyticswithExcel**						
Course Code	**22AIL308B**						
Category	**AbilityEnhancementCourse –III**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	01	**00**	**00**	**00**	**01**	**15**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 02 Hours**		

COURSEOBJECTIVES:

1. Understandingdescriptivestatisticsandvisualizeadatasetas Histograms
2. Provide tools for data sorting, filtering, visualization using charts and summarizationtables (pivot).
3. Analyzethe datathat consistofatableofcellswhich containdataand formulas
4. Tobeable toanticipatethe futureusing forecasting toolspresented
5. Illustratetheuseofdifferenttoolsforwhat-ifscenarios,goalseek,linearsolversandstatisticalanalysistools.

Unit1 **03hours**

DataAnalytics

Navigatingworkspacewithintheexcelapplications,BasicExcelFormulas,StructuringDatainExcel,IntermediateExcel Functions,DescriptiveStatistics andHistograms.

Unit2 **03hours**

Visualizations

Introduction to Visualizations and PieCharts, Histograms, bar charts, Line Charts, BoxandWhisker,RadialCharts,ComboCharts,ScatterPlots,ConditionalFormatting,Sparklines,Control Charts.

Unit3 **03hours**

PivotTables,Chartsand Slicers

IntroductiontoPivotTables,RootCauseAnalysis,ComparativeAnalysis,PivotChartsandSlicers.

HypothesisTestingandRegression

TypesofData,FundamentalsofSampling,Distributions,IntroductiontoHypothesisTesting,T-tests,Normality, Simple Regression,Multi-VariateRegression

Unit4 **03hours**

Forecasting

Introduction to Forecasting, Factor Forecasting – Regression, Factor Forecasting - MonteCarlo Simulation, Time Series Forecasting - Parameter Tuning, Time Series Forecasting -AutoRegression.

Unit5 **03hours**

AnalyticalTools

Scenario Analysis, Data Tables, Introduction to Excel Solver Tool: Excel Solver Tool - TheBackpack Problem, Excel Solver Tool - The Mixing Problem, Excel Solver Tool - TheTravelingSalesman Problem.

TEACHINGLEARNINGPROCESS: ChalkandTalk,powerpointpresentation,animations,videos blended with Practical classes

COURSEOUTCOMES: Oncompletionofthecourse,studentshouldbe ableto:

CO1: Understanding the data analytics taxonomy, descriptive statistics andforecasting.

CO2: Understandstatisticstousedifferentstatisticaltestsbasedondifferentcircumstances.

CO3: Applyingexcelformulastobasicstatisticalconcepts.

CO4: Analyzeanalyticalmethodswithexceltool.

CO5: Introduce several archetypal problems and solve it using data analysis tools found inexcel,including excel solver.

TEXTBOOKS

1. Nigam, Manisha. "**AdvancedAnalyticswithExcel2019:PerformDataAnalysisUsingExcelÕsMostPopularFeatures**"India: BPBPUBN, 2020ISBN-9789389845808, 9389845807

REFERENCEBOOKS

2. Mount, George. **"AdvancingIntoAnalytics"**UnitedStates: O'ReillyMedia, 2021,ISBN-9781492094319,1492094315

ONLINERESOURCES

1. Data Analytics with excel:https://www.udemy.com/course/data-analytics-in-excel/
2. Forecasting and Regression Analysis in Excel:https://www.youtube.com/watch?v=qJfp9r-njUQ
3. Make a Pivot Table in Excel with Examples:https://www.youtube.com/watch?v=ho-vfOcsrZQ

MAPPINGofCOswithPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	3	-	-	-	-	3	3	-
CO4	3	3	-	3	3	-	-	-	-	3	3	-
CO5	3	3	3	3	3	-	-	-	-	3	3	-

Strengthofcorrelation: Low-1, Medium-2, High-3

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

CourseTitle	**VERSIONCONTROLLERwith GiT**						
CourseCode	**22AIT308C**						
Category	AbilityEnhancementCourse						
Scheme andCredits	No.of Hours/Week					Totalteaching hours	Credits
	L	T	P	SS	Total		
	01	00	00	00	01	15	01
CIEMarks:50	**SEEMarks:50**		**TotalMax. marks=100**		**DurationofSEE: 03Hours**		

COURSEOBJECTIVES:

1. UnderstandtheuseofbasicGiT CommandsandFile systems
2. UseofCommits,Diffs,BranchesandAlteringcommands.
3. Useofcreate alocalrepository,create acommit,create aremote repository andpushcommitstoaremoterepository.
4. Understandtowrite effectivecommitmessages

Unit13hrs
Introduction: Basic GiT concepts: Basic Concepts, Repositories, Git Object Types ,Index ,ContentAddressable Names ,Git Tracks Content ,Pathname Versus Content Object Store Pictures , Git Concepts at WorkObject StorePictures, GitConcepts at Work:gitdirectory,Objects, Hashes,andFilesandTrees.

Unit2 **3hrs**
File management and the Index: File Classifications in Git: Using git add, Using git rm ,Using git mv, ADetailedView of Git'sObjectModeland Files.**Commits:** Identifying Commits: Absolute Commit Names ,refs and symrefs ,Relative Commit Names, CommitHistory: Viewing Old Commits, Commit Graphs ,Commit Ranges, Finding Commits: Using git bisect , Using gitblame, Using Pickaxe.

Unit3 **3hr**
Branches: Branch Names, Using Branches, Creating Branches, Listing Branch Names ,Viewing Branches ,CheckingOutBranches,Deleting Branches.
Diffs: Formsofthegit diffCommand,examples,SimplegitdiffExample,gitdiffandCommit Ranges ,gitdiffwithPath Limiting,Comparing HowSubversion andGitDerive diffs.

