DEPARTMENT
OF
COMPUTER SCIENCE &ENGINEERING
SMIT MAJITAR

COURSE CURRICULUM FOR
B. TECH (CSE,AI-ML)ACCORDING TO
NATIONAL EDUCATION POLICY-2020

APPLICABLE FOR 1ST YEAR FROM 2024-25 BATCH
AND
SUBSEQUENT BATCHES

Total Credits:

$$21+21+27 + 26 + 28 + 26 + 15 +16 = 180$$

1st Year

PROGRAM OUTCOMES FOR B.TECH

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 teamwork**: 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 techno logical change.

VISION AND MISSION FOR SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

Vision:

- To achieve eminence in the field of quality technological education and research.

Mission:

- To develop SMIT into an Institution of Excellence capable of producing competent techno-managers who can contribute effectively to the advancement of the society.

Objective:

- To provide wholesome education to meet the intellectual aspirations of the students.
- To equip students with techno-managerial skills to enable them to take their assigned role in the industry.
- To inculcate essential ethics and values to meet the spiritual needs to the students.
- To provide a sound institutional environment nurturing emotional strength, healthy mind, body and resilience amongst the students

VISION AND MISSION FOR DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Vision:

- To be among the nation's premiere research and teaching departments in Computer Science & Engineering.

Mission:

- Empower the learners to be successful, effective problem solvers, lifelong learners, ethical and positive contributors towards social and economic upliftment of the nation.

- Foster innovative research in Computer Science and Engineering and inter-disciplinary domains to benefit: Industries, Government and to make a global impact through the emerging research ideas.

- Strive towards transformation in the values, knowledge and skill sets of the learners so as to facilitate the learners to actualize their full potential towards sustainable development of humankind, society and the environment.

PROGRAM SPECIFIC OUTCOME(PSO) FOR B. TECH DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

- **PSO1**: Students should be able to identify, design, develop and implement computer programs in various software development platforms using varied domain knowledge and innovative ideas to solve real time problems.

- **PSO2**: Students should be able to pursue Project/ Example based learning and display a firm grasp on the technical knowhow of different subjects through measurable outcomes like publications, products, technical write up and so on.

- **PSO3**: Students should be able to practice professional ethics, communicate effectively, acquire managerial and leadership traits and inculcate the ability to function effectively in multi-disciplinary teams.

FIRST YEAR B. TECH CURRICULUM 2024 (Common to all branches)

Semester		GROUP A (FIRST SEMESTER) PHYSICS GROUP					GROUP B (FIRST SEMESTER) CHEMISTRY GROUP					
	Sub. Code	Subject Name	L	T	P	C	Sub. Code	Subject Name	L	T	P	C
I		Engineering Mathematics–I	3	1	0	4		Engineering Mathematics–I	3	1	0	4
		Elements of Civil Engineering	2	1	0	3		Element of Mechanical Engineering	2	1	0	3
		Engineering Physics	3	1	0	4		Engineering Chemistry	3	1	0	4
		Basic Electronics	2	1	0	3		Element of Electrical engineering	2	1	0	3
		Communication Skills	2	0	0	2	CS101A1	Computer Programming in C	3	1	0	4
		Engineering Graphics	1	0	2	2		Environmental Science	2	0	0	1
		Constitution of India	2	0	0	1						
		Workshop Practice	0	0	2	1	CS101A4	Computer Programming Lab	0	0	2	1
		Engineering Physics Lab	0	0	2	1		Engineering Chemistry Lab	0	0	2	1
			15	4	6	21			15	5	4	21
	Total Contact Hours (L + T + P)		25				Total Contact Hours (L + T + P)		24			
	*Mandatory audit course						*Mandatory audit course					
II		GROUP A (SECOND SEMESTER)						GROUP B (SECOND SEMESTER)				
		Engineering Mathematics–II	3	1	0	4		Engineering Mathematics–II	3	1	0	4
		Element of Mechanical Engineering	2	1	0	3		Elements of Civil Engineering	2	1	0	3
		Engineering Chemistry	3	1	0	4		Engineering Physics	3	1	0	4
		Element of Electricalengineering	2	1	0	3		Basic Electronics	2	1	0	3
	CS101A1	Computer Programming in C	3	1	0	4		Communication Skills	2	0	0	2
		Environmental Science	2	0	0	1		Engineering Graphics	1	0	2	2
								Constitution of India	2	0	0	1
	CS101A4	Computer Programming Lab	0	0	2	1		Workshop Practice	0	0	2	1
		Engineering Chemistry Lab	0	0	2	1		Engineering Physics Lab	0	0	2	1
			15	5	4	21			15	4	6	21
	Total Contact Hours (L + T + P)		24				Total Contact Hours (L + T + P)		25			

Note: UHV–I has been introduced under Mandatory Induction Program.