Unit4 **3hr**
Merges: MergeExamples,WorkingwithMergeConflicts,MergeStrategies.
AlteringCommits: CautionAbout AlteringHistory:Usinggitreset,Usinggit cherry-pick,Usinggit revert,reset,revert,andcheckout,Rebasing Commits :Usinggitrebase-i,rebase Versusmerge.

Unit 5 **3hrs**
Repository Management: Repository Structure, Living with Distributed Development, Knowing YourPlace,Working with Multiple Repositories.
Patches: WhyUsePatches?,GeneratingPatches.,MailingPatches,ApplyingPatches,BadPatches,PatchingVersus Merging,

TEACHINGLEARNINGPROCESS:ChalkandTalk,powerpointpresentation,animations,videos

COURSEOUTCOMES: Attheendofthecoursethestudentwillbeableto:

CO1. Illustratehowto useGitforreal-worlddevelopment scenarios
CO2.Gain insightinto Git's common usecases, initial tasks,andbasicfunctions.
CO3.Applyhowtomanagemerges, conflicts,patches, anddiffs.
CO4: Gain insight into merging and commit altering
CO5:Manage Repository

TEXTBOOKS

Version Control with Git, Prem Kumar Ponuthorai, Jon Loeliger, Publisher(s): O'Reilly Media,Inc.3rd Edition,2022. ISBN:9781492091196

REFERENCEBOOKS

1.VersionControlwithGit,2ndEditionbyJonLoeliger,MatthewMcCullough

ONLINERESOURCES

1. http://elearning.vtu.ac.in/econtent/courses/video/
2.https://nptel.ac.in/courses/106/101/106101060/.
3. http://cse01-iiith.vlabs.ac.in/

MAPPINGofCOswithPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

Strength ofcorrelation: Low-1, Medium-2, High-3

IV SEMESTER

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**ANALYSIS & DESIGN OF ALGORITHMS**						
Course Code	**22AIT401**						
Category	Professional Core Course (PCC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**39**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To introduce the concept of an algorithm and understand the methods for analysis.
2. To represent algorithmic time efficiency using different asymptotic notations.
3. Explore the various algorithm design techniques, the process of its design and analysis.
4. To solve problems using appropriate design techniques.
5. Understand concepts of space-time trade offs.

UNIT I **07 hours**

Introduction: Notion of Algorithm, Methods of specifying algorithm, Important problem types:Sorting searching string processing, graph problems,combinatorial problems,, Asymptotic Notations and Basic efficiency classes: Informal introduction ,O- notation, Ω-notation ,Θ- notation, Basic efficiency classes, Mathematical Analysis of Non-Recursive and RecursiveAlgorithms

Brute Force:Introduction, Bubble Sort, Sequential search

Text Book 1:Chapter 1: 1.1,1.3 Chapter 2:2.2,2.3.2.4, Chapter 3:3.1,3.2

UNIT II **08 hours**

Divide and conquer: General Method, Binary search,Recurrence equation for DAC, Finding Minimum and maximum,Merge Sort, Quick Sort

Decrease-and-conquer: Introduction, Depth First Search,Breadth First Search,Topological Sorting.

Text Book 1 :Chapter 4, 4.1,4.2,4.3 Chapter 5:5.2,5.

UNIT III **09 hours**

Greedy method: The General Method, Knapsack Problem, Minimum cost spanning trees : Prim's Algorithm, Kruskal'sAlgorithm, Single Source Shortest Paths: Dijikstras Algorithm, Huffman trees

Transform and Conquer: Heaps and Heapsort

Text Book 2: Chapter 4 :4.1,4.2,4.4; Text Book 1: Chapter 9 : 9.1,9.2,9.3,9.4 Chapter 6 : 6.4

UNIT IV **07 hours**

Dynamic Programming: Computing binomial coefficient**,**Warshall's and Floyds algorithms, Knapsack problem, Travelling Sales person problem

Backtracking:N-Queen problem, sum of Subset Problem

Text Book 1:Chapter 8 : 8.1,8.2,8.4, Ch 12:12.1 Text Book 2: Chapter 5: 5.9

UNIT V **08 hours**

Branch-and-Bound: Assignment Problem, Traveling Sales man Problem

Space and Time Tradeoffs: Sorting by Counting : Comparison Counting sort ,Distribution Counting Horspool's algorithm
NP-Complete and NP Hard problems: P and NP problems,NP complete problems

Text Book 1: Chapter 11: 11.2 , Chapter 7:7.1,7.2 Chapter 10: 10.3 :

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Determine performance of recursiveandnon-recursivealgorithms.

CO2: Develop and analyzealgorithms tosolveproblemsusingvariousdesign techniques.

CO3: Apply different design techniques tosolveproblems.

CO4: Determine solutions to optimization problems by applying suitable algorithm.