B.TECH. COURSE STRUCTURE – SEMESTER WISE

THIRD SEMESTER

Year	Course Code	Course Title	Total Number of Contact Hours				Credits
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
2ND	MA205A1	Discrete Mathematics	3	1	0	4	4
	CSML201A1	Machine Learning	3	1	0	4	4
	CSML202A1	Data Structures	3	1	0	4	4
	CSML203A1	Object Oriented Programming using C++	3	1	0	4	4
	CSML2**A3	Program Elective-I	3	1	0	4	4
	CSML2**A2/ CSML2**A8	Open Elective-I/Minor/NCC	3	1	0	4	4
	CSML201A4	Data Structures Laboratory	0	0	2	2	1
	CSML202A4	Object Oriented Concepts & Programming using C++ Laboratory	0	0	2	2	1
	CSML201A5	Project Based Learning- I	0	0	2	2	1
TOTAL			18	6	6	30	27

FOURTH SEMESTER

Year	Course Code	Course Title	Total Number of Contact Hours				Credits
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
2ND	MA206A1	Probability, Statistics and Stochastic Processes	3	1	0	4	4
	CSML204A1	Design and Analysis of Algorithms	3	1	0	4	4
	CSML205A1	Database Management Systems	3	1	0	4	4
	CSML2**A3	Program Elective-II	3	1	0	4	4
	CSML2**A2/ CSML2**A8	Open Elective-II/Minor/NCC	3	1	0	4	4
		Universal Human Values-II: Understanding Harmony and Ethical Human Conduct	3	0	0	3	3
	CSML203A4	Algorithm Laboratory	0	0	2	2	1
	CSML204A4	Database Management Systems Laboratory	0	0	2	2	1
	CSML202A5	Project Based Learning- II	0	0	2	2	1
TOTAL			18	5	6	29	26

Prof. (Dr.) Udit K Chakraborty, 11/6/2024
Chairperson, HoD CSE
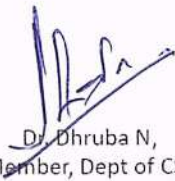
Prof. (Dr.) Kalpana Sharma,
Member, Dept. of CSE
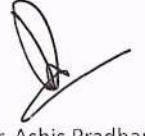
Prof. (Dr.) C.T. Singh,
Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen,
Member, Dept of CSE

Dr. Sandeep Gurung,
Member, Dept of CSE

Dr. Nitai Paitya,
Member, Dept of CSE

Mr. Santanu Kr. Misra,
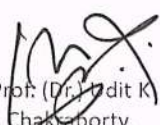Member, Dept of CSE

Dr. Dhruba N,
Member, Dept of CSE

Mr. Ashis Pradhan,
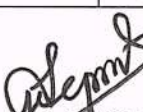Member, Dept of CSE

Ms. Nitisha Pradhan,
Member, Dept of CSE

Year	Course Code	Course Title	Total Number of Contact Hours				Credits
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
3rd	CSML301A1	Artificial Intelligence	3	1	0	4	4
	CSML302A1	Python Programming	3	1	0	4	4
	CSML303A1	Operating System	3	1	0	4	4
	CSML304A1	Computer Networks	3	1	0	4	4
	CSML3**A3	**Program Elective-III**	2	1	0	3	3
	CSML3**A2/ CSML3**A8	Open Elective-III/Minor/NCC	3	1	0	4	4
	CSML301A4	Machine Learning using Python Laboratory	0	0	2	2	1
	CSML302A4	Computer Network Laboratory	0	0	2	2	1
	CSML301A5	Project Based Learning- III	0	0	2	2	1
	CSML301A9	Industrial Training-I	0	0	2	2	1
	GN301A1	Quantitative Aptitude and Logical Reasoning-I	1	0	0	1	1
TOTAL			18	6	8	32	28

Year	Course Code	Course Title	Total Number of Contact Hours				Credits
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
		Industrial Management	2	0	0	2	2
	CSML305A1	Software Engineering	3	1	0	4	4
	CSML306A1	Data Analytics	3	1	0	4	4
	CSML3**A3	**Program Elective-IV**	3	1	0	4	4
	CSML3**A3	**Program Elective-V**	3	1	0	4	4
	CSML3**A2/ CSML3**A8	Open Elective-IV/Minor	3	1	0	4	4
	CSML303A4	Software Engineering Laboratory	0	0	2	2	1
	CSML304A4	Data Analytics using Python Laboratory	0	0	2	2	1
	CSML302A5	Mini Project	0	0	2	2	1
	GN302A2	Quantitative Aptitude and Logical Reasoning-II	1	0	0	1	1
TOTAL			16	5	08	31	26

Prof. (Dr.) Udit K Chakraborty,
Chairperson, HoD CSE

Prof. (Dr.) Kalpana Sharma,
Member, Dept. of CSE

Prof. (Dr.) C.T. Singh,
Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen,
Member, Dept of CSE