CO5: Solve problems associatedwithspace–time tradeoffs

TEXT BOOK:

1. AnanyLevitin:IntroductiontotheDesignandAnalysisofAlgorithms,SecondEdition,PearsonEducation, 2009.
2. EllisHorowitz,SartajSahni,Sanguthevar Rajasekaran:ComputerAlgorithms/C++,2nd Edition,University press, 2014

REFERENCE BOOKS:

1. ThomasH.Cormen,CharlesE.Leiserson,RonalL.Rivest,CliffordStein:IntroductiontoAlgorithms,2nd Edition,PHI, 2006.
2. DesignandAnalysisofAlgorithms,S.Sridhar,Oxford(HigherEducation

EBOOKS/ONLINE RESOURCES

https://onlinecourses.nptel.ac.in/

SCHEME FOR EXAMINATIONS:

PCC shall be evaluated both by CIE and SEE. Both Assigment and Group Activity are evaluated for 5 Marks each. Each CIE test is conducted for 25 Marks .Total CIE theory test marks of 50 is reduced to 40 Marks and Assignment & Group Activity Marks are added to get final CIE Marks . SEE Theory exam is conducted for 100 marks and then reduced to 50 Marks.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3	2	3								
CO3	3	3	2	3								
CO4	3	3	2	3								
CO5	3	3	2	3								
Strength of correlation: Low-1, Medium- 2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

CourseTitle	**Artificial Intelligence**						
CourseCode	**22AIU402**						
Category	Integrated Professional Core Course (IPCC)						
Scheme andCredits	**No.ofHours/Week**					**TotalTeaching hours**	**Credits**
	L	**T**	**P**	**SS**	**Total**		
	03	00	02	00	05	60	04
CIE Marks: 50	**SEEMarks: 50**		**TotalMax.marks=100**		**Durationof SEE:03Hours**		

COURSEOBJECTIVES:

1. The objective of the course is to:
2. To understand agent programming for different applications.
3. To learn different problem solving methods for artificial agents.
4. To learn knowledge representation using predicate logic and propositional logic.
5. To learn implementing planning in agents.

Unit1 **8hours**

Introduction: what is AI, the foundations of AI, history of AI, the state of the art, and Intelligent agents: Agents and environments, good behavior, concept of rationality, nature of environments, and structure of agents.

Unit28hours

Problem-solving by Searching: Problem solving agents, searching for solutions, uninformed search strategies informed search strategies, heuristic functions, games, optimal decision in games, alpha-beta pruning.

Unit3 **8hours**

Logical agents:knowledgebasedagents,thewumpusworld,logic, propositionallogic,reasoningpatternsinpropositionallogic,effectivepropositionalinference, agentsbasedonpropositionallogicfirstorderlogic,syntaxandsemanticsoffirstorderlogic, Propositionalvs.Fistorder inference.

Unit48hours

Knowledgerepresentation:ontologicalengineering, categories and objects, actions, situations and events, mental eventsand mental objects .Planning: the planning problem, planning withstate spacesearch,partialorderplanning,planninggraph.

Unit58hours **Makingsimpledecisions:**combiningbeliefsanddesiresunder uncertainty,thebasicsofutilitytheory,utilityfunctions, multiattributeutilityfunctions,decisionnetworks,thevalueinformation, decisiontheoreticexpertsystem **,Learningfromexamples**:formsoflearning,inductivelearning,learningdecisiontrees
Programming Exercises: 1. Write a Program to implement Breadth First Search using Python. 2. Write a Program to implement Depth First Search using Python. 3. Write a Program to implement Tic-Tac-Toe game using Python. 4. Write a Program to implement 8-Puzzle problem using Python. 5. Write a Program to Implement Water-Jug problem using Python

TEACHINGLEARNINGPROCESS: ChalkandTalk,powerpointpresentation,animations,videos

COURSE OUTCOMES: On completion of the course, student should be able to:
CO1: Understand and design different types of agents for real time applications.
CO2: Apply search methods to solve real time problems in building AI applications.
CO3: Effectively use predicate logic and propositional logic rules for inferring behaviours of agents in real time applications.
CO4: Apply different planning methods to improve the agent's performances in real-time applications.

TEXTBOOKS

1. Artificial Intelligence: A Modern Approach, by Stuart Russell and Peter Norvig, 2nd Edition, Publisher: Pearson education ltd-2013 ISBN: 978-81-7758-367-0

REFERENCEBOOKS:

1. Luger, G. F., & Stubblefield, W. A., Artificial Intelligence - Structures and Strategies for Complex Problem Solving. New York, NY: Addison Wesley, 5th edition (2005).
2. Nilsson, N. J. Artificial Intelligence - A Modern Synthesis. Palo Alto: Morgan Kaufmann. (1998).
3. Nilsson, N. J., Principles of Artificial Intelligence. Palo Alto, CA: Tioga (1981).
4. Rich, E., & Knight, K., Artificial Intelligence. New York: McGraw-Hill (1991).

ONLINERESOURCES:

1. http://Nptel.ac.in/courses/106/106/106140
2. http://Nptel.ac.in/courses/106/102/102220

MAPPINGofCOswithPOs

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

Strengthofcorrelation: Low-1, Medium-2, High-3

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**DATABASE MANAGEMENT SYSTEMS**						
Course Code	**22AIU403**						
Category	Integrated Professional Core Course (IPCC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**02**	**00**	**05**	**60**	**04**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

6. To analyze the basic concepts and architecture of DBMS.
7. To understand the conceptual and relational models to design databases
8. To Create and manipulate a relational database using SQL..
9. To understand the normalization steps in database design and removal of data anomalies.
10. To acquire the knowledge of transaction processing, NoSQL and MongoDB concepts

UNIT I : 08 hours

Introduction: Introduction; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Classification of Database Management systems**.**

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

T1:Ch1,2,7

UNIT II 07 hours

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra. Relational Database Design Using ER-to-Relational Mapping

T1: Ch 3 , Ch 6.1-6.5 9.1

UNIT III 09 hours

SQL :Schema Definition, Basic Constraints and Queries: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL

T1:ch4, ch5

UNIT IV 07 hours

Database Design: Functional Dependencies and Normalization: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. Relational Database Schema Design Algorithms and further Dependencies: Properties of Relational Decompositions; Multi valued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form

T1: Ch15, ch16

UNIT V **08 hours**

Introduction to Transaction Processing Concepts and Theory:

Introduction to Transaction Processing,Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability,Characterizing Schedules Based on Serializability,Transaction Support in SQL

Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control,Two-Phase Locking Techniques for Concurrency Control,Multiversion Concurrency Control Techniques,Validation (Optimistic) Concurrency Control Techniques,Granularity of Data Items and Multiple Granularity Locking

T1: Ch 21, Ch 22

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Lab Component:

1. Consider the customer-sale scenario given below. The primary keys are underlined and the data types are specified:

CUSTOMER(Cust id : integer, cust_name: string)
ITEM(item_id: integer, item_name: string, price: integer)
SALE(bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following:

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the bills for the current date with the customer names and item numbers
d) List the total Bill details with the quantity sold, price of the item and the final amount
e) List the details of the customer who have bought a product which has a price>200
f) Give a count of how many products have been bought by each customer
g) Give a list of products bought by a customer having cust_id as 5
h) List the item details which are sold as of today
i) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount

2. Consider the following schema for a Library Database:

BOOK(Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS(Book_id, Author_Name)
PUBLISHER(Name, Address, Phone)
BOOK_COPIES(Book_id, Programme_id, No-of_Copies)
BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)
LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)

Write SQL queries to

a) Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
b) Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2019 to Jun 2019
c) Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
d) Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
e) Create a view of all books and its number of copies that are currently available in the Library.

3. Consider the Employee-pay scenario given below. The primary keys are underlined and the data types are specified:

EMPLOYEE(emp_id : integer, emp_name: string)
DEPARTMENT(dept_id: integer, dept_name:string)
PAYDETAILS(emp_id : integer, dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)

PAYROLL(emp_id : integer, pay_date: date)
For the above schema, perform the following:
a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List the employee details department wise
d) List all the employee names who joined after particular date
e) List the details of employees whose basic salary is between 10,000 and 20,000
f) Give a count of how many employees are working in each department
g) Give a names of the employees whose netsalary>10,000
h) List the details for an employee_id=5
i) Create a view which lists out the emp_name, department, ba basic, dedeuctions, netsalary
j) Create a view which lists the emp_name and his netsalary

4. Consider the following relational schema for the Office of the Controller of Examinations Application.
Student (Rollno, Name, Dob, Gender, Doa, Bcode);
Implement a check constraint for Gender
Branch (Bcode, Bname, Dno);
Department (Dno, Dname);
Course (Ccode, Cname, Credits, Dno);
Branch_Course (Bcode, Ccode, Semester);
Enrolls (Rollno, Ccode, Sess, Grade);
For Example, SESS can take values **'MAY2019', 'DEC2019'** Implement a check constraint for grade Value Set **('S', 'A', 'B', 'C', 'D', 'E', 'U');** Students are admitted to Branches and they are offered by Departments. A branch is offered by only one department. Each branch has a set of Courses (Subjects). Each student must enroll during a semester. Courses are offered by Departments. A course is offered only by one department. If a student is unsuccessful in a course he/she must enroll for the course during next session. A student has successfully completed a course if the grade obtained by is from the list **(A, B, C, D, and E).** A student is unsuccessful if he/she have grade **'U'** in a course.Develop a SQL query to
a) list details of Departments that offer more than 3 branches.
b) list the details of Departments that offer more than 6 courses.
c) list the details of courses that are common for more than 3 branches.
d) list students who got 'S' in more than 2 courses during single enrollment.
e) Create a view that will keep track of the roll number, name and number of courses, a student has completed successfully.

5. Consider the schema for Movie Database:
ACTOR (Act_id, Act_Name, Act_Gender)
DIRECTOR (Dir_id, Dir_Name, Dir_Phone)
MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST (Act_id, Mov_id, Role)
RATING (Mov_id, Rev_Stars)
Write SQL queries to
a) List the titles of all movies directed by 'Hitchcock'.
b) Find the movie names where one or more actors acted in two or more movies.
c) List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).
d) Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
e) Update rating of all movies directed by 'Steven Spielberg' to 5.

COURSE OUTCOMES: On completion of the course, student should be able to:
CO1:Analyze the database concepts, data models and design the ER model for real world applications
CO2:Design a database schema for database application and perform manipulation operations.
CO3: Develop complex queries using SQL to retrieve the information required from the database.
CO4: Apply normalization techniques to database.

CO5:Analyze the concepts of transaction processing, NoSQL and MongoDB

TEXT BOOK:

1.Elmasri and Navathe: Fundamentals of Database Systems, 6th Edition, Pearson Education, 2011.

REFERENCE BOOKS

1. Raghu Ramakrishna and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
2. Silberschatz, Korth and Sudharshan: Data base System Concepts, 5th Edition, Mc-GrawHill, 2006.
3. C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearson education, 2006.
4. www.w3resources.com

SCHEME FOR EXAMINATIONS:

The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).However, questions from the practical part of IPCC shall be Included in these question paper.

MAPPING of COs with POs and PSOs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3		2							
CO2	2		2		2							
CO3		3	3		2				1			
CO4	2	1	2									
CO5	2	1	2		2							
Strengthofcorrelation: Low-1, Medium-2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**ANALYSIS &DESIGN OF ALGORITHMSLAB**						
Course Code	**22AIL404**						
Category	Professional Core Course Lab (PCCL)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	**00**	**02**	**00**	**02**	**26**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. Tointroducevariousalgorithmdesigntechniques.
2. Todesignalgorithmswithspecifictechniqueandimplementthesealgorithmsusingthe appropriatetechnique.
3. To enhancetheskill to debug programs.