Dr. Sandeep Gurung,
Member, Dept of CSE

Dr. Nitai Paitya,
Member, Dept of CSE

Mr. Santanu Kr. Misra,
Member, Dept of CSE

Dr. Dhruba N,
Member, Dept of CSE
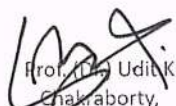
Mr. Ashis Pradhan,
Member, Dept of CSE

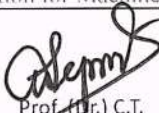Ms. Nitisha Pradhan,
Member, Dept of CSE

Year	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits
		SEVENTH SEMESTER					
4th	CSML4**A2/ CSML4**A8	Open Elective-V/Minor	3	1	0	4	4
	CSML4**A3	Choice-Based Elective	2	1	0	3	3
	CSML401A6	Major Project Phase-I	0	0	14	14	10
	CSML401A9	Industrial Training-II	0	0	2	2	1
TOTAL							18
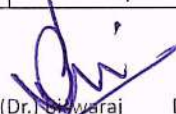
Year	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits
		EIGHT SEMESTER					
4th	CSML4**A2/ CSML4**A8	Open Elective-VI /Minor	3	1	0	3	4
	CSML402A6	Major Project -Phase-II	0	0	24	24	9
TOTAL			0	0	0	24	13

	LIST OF ELECTIVES FOR 3rd SEMESTER		
	PROGRAM ELECTIVE-1		
Year	COURSE CODE	COURSE TITLE	CREDIT
2nd	CSML201A3	Java Programming	4
	CSML202A3	Fundamentalsof Web Technologies	4
	CSML203A3	User Interface/User Experience (UI/UX) Design	4
	CSML204A3	Information Transmission and Coding Theory	4
	CSML205A3	Computer Graphics	4
	CSML206A3	Microprocessorsand Peripheral Devices	4
	CSML207A3	Digital Design and Computer Organization	4
	CSML208A3	Information Systems and Security	4
	CSML209A3	E-Commerce	4
	CSML210A3	Digital Signal Processing	4
	CSML211A3	Mathematical Foundation for Machine Learning	4

Prof. (Dr.) Udit K Chakraborty, Chairperson, HoD CSE

Prof. (Dr.) Kalpana Sharma, Member, Dept. of CSE

Prof. (Dr.) C.T. Singh, Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen, Member, Dept of CSE

Dr. Sandeep Gurung, Member, Dept of CSE

Dr. Nitai Paitya, Member, Dept of CSE

Mr. Santanu Kr. Misra, Member, Dept of CSE
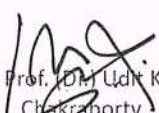
Dr. Dhruba N, Member, Dept of CSE

Mr. Ashis Pradhan, Member, Dept of CSE

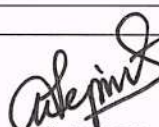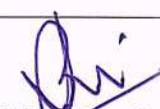Ms. Nitisha Pradhan, Member, Dept of CSE

LIST OF ELECTIVES FOR 4TH SEMESTER

PROGRAM ELECTIVE-II

Year	COURSE CODE	COURSE TITLE	CREDIT
2nd	CSML208A3	Advanced Java Programming	4
	CSML209A3	System Programming	4
	CSML210A3	Discrete Structure	4
	CSML211A3	Graph Theory	4
	CSML212A3	System Simulation and Modelling	4
	CSML213A3	Advanced Web Technologies	4
	CSML214A3	Embedded Systems	4
	CSML215A3	Social Network Analysis	4
	CSML216A3	VLSI System Design	4
	CSML217A3	Signals and Networks	4
	CSML218A3	Information Retrieval	4
	CSML219A3	Data Warehousing and Data Mining	4
	CSML220A3	Advanced Computer Organization and Architecture	4
	CSML221A3	Digital Image Processing	4
	CSML222A3	Principles of Programming Languages	4
	CSML223A3	Speech Processing	4
	CSML224A3	Analog Electronic Circuits	4
	CSML225A3	Microcontrollers	4

LIST OF ELECTIVES FOR 5TH SEMESTER

PROGRAM ELECTIVE-III

Year	COURSE CODE	COURSE TITLE	CREDIT
	CSML301A3	Latest Trends in Computer Science	3
	CSML302A3	Design Thinking	3
	CSML303A3	Speech and Natural Language Processing	3
	CSML304A3	Remote Sensing	3
3rd	CSML305A3	Autonomous Mobile Robotics and Computational Intelligence	3
	CSML306A3	Internet of Things	3
	CSML307A3	Big Data	3
	CSML308A3	Soft Computing	3
	CSML309A3	Computer Vision	3
	CSML310A3	Cryptography and Network Security	3
	CSML311A3	Computational Number Theory	3
	CSML312A3	Fault Tolerant Computing	3
	CSML313A3	Advanced Algorithm	3
	CSML314A3	Artificial Neural Network	3
	CSML315A3	ARM controller	3

Prof. (Dr.) Udit K Chakraborty, Chairperson, HoD CSE

Prof. (Dr.) Kalpana Sharma, Member, Dept. of CSE

Prof. (Dr.) C.T. Singh, Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen, Member, Dept of CSE

Dr. Sandeep Gurung, Member, Dept of CSE

Dr. Nitai Paitya, Member, Dept of CSE

Mr. Santanu Kr. Misra, Member, Dept of CSE

Dr. Dhruba N, Member, Dept of CSE

Mr. Ashis Pradhan, Member, Dept of CSE

Ms. Nitisha Pradhan, Member, Dept of CSE

PROGRAM ELECTIVE-IV

Year	COURSE CODE	COURSE TITLE	CREDIT
3rd	CSML316A3	High Performance Computing	4
	CSML317A3	Parallel and Distributed Algorithm	4
	CSML318A3	Internet Technology and Society	4
	CSML319A3	Deep Learning	4
	CSML320A3	Cloud Computing	4
	CSML321A3	Remote Sensing and Geographic Information System	4
	CSML322A3	Ethical Hacking	4
	CSML323A3	Ad-hoc Wireless Networks	4
	CSML324A3	Mobile Computing	4
	CSML325A3	Distributed Database Systems	4
	CSML326A3	Computational Geometry	4
	CSML327A3	Advanced Computer Network	4
	CSML328A3	Bio Inspired Computing	4
	CSML329A3	Real Time Systems	4
	CSML347A3	DevOps Engineering	4

PROGRAM ELECTIVE-V

	COURSE CODE	COURSE TITLE	CREDIT
	CSML330A3	Wireless Sensor Network	4
	CSML331A3	Queueing Theory and Modelling	4
	CSML332A3	Quantum Computing	4
	CSML333A3	Cyber Security	4
	CSML334A3	Future Internet Architecture	4
	CSML335A3	Distributed Systems	4
	CSML336A3	Optimization Techniques	4
	CSML337A3	Engineering Research Methodology	4
	CSML338A3	Human Computer Interaction	4
	CSML339A3	Augmented Reality	4
	CSML340A3	Blockchain	4
	CSML341A3	Pattern Recognition	4
	CSML342A3	Web Content Management and Web 3.0	4
	CSML343A3	Cyber Physical Systems	4
	CSML344A3	Reinforcement Learning	4
	CSML345A3	Generative AI and Prompt Engineering	4
	CSML346A3	MERN Stack Development	4

CHOICE BASED ELECTIVE

Year	COURSE CODE	COURSE TITLE	CREDIT
4th	CSML401A3	Indian Music System	4
	CSML402A3	History of Science	4
	CSML403A3	Introduction to Art and Aesthetics	4
	CSML404A3	Economic Policies in India	4

Prof. (Dr.) Udit K Chakraborty,
Chairperson, HoD CSE

Prof. (Dr.) Kalpana Sharma,
Member, Dept. of CSE

Prof. (Dr.) C.T. Singh,
Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen,
Member, Dept of CSE

Dr. Sandeep Gurung,
Member, Dept of CSE

Dr. Nitai Paitya,
Member, Dept of CSE

Mr. Santanu Kr. Misra,
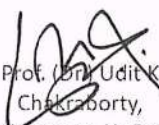Member, Dept of CSE

Dr. Dhruba N,
Member, Dept of CSE

Mr. Ashis Pradhan,
Member, Dept of CSE

Ms. Nitisha Pradhan,
Member, Dept of CSE

SEMESTER	COURSE CODE	COURSE TITLE	CREDIT
3rd	CSML201A2/ CSML201A8	Industry Version 4.0	4
4th	CSML202A2/ CSML202A8	Programming with Data Structures	4
5th	CSML301A2/ CSML301A8	Soft Computing	4
6th	CSML302A2/ CSML302A8	Prompt Engineering	4
7th	CSML401A2/ CSML401A8	Future Internet Architecture	4
8th	CSML402A2/ CSML402A8	Intellectual Property Rights/Human Computer Interaction	4

OPEN ELECTIVE/MINOR-ARTIFICIAL INTELLIGENCE SYSTEM

OPEN ELECTIVE/MINOR-Computational Mathematics

SEMESTER	COURSE CODE	COURSE TITLE	CREDIT
3rd	CSML203A2/ CSML203A8	Python	4
4th	CSML204A2/ CSML204A8	Discrete Structures/Graph Theory/System Simulation & Modeling	4
5th	CSML303A2/ CSML303A8	Latest Trends in Computer Science /Soft Computing/Data Analysis/Big Data/ Computational Number Theory	4
6th	CSML304A2/ CSML304A8	High Performance Computing/ Computational Geometry/Queueing Theory & Modelling/Optimization Techniques	4
7th	CSML403A2/ CSML403A8	Future Internet Architecture	4
8th	CSML404A2/ CSML404A8	Intellectual Property Rights/Human Computer Interaction	4