I. LISTOFPROGRAMS

ImplementthefollowingusingC/C++/ GO Language :

1	Design and implement an algorithm to Sort a given set of elements using DAC merge sortmethod and determine the time required to sort the elements. Repeat the experiment fordifferentvalues ofn andanalyzethetime complexity.
2	Printallthe nodesreachable fromagivenstartingnodeina digraphusingBFSmethod.
3	Obtainthetopologicalorderingofverticesinagivengraphusing DFSmethod/Sourceremovalmethod
4	Fromagivenvertexinaweightedconnectedgraph,findshortestpathstootherverticesusingDijkstra's algorithm.
5	ApplyPrim'salgorithmtoundirectedgraphandobtainminimumcostSpanningTree.
6	DesignandimplementHeapSortalgorithmtoarrangeelementsindesiredorder
7	Designandimplementanalgorithmtosolve0/1Knapsackproblemusingdynamicprogramming.
8	Designand ImplementFloyd'salgorithmfortheAll-Pairs-Shortest-Pathsproblem.
9	Designandimplement analgorithm tosolveN-Queen's problemusing BackTracking.
10	DesignandimplementHorspool'salgorithm.

Note:Intheexaminationeach studentpicksonequestion fromthelotof all10questions.

OPEN ENDED QUESTIONSDevelop / SimulateFollowing GameApplications:

1. Knapsack
2. SpanningTrees
3. Sumof Subset
4. TravellingSalesPersonetc.

NOTE:

1. STUDENT IS PERMITED TO SUBMIT OPEN ENDED SOLUTION TO ANY OTHER OPEN ENDEDQUESTION APART FROM THE LIST ABOVE. BUT IT HAS TO BE APPROVED BY THESTAFF INCHARGE.

2. INTHEEXAMINATIONEACHSTUDENTPICKSONEQUESTIONFROMALOTOF ALL10QUESTIONS

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Develop algorithms using different design techniques.

CO2: Implement thealgorithms usingC/C++.

CO3:Analyzethetimecomplexityof algorithms.

CO4: Solve optimizationproblems by implementing suitable algorithm.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3	2	3								
CO3	3	3	2	3								
CO4	3	3	2	3								
Strengthofcorrelation: Low-1, Medium-2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**DISCRETE MATHEMATICAL STRUCTURES**							
Course Code	**22AIT405A**							
Category	**ESC**							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	00	00	04	40	00	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks = 100**		**Duration of SEE: 03 Hours**			

COURSE LEARNING OBJECTIVES

Thiscourse is proposed toenhance the student's ability to think logically, mathematically and algorithmically and use the concepts of discrete mathematical structures to solve problems connected to computer and information science & engineering.

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Fundamentals of Logic:** Propositions-Logical Connectives, Tautologies, Contradictions. Logical Equivalence–The Laws of Logic, Inverse, Converse	04	04

	and Contrapositive. Logical Implication – Rules of Inference. Quantifiers and Types of Quantifiers. **Self-study:** Proofs of theorems - Method of direct and indirect proofs. **Applications:** Applications to Switching Networks. (RBT levels: **L1, L2, L3, L4**)		
II	**Set Theory and Mathematical Induction:** Sets, subsets, set operations, laws of set theory, counting and venn diagram. The well ordering principle, principle of mathematical induction, alternative form of mathematical induction. **Self-study:**Axioms of probability, **Applications:** Applications to recursive relations. (RBT levels: **L1, L2, L3, L4**)	04	04
III	**Relations and Functions:** Cartesian product, relations, Equivalence relation and partition. Partial order, Poset, Hasse diagram. Functions, one-one and onto functions, composition of a function and inverse functions. **Self study:** Pigonhole principle**,** Stirling numbers. **Applications:** Computer recognition-zero-one matrices and directed graphs. (RBT levels: **L1, L2, L3, L4**)	04	04
IV	**Introduction to Graph Theory:** Definition of a graph and examples. Degree of a vertex and degree sequence- Hakim's theorem(no proof). Standard graphs - complete graph, regular graph, Peterson graph, bipartite graph, complete bipartite graph. Compliment of a graph, self-complimentary graphs. Graph isomorphism. Sub graph- proper sub graph, spanning sub graph, induced sub graph. Walk, trial, path, cycle, connectedness, Euler and Hamiltonian graph. **Self-study:** Operation on graphs - union, intersection, ring sum, Cartesian product, deletion & addition of edge/vertex. **Applications:** Konigsberg bridge problem,Seating arrangement problem. (RBT levels: **L1, L2, L3, L4**)	04	04
V	**Trees and Cut-sets:** Trees, Properties, Rooted Tree, Binary tree, Spanning Tree, Minimal Spanning Tree - Prism Algorithm Kruskal's Algorithm, Dijikstra's shortest path algorithm for directed and undirected graph. **Self-study:** Cut Set, Network Flow, Maximum Flow and Minimum cut Theorem. **Applications:** Prefix code: David Huffman Algorithm. (RBT levels: **L1, L2, L3, L4**)	04	04

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1	**Demonstrate** the knowledge of fundamental concepts in discrete mathematics and graph theory.
CO2	**Apply** the concepts of logics, mathematical induction and set theory to solve domain specific problems.
CO3	**Analyze** the given problem to find the solution by suitable discrete mathematical concepts.
CO4	**Examine** the given concepts related to mapping and graph theory.
CO5	**Develop** a variety of algorithms using appropriate technology.

TEACHING – LEARNING PROCESS: Chalk and Talk, power point presentation,

TEXTBOOKS

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
2. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer
   Science",Tata McGraw-Hill.
3. Introduction to graph theory by Gary Chartrand and Ping Zang, Tata McGraw-Hill addition 2006.