Prof. (Dr.) Udit K Chakraborty,
Chairperson, HoD CSE

Prof. (Dr.) Kalpana Sharma,
Member, Dept. of CSE

Prof. (Dr.) C.T. Singh,
Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen,
Member, Dept of CSE

Dr. Sandeep Gurung,
Member, Dept of CSE

Dr. Nitai Paitya,
Member, Dept of CSE

Mr. Santanu Kr. Misra,
Member, Dept of CSE

Dr. Dhruba N,
Member, Dept of CSE

Mr. Ashis Pradhan,
Member, Dept of CSE

Ms. Nitisha Pradhan,
Member, Dept of CSE

OPEN ELECTIVE/MINOR-Computer Graphics & Visualization

SEMESTER	COURSE CODE	COURSE TITLE	CREDIT
3rd	CSML205A2/ CSML205A8	Python/User Interaction (UI)-User Experience (UX)	4
4th	CSML206A2/ CSML206A8	Digital Image Processing	4
5th	CSML305A2/ CSML305A8	Latest Trends in Computer Science /Soft Computing/ Artificial Neural Network/ Computer Vision	4
6th	CSML306A2/ CSML306A8	Deep Learning/ Machine Learning	4
7th	CSML405A2/ CSML405A8	Future Internet Architecture	4
8th	CSML406A2/ CSML406A8	Intellectual Property Rights/Human Computer Interaction	4

OPEN ELECTIVE/MINOR-Computational Social Science

SEMESTER	COURSE CODE	COURSE TITLE	CREDIT
3rd	CSML207A2/ CSML207A8	Python	4
4th	CSML208A2/ CSML208A8	Social Network Analysis/Information Retrieval/Data Mining	4
5th	CSML307A2/ CSML307A8	Soft Computing/ Data Analytics/Speech & Natural Language Processing	4
6th	CSML308A2/ CSML308A8	Internet Technology & Society/Block Chain/Machine Learning	4
7th	CSML407A2/ CSML407A8	Future Internet Architecture	4
8th	CSML408A2/ CSML408A8	Intellectual Property Rights/Human Computer Interaction	4

OPEN ELECTIVE/MINOR-Industry 5.0

SEMESTER	COURSE CODE	COURSE TITLE	CREDIT
3rd	CSML209A2/ CSML209A8	Industry Version 4.0	4
4th	CSML210A2/ CSML210A8	Programming with Data Structures	4
5th	CSML309A2/ CSML309A8	Latest Trends in Computer Science	4
6th	CSML310A2/ CSML310A8	Internet Technology & Society	4
7th	CSML409A2/ CSML409A8	Future Internet Architecture	4
8th	CSML410A2/ CSML410A8	Intellectual Property Rights/Human Computer Interaction	4

Prof. (Dr.) Udit K Chakraborty, Chairperson, HoD CSE

Prof. (Dr.) Kalpana Sharma, Member, Dept. of CSE

Prof. (Dr.) C.T. Singh, Member, Dept of CSE

Prof. (Dr.) Biswaraj Sen, Member, Dept of CSE

Dr. Sandeep Gurung, Member, Dept of CSE

Dr. Nitai Paitya, Member, Dept of CSE

Mr. Santanu Kr. Misra, Member, Dept of CSE

Dr. Dhruba N, Member, Dept of CSE

Mr. Ashis Pradhan, Member, Dept of CSE

Ms. Nitisha Pradhan, Member, Dept of CSE

Sub Code: MA205A1   **Credit: 3 (L-2, T-1, P-0)**

DISCRETE MATHEMATICS

Questions to be set: 05 (All Compulsory)

Course Objectives: The objective of this course is to familiarize on numerous counting techniques and abstract structures which appear frequently in many areas such as Algorithm analysis, data structures, database management system. Discrete mathematics plays a crucial role in enabling students of computer science to tackle these problems. Graph theory has tremendous application in Computer Networks, Switching. Group theory has enormous applications coding theory and
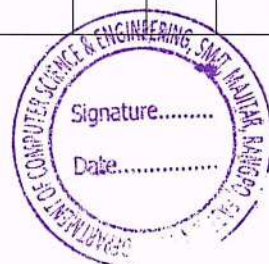
Pre-requisites: Set theory, Permutations and Combinations, Relations, Functions, Differential &Integral calculus.

**Course Outcomes (CO'S):** On successful completion of this course, students will be able to:

1.Solve problems using Counting Principles, Relations, Functions and Understand latticesas algebraic structures.
2.Apply concepts of Group theory to model the real-world problems.
3.Analyze the use of graphs in engineering applications.
4.Solve problems using Permutation and Combination, Ordering, Recursion andgenerating functions.
5.Evaluate problems related to mathematical logic. Extend the concepts of PredicateCalculus in computer science.

**not more than 20% of total topics to be allotted for assignment.

Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: < Set theory>	in class	Principle of inclusion and exclusion, Relations, and functions, Techniques of Proofs, Pigeonhole Principle; Partial ordering, lattice and algebraic systems, principle of duality, basic properties of algebraic systems defined by lattices, distributive and complemented lattices	10	1		
Module 2: <Group Theory>		Groups, subgroups, permutation group with simple examples. Cosets, normal subgroup, Burnside's theorem (statement only) and its simple applications, codes and group codes. Burnside's theorem (statement only) and its simple applications, codes and group codes				
Module 3: <Graph Theory>	in class	Graphs, Digraphs, Walk, Path, Cycles, Connectedness, Tree, Computer representation of relation, relation digraph, and graphs, transitive closer and Warshall's Algorithm	8	3		
	**Assignment Topics			3		

Module 4: < Configuration, Ordering:>	in class	Elementary configurations: Permutations and Combinations, Generating functions, Partitions and Compositions, Lexicographical and Fike's orderings of permutations. Algorithms for Lexicographical, Reverse Lexicographical and Fike's ordering of permutation.	7	4		
	**Assignment Topics			4		
Module 5: <Predicate Calculus>	in class	Connectives, Well-formed formula (WFF), Quantification, examples and properties of WFF into Causal form. Resolution and refutation, answer extraction and simple examples.	10	5		
	**Assignment Topics			5		

Signature..........

Date..............
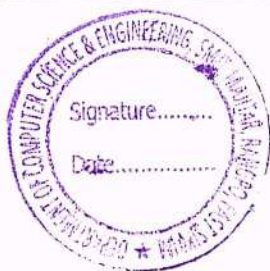
Text Books:

1. Jean-Paul Tremblay and Manohar, R: Discrete Mathematical Structures with application toComputer Scienc McGraw Hill.
2. C.L. Liu: Elements of discrete mathematics, McGraw Hill.
3. Narasingh Deo: Graph theory with applications to Computer Science, PHI.

Reference Books:

1. B. Kolman, R.C. Busby & S. Ross.: Discrete Mathematical Structures, Pearson.
2. Principles of Artificial Intelligence; N. J. Nielson.
3. E. S. Page & L.B. Wilson: An introduction to Computational Combinatorics, CambridgeUniversity.

Sub Code: CSML201A1   **Credit: 4(L-3, T-0, P-0)**
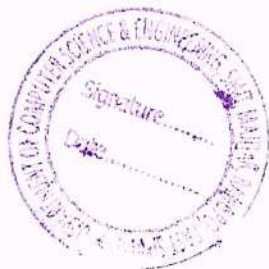
MACHINE LEARNING

Questions to be set: 05 (All Compulsory)

Course Objectives: It reflects recent developments while providing a comprehensive introduction to the fields of pattern recognition and machine learning. It is aimed at advanced undergraduates assuming no previous knowledge of pattern recognition or machine learning concepts.
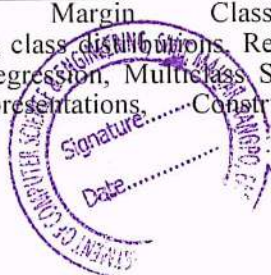
Pre-requisites: Knowledge of multivariate calculus and basic linear algebra and basic probability theory.

Course Outcomes(CO): On completion of the course it is expected to endow the students withskills to:

1. Identify methods to solve ML problems.
2. Design pattern recognition program systems using approaches of these theories for solving various real-world problems.
3. Identify importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
4. Describe areas of application of ML.
5. Formulate solution strategies for solving ML problems in real life.

** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: < Introduction and Linear Models for Regression >	In Class	Polynomial Curve Fitting, Probability Theory: Expectations and Co-variances, Bayesian probabilities, The Gaussian distribution, Curve fitting re-visited. Linear Basis Function Models: Maximum likelihood and least squares, Sequential learning, Regularized least squares.	8	1		
	Assignment Topics	The Bias-Variance Decomposition: Bayesian Linear Regression, Parameter distribution, Predictive distribution.				
Module 2: < Linear Models for Classification >	In Class	Discriminant Functions: Two classes, Multiple classes, Least squares for classification, Probabilistic Generative Models: Continuous inputs.	7	2		
	Assignment Topics	Maximum likelihood solution, Probabilistic Discriminative Models: Fixed basis functions, Logistic regression.				
Module 3: < Sparse Kernel Machines and	In Class	Maximum Margin Classifiers: Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, Dual Representations, Constructing	9	3		