REFERENCE BOOKS

1. Narsingh Deo, Graph theory with applications to engineering and computer Science, PHI, 1979.
2. C L Lium& D P Mohapatra, Elements of Discrete Mathematics, A Computer Oriented Approach, The McGraw-Hill Companies.
3. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.
4. Graph theory with applications to engineering and computer Science by Narsingh Deo

Web links and Video Lectures (e-Resources)

1. https://onlinecourses.nptel.ac.in/noc20_cs82/preview
2. https://nptel.ac.in/courses/106108227
3. https://archive.nptel.ac.in/courses/111/106/111106102/
4. https://www.youtube.com/watch?v=sWsXBY19o8I
5. https://youtu.be/ZiojZJfQYh0

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	3										
Strength of correlation: Low-1, Medium-2, High-3												

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Artificial Intelligence & Machine Learning
Scheme and Syllabus - CBCS-2023 -2024

Course Title	**METRIC SPACES**							
Course Code	**22AIT405B**							
Category	**ESC**							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	00	00	04	40	00	03

CIE Marks: 50	SEE Marks: 50	Total Max. marks = 100	Duration of SEE: 03 Hours

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students theskills to develop the theory of metric spaces and apply the concepts in complex engineering problems.

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Introduction to Metric spaces:** Set, operation on sets, Cartesian product of sets, Relation, Function, ordered sets, equivalent sets, sequences, field , linear space, Normed linear space, Euclidean space, Minkowski's inequality, Holder inequality, Topological space. (RBT levels: **L1, L2, L3, L4**)	04	04
II	**Metric space:** Definition, Pseudo metric space, open ball, metric topology, Closed ball, Metric induced by norm, Neighborhood of a point, subspace of a metric space, Base of a metric space. (RBT levels: **L1, L2, L3, L4**)	04	04
III	**Bounded set:** Definition , Bounded metric space, Dense set, separable space, Nowhere dense set, equivalent matrices, Cartesian product of matrices. (RBT levels: **L1, L2, L3, L4**)	04	04
IV	**Completeness:** Convergent sequence, Cauchy sequence, complete metric space, Cantor's intersection theorem, category of a set, Baire category theorem. (RBT levels: **L1, L2, L3, L4**)	04	04
V	**Compactness and Connectedness:** Definition, Bolazno-Weistrass property, sequential compactness, Separated sets, connected metric space**.** (RBT levels: **L1, L2, L3, L4**)	04	04

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1	**Learn** basic facts about the cardinality of a set and various set theoretic paradoxes.
CO2	**Recognize** open and closed spheres and bounded sets.
CO3	**Understand** several standard concepts of metric spaces and their properties
CO4	**Identify** the continuity of a function defines on metric spaces and homomorphism
CO5	**Analysis** compactness and connectedness of metric spaces.

TEACHING – LEARNING PROCESS: Chalk and Talk, power point presentation,

TEXTBOOKS

1. Parijat Sinha, Metric spaces, Kedarnath Ramnath, India, 2020.
2. E.T. Copson (1988). *Metric spaces*. Cambridge University Press
3. P.R. Halmos (1974). *Naive Set Theory*. Springer
4. P.K. Jain&Khalil Ahamad (2019), *Metric Spaces*. Narosa

REFERENCE BOOKS

1. S.Kumaresan (2011). *Topology of Metric spaces* (2^{nd} edition),Narosa

2. Satish Shirali&Harikishan L. Vasudeva (2006). *Metric Spaces*. Springer-Verlag.
3. Micheal O;Searcoid (2009), Metric spaces. Springer-Verlag
4. G.F. Simmons (2004). Introduction to Topology and Modern analysis. McGraw-Hil

Web links and Video Lectures (e-Resources)

1. http://www.umsl.edu
2. http://www.waterstones.com

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	3										
Strength of correlation: Low-1, Medium-2, High-3												

Course Code	**22AIT405C**							
Category	**ESC**							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	00	00	04	40	00	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks = 100**		**Duration of SEE: 03 Hours**			

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students theskills to develop the theory of games and working algorithms to solve complex engineering problems.

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Basic Concepts and computational issues:** Assumption of Game theory, example of Game theory, equilibrium concepts, Nash equilibrium, Indifference principle, Security of players. (RBT levels: **L1, L2, L3, L4**)	04	04
II	**Matrix Games:** Minmax theorem, implication of Minmax theorem, MSNE's of matrix games, iterative elimination of dominated strategies, Bress's paradox, Yao's Lemma and applications, support enumeration algorithm. (RBT levels: **L1, L2, L3, L4**)	04	04
III	**Computing Equilibrium:** Succinct game, potential games, best response dynamics, fast convergence of best response, PSNE's for conjunction and systematic conjunction games, PPAD class, Sperner lemma. Approximate MSNE computation, (RBT levels: **L1, L2, L3, L4**)	04	04
IV	**Correlated and Coarse Correlated Equilibrium:** correlated equilibrium, Coarse correlated equilibrium, external regret frame work, multiplicative weight algorithm, Swap regret and correlated equilibrium, Swap regret to external regret reduction, **Price of Anarchy:** BRAESS's paradox and Pigou's network, PoA of selfish routing algorithm, Bayesian game, BNE of first price action, extensive form game (RBT levels: **L1, L2, L3, L4**)	04	04
V	**Mechanism Design:** introduction, implementation of social choice functions, revelation principle, properties of social choice function, Gibbard-Satterthwait theorem. (RBT levels: **L1, L2, L3, L4**)	04	04

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1	**Learn** the basic notions of game theory, matrix games, equilibria, strategic interaction.
CO2	**Understand** the notion of efficiency in games, Braess's paradox, Bayesian game.
CO3	**Know** how to implement algorithms for computing equilibria, correlated equilibria and swap regret.
CO4	**Understand** issues of strategic behaviour, correlated equilibrium and self-routing algorithms.
CO5	**Develop** mechanism design, social choice functions and apply Gibbard-Satterthwait theorem.