Kernel Methods >		Kernels, Radial Basis Function Networks.				
	**Assignment Topics					
Module 4: < Neural Networks >	in class	Basic concepts: The artificial neuron, The McCulloch-Pitts neural model, The perceptron neural network architectures: Single layer feed forward ANNs.	7	4		

|						
	**AssignmentTopics	Multi-layer feed forward ANNs, Activation function,Generalized delta rule, The Back propagation Algorithm: Learning, Parameter optimization,Convolutional networks: Auto-sparse encoders.				
Module 5: < Mixture Models and EM, Continuous Latent Variables and Sequential Data >	in class	K-means Clustering, Mixtures of Gaussians, Maximum likelihood. Principal Component Analysis: Maximum variance formulation, Markov Models, Hidden Markov Models, Maximum likelihood for the HMM,	9	5		
	**Assignment Topics	EM for Gaussian mixtures, Applications of PCA, PCA for high-dimensional data, The forward- backward algorithm.				

Text Books:
1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer.
2. David J.C. Mackay, "Information Theory, Inference and Learning Algorithms", Cambridge UniversityPress, 2003.

Reference Books:
1. Andrew Ng, "Lecture Notes on Machine Learning".
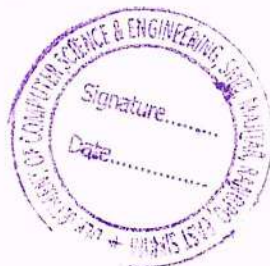
Sub Code: CSML202A1   **Credit:4 (L-3, T-1, P-0)**

DATA STRUCTURES

Questions to be set: 05 (All Compulsory)

Course Objectives: This course emphasizes on the organization of information, the implementation of linear data structures such as linked lists, stacks, queues, and non-linear data structures such as trees, and graphs. This course also explores recursion principles, the close relationship between data structures and algorithms and the analysis of algorithm complexity.
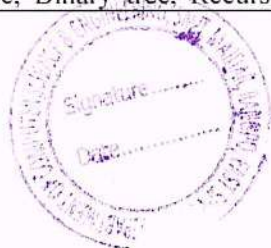
Pre-requisites: Programming concepts and 'C' language.

Course Outcomes (CO): On successful completion of this course, students should be able to:
1. Describe the working of data structures like array, stack, queue, linked list, tree and graph
2. Explain common applications for array, stack, queue, linked list, tree and graph
3. Solve a given problem using appropriate data structures and algorithm
4. Discuss about the working of the principal algorithms for sorting, searching, and hashing
5. Correlate the performance of a program with respect to the choice of data structure & algorithm

** not more than 20% of total topics to be allotted for assignment

Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: \<Introduction\>	in class	Definition, Algorithmic analysis: 'Oh' notation, Contiguous data structures: Representation of multidimensional arrays, highly structured sparse matrices using dimensioned arrays,	8	1		
	**Assignment Topics	String representation and manipulation.				
Module 2: \<Stacks & Queues\>	in class	Definition, Operations on stacks, Implementation using array. Application of Stacks: Evaluation of arithmetic expressions. Recursion: Use of recursive techniques in enumeration problems and back tracking algorithms, Recursion removal using stacks. Definition, Operations on queue, Implementation of queues, Circular queues. Applications	8	1, 2		
	**Assignment Topics					
Module 3: \<Non-contiguous Data Structures\>	in class	Linear linked list: Insertion, Traversal and deletion operations on singly linked list.Varioustypes of linked list: Doubly linked list, Circular lists, Use of header node in circular lists, Generalized (recursive) list, Application of linear list.	7	2,3		
	**Assignment Topics	Representation and manipulation of sets, Strings and graphs.				
Module 4:	in class	Definition of a tree and various terminologies used in tree, Binary tree, Recursive and non-recursive	10	2,3		

\<Trees & Graphs\>		tree traversal algorithms, Representation of n-ary trees using binary trees, Application of trees, Expression trees. Search trees: Definition, Insertion, Deletion and reversal, Height balanced search trees (using AVL trees illustrative example) and weight balanced search trees. Terminology and representations: Introduction, Definition and terminology, Graph representations, Traversals, connected components and spanning trees, Shortest path problem, Dijkstra's algorithm.				
	**Assignment Topics					
Module 5: \<Sorting and searching \>	in class	Sorting: Insertion, 2-way merge, Heap sort and quick sort, Comparison of different sorts. Hashing technique: Hash tables, Different hashing functions, Overflow handling, Methods for collision handling, Theoretical evaluation.	7	4,5		
	**Assignment Topics	Radix sort. Searching: Linear, Binary search, Comparison of different methods. H				

Text Books:
1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures", Galgotia.
2. Samanta, D., "Classic Data Structures", PHI.