TEACHING – LEARNING PROCESS: Chalk and Talk, power point presentation,

TEXTBOOKS

1. Nisan/Roughgarden/Tardos/Vazirani (eds), Algorithmic Game Theory, Cambridge University, 2007.
2. Michael Maschler, Eilon Solan, and Shmuel Zamir, Game Theory.
3. Y. Narahari, Game Theory and Mechanism Design.

REFERENCE BOOKS

1. Palash Dey, Lecture notes: Algorithmi Game Theory, Indian Institute of Technology, Kharagpur.
2. Sir Donald Buphet, Game Theory: The Everyday Guide,
3. Avinash K. Dixit, Barry J. Nalebuff, The Art of Strategy: A Game Theorist's Guide to Success in Business and Life, W. W Norton & Company., illustrated Ed., 2010.
4. Ivan Pastine, Tuvana Pastine, Tom Humberstone, Introducting game theory: A grahic guide, Icon books, 2017.

Web links and Video Lectures (e-Resources)

1. https://youtu.be/gsIulizlQJ4
2. https://archive.nptel.ac.in/courses/106/105/106105237/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	3										
Strength of correlation: Low-1, Medium-2, High-3												

CourseTitle	**Green IT and Sustainability**						
CourseCode	**22AIT406A**						
Category	**AEC-IV**						
Scheme andCredits	**No. of Hours/Week**					**Total Teaching hours**	**Credits**
	L	**T**	**P**	**SS**	**Total**		
	01	00	00	00	01	15	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE:02 Hours**		

COURSEOBJECTIVES:

1. To familiarize the students to the area of Green IT and concepts of sustainability engineering.
2. To enable students with an understanding of principles and frame work of sustainable engineering.
3. To provide students with an understanding of Life Cycle Assessment tool in sustainable engineering.
4. To provide students with understanding of integration of sustainability with design.
5. Demonstrate the broad perspective of sustainable practices.

Unit1 **03hours**

Climate change:

Enterprise IT emits a lot of greenhouse gases and contributes to climate change. Businesses must track and reduce their emissions as well as various types of toxic electronic waste that pollute the environment. Green IT approaches can be a useful part of broader climate strategies in companies.

Benefits of green IT: Benefits of Green Computing & Green IT Practices

Unit2 **03hours**

Compliance:

Businesses are increasingly under pressure from governments and the public to reduce their environmental impact. Green IT makes more efficient use of resources, reducing waste and emissions and improving recycling rates. This helps businesses comply with government regulations.

Challenges of green IT: Designing energy-efficient computers, servers, printers, projectors, and other digital devices is considered a sustainable and green design.

Unit3 **03hours**

Sustainable Development and Role of Engineers: Introduction, Sustainable Development, Paris Agreement and Role of Engineering, Sustainable Development and the Engineering Profession, Key attributes of the Graduate Engineering.

Sustainable Engineering Concepts: Key concepts – Factor 4 and Factor 10: Goals of sustainability, System Thinking, Life Cycle Thinking and Circular Economy.

Unit4 **03hours**

Cleaner Production(CP):

Definition, principles of Cleaner production and its benefits, Role of Industry, Government and Institutions in cleaner production, clean development mechanism, reuse, recovery, recycle, raw material substation Wealth from waste.

Unit5 03hours

Integrating Sustainability in Engineering Design: Problems Solving in Engineering, conventional to Sustainable Engineering Design Process, Design for Life Guidelines and Strategies, Measuring Sustainability, Sustainable Design through sustainable procurement criteria, Case studies on sustainable Engineering Design Process – Sustainable Process Design, Sustainable Production Design Sustainable product design in Electronic Engineering,

TEACHINGLEARNINGPROCESS: Chalk and Talk, power point presentation, animations, videos blended with Practical classes

COURSEOUTCOMES: On completion of the course, student should be able to:

CO1: Understanding the Green IT and Sustainability.

CO2: Elucidate the basics of sustainable development, engineering and its role.

CO3: Apply the Principle, and methodology of Life Cycle Assessment Tool

CO4: Understand integration methods of sustainability to Engineering Design

CO5: Develop innovative, reliable, sustainable and economically viable designs

TEXTBOOKS

3. Toolseeram Ramjeawon,"**Introduction to Sustainability for Engineers**", CRC Press, 1st Edn., 2020.
4. Allen, D. T., and Shonnard, D.R., "**Sustainability Engineering: Concepts, Design and Case Studies"**, Prentice Hall, Pearson Education Limited, 2015.
5. Shachi Shah, V. Venkatramanan, Ram Prasad **"Sustainable Green Technologies for Environmental Management"**, Springer Singapore, 2019.
6. Ni bin Chang, "**Systems Analysis for Sustainable Engineering: Theory and Applications**", McGraw-Hill Professional, 2011.

REFERENCEBOOKS

1. UNESCO, InternationalCentre for Engineering Education, "**Engineering for Sustainable development: Delivery a sustainable development goals**", France, 1st Edn., 2021

ONLINERESOURCES

4. Business and Sustainable Development, IIT Bombay, Prof. Trupti Mishra https://nptel.ac.in/courses/110101153
5. https://www.techtarget.com/searchcio/definition/green-IT-green-information-technology
6. https://nptel.ac.in/courses/107103081/www.macf
7. https://engineeringforoneplanet.org/

MAPPING of Cos with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	3	-	-	-	-	2
CO2	-		-	-	-	2	3	-	-	-	-	2
CO3	-	-	-	-	-	2	3	-	-	-	-	2
CO4	-	-	-	-	-	2	3	-	-	-	-	2
CO5	-	-	-	-	-	2	3	-	-	-	-	2

Strengthofcorrelation: Low-1, Medium-2, High-3

Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Artificial Intelligence & Machine Learning

Scheme and Syllabus - CBCS-2023 -2024

CourseTitle	TechnicalwritingusingLATEX (Lab)						
CourseCode	**22AIL406B**						
Category	AbilityEnhancementCourse-IV						
Scheme andCredits	No.of Hours/Week					Totalteaching hours	Credits
	L	T	P	SS	Total		
	00	00	01	00	01	15	01
CIEMarks:50	**SEEMarks:50**		**TotalMax. marks=100**		**DurationofSEE: 03Hours**		

COURSEOBJECTIVES:

5. Understandtheuseofbasicinstallation process andenvironment
6. Understand editing text documents using latex packages and commands.
7. Understand to create and edit mathematical formulae and Tables
8. Understandto insert and edit images using latex packages
9. Understand to write article/letters/resumes using Latex

List of Programs

1. **Introduction:** Installation of Latex and usage, Demonstrate usage of Class and packages Latex programming and commands, sample packages, Latex Error messages.

2. **Latex Programs for the following:**
   Fonts, symbols, indenting, paragraphs, line spacing, word spacing, titles and subtitles.
   Document class, page style, parts of the documents, table of contents.

3. **Latex Programs for the following:**
   Command names and arguments, environments, declarations.
   Theorem like declarations, comments within text.

4. **Latex Programs for the following:**
   Mathematical environments, math mode ,mathematical symbols
   Graphic package, multivalued functions, drawing matrices

5. **Latex Programs for the following:**
   Tables, tables with captions .
   References to figures and tables in text

6. **Latex Programs for the following:**
   Mathematical environments, math mode ,mathematical symbols
   Graphic package, multivalued functions, drawing matrices

7. **Latex Programs for the following:**
   Tables, tables with captions
   References to figures and tables in text

8. **Latex Programs for the following:**
   picture environments
   extended pictures, other drawing packages
   Preparing book, project report in LaTeX.

9. **Latex Programs for the following:**
   Editing articles
   Creating resumes

10. **Latex Programs for the following:**
    Letters writing
    Managing references

COURSEOUTCOMES: Attheendofthecoursethestudentwillbeableto:

CO1. Install Latex software's and use the environment comfortably
CO2. Edit text documents using latex packages and commands.
CO3. Create and edit mathematical formulae and Tables
CO4. Insert and edit images using latex packages
CO5. Write article/letters/resumes using Latex

REFERENCEBOOKS

1.Guide to LaTeX, Fourth Edition byHelmut Kopka, Patrick W. Daly, Released November 2003 Publisher(s): Addison-Wesley Professional, ISBN: 9780321173850

ONLINERESOURCES

1. https://latex-tutorial.com/tutorials/
2. https://www.javatpoint.com/latex

MAPPINGofCOswithPOshttps://www.javatpoint.com/latex

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	2
CO2	3	2	2	2	2	-	-	-	-	-	-	2
CO3	3	2	2	2	2	-	-	-	-	-	-	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2
CO5	3	2	2	2	2	-	-	-	-	-	-	2
Strength ofcorrelation: Low-1, Medium-2, High-3												

CourseTitle	**MERN**						
CourseCode	**22AIL406C**						
Category	AbilityEnhancementCourse-IV						
Scheme andCredits	No.of Hours/Week					Totalteaching hours	Credits
	L	T	P	SS	Total		
	00	00	01	00	01	15	01
CIEMarks:50	**SEEMarks:50**		**TotalMax. marks=100**		**DurationofSEE: 03Hours**		

COURSEOBJECTIVES:

1. Usage of various front and back end Tools
2. They can understand and create applications on their own
3. Demonstrate and Designing of Websites can be carried out.
4. Develop web based application using suitable client side and server side code.
5. Implement web based application using effective database access

Lab Exercises

1. Write a program to create a simple webpage using HTML.
2. Write a program to create a website using HTML CSS and JavaScript
3. Write a program to build a Chat module using HTML CSS and JavaScript
4. Write a program to create a simple calculator Application using React JS
5. Write a program to create a voting application using React JS
6. Write a program to create and Build a Password Strength Check using Jquery
7. Write a program to create and Build a star rating system using Jquery
8. Create a Simple Login form using React JS
9. Using the CMS users must be able to design a web page using the drag and drop method
10. Create a project on Grocery delivery application
11. Connecting our TODO React js Project with Firebase

TEACHINGLEARNINGPROCESS: Practical classes blended with

COURSEOUTCOMES:

Attheendofthecoursethestudentwillbeableto:

CO1. Usage of various front and back end Tools

CO2. They can understand and create applications on their own

CO3. Demonstrate and Designing of Websites can be carried out.

CO4. Develop web based application using suitable client side and server side

code.

CO5: Implement web based application using effective database access

REFERENCEBOOKS

1.MongoDB in Action: Covers MongoDB version 3.0 2nd Edition, by Kyle Banker (Author), Peter Bakkum (Author), Shaun Verch (Author), Doug Garrett (Author), Tim Hawkins (Author), MANNING SHELTER ISLAND

ONLINERESOURCES

1. https://www.w3resource.com/
2. https://www.udemy.com/course/the-complete-mongodb-course/

MAPPINGofCOswithPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	2	2	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2
CO5	3	2	2	2	2	-	-	-	-	-	-	2
Strength ofcorrelation: Low-1, Medium-2, High-3												