Reference Books:
1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson
2. E.M. Reingold and W.J. Hansen, "Data Structures", CBS.
3. A. S. Tanenbaum, Y. Langsam, M.J. Augenstein, "Data Structures using C", Pearson.
4. M. A. Weiss, "Data Structure and Algorithm Analysis in C", Pearson

Sub Code: CSML203A1   **Credit: 4(L-3, T-0, P-0)**

OBJECT ORIENTED CONCEPTS & PROGRAMMING USING C++

Questions to be set: 05 (All Compulsory)

Course Objectives: This course introduces C++ as an Object-Oriented Programming Language, building on existing knowledge of C and Java. The unit covers the C++language with a focus on its object-oriented features, and how these can be implemented as part of program designs and implementation. The students will also study and gain practical experience with the implementation issues related to object-oriented techniques, be able to build good quality software using object-oriented techniques and understand the role of patterns in object-oriented design.
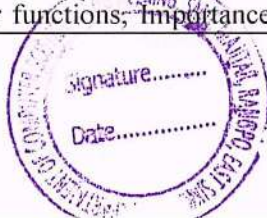
Pre-requisites: Computer Programming concepts

Course Outcomes (CO): On successful completion of this course, students should be able to:

1. Identify importance of object-oriented programming and difference between structured oriented and object-oriented programming features.
2. Able to make use of objects and classes for developing programs.
3. Able to use various object-oriented concepts like operator overloading to solve different problems.
4. Apply virtual and pure virtual function & complex programming situations
5. Illustrate the process of data file manipulations using C++.

** not more than 20% of total topics to be allotted for assignment

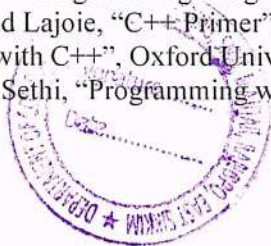| Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: <Basic concepts of OOP >	In Class	The Data types: Literal constant, Variables, Pointer types, String types, Constant qualifier, Reference types, The Boolean type, Enumeration types, Array types, Typedef names, Volatile qualifier, Class types, Expressions: Definition, Operators: Arithmetic, Increment and decrement, Conditional, Size of operator, New and delete, Comma	8	1		
	Assignment Topics	The bitwise operator, Precedence, Type conversions, Statements: Selection, Iteration, Jump.				
Module 2: < Procedural-Based programming & Object–based programming >	In Class	Inline functions, Linkage directives: Extern "C", Scope: Global objects and functions, Local objects, Dynamically allocated objects. Classes: Definition , Class object, Class member functions, Constructors and destructors, Friend function and classes, Static class members, Structures and unions, Bit field: A space saving member, Classscope, Nested classes, Structured programming and Object oriented programming paradigm.	10	2		
	Assignment Topics	Functions: Overview, Function prototype, Argument passing, Returning a value, Recursion				
Module 3: < Overloaded functions/ Operators (polymorphism)&	In Class	Overloaded declarations, the three steps of overload resolution, Argument type conversions, Overloading operators: Operators like =, (), ->, <>, + and -- (Using both friend as well as member functions, Importance of this pointer).	8	3		

Generic programming using template function & template classes>		Definition of generic programming, Function template, Template arguments and overloadingfunction template				
	Assignme ntTopics	Overloading function template				
Module 4: <Inheritance andio-stream library >	in class	Inheritance: Base class member access,Inheritance types, Protected mechanism, Virtualbase classes. Virtual functions (Run-time polymorphism concept): Virtual functions, Purevirtual functions, Early vs. late binding. The io-stream library: Streams, Stream classes, Managing unformatted and formatted I/O operations, Manipulators.	10	4	
	Assignme ntTopics	The io-stream library: Streams, Stream classes, Managing unformatted and formatted I/Ooperations, Manipulators.				
Module 5: <Files/ exception handling >	in class	Classes for file stream operations, Accessing files, Sequential I/O operations, Random access	4	5	
	Assignme ntTopics	Command- line arguments, Exception handling(throw, try, and catch)				

Textbooks:
1. Herbert Schildt, "The Complete Reference C++", Tata McGraw Hill.
2. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill.

Reference Books:
1. Bjarne Stroustrup, "C++ Programming Language", Pearson.
2. Stanley B Lippman and Lajoie, "C++ Primer", Pearson.
3. Saurav Sahay, "OOP with C++", Oxford University Press.
4. B.L. Juneja and Anita Sethi, "Programming with C++", New Age International Publication

DATA STRUCTURES LABORATORY

Course Objectives: The objective of this course is to get insight into the practical applications of various algorithms.

Pre-requisites: Theory paper CS 1302 Data Structures and associated prerequisites

Course Outcomes (CO): On successful completion of this course, students should be able to:
1. Write program related to application of data structures using programming constructs of a language likeC programming language
2. Identify the suitable input and output for a specified problem statement
3. Conclude the working of various algorithms in terms of time and space complexity
4. Examine the errors encountered in the program using appropriate tools and fix them
5. Write well-indented and well-documented code

** not more than 20% of total topics to be allotted for assignment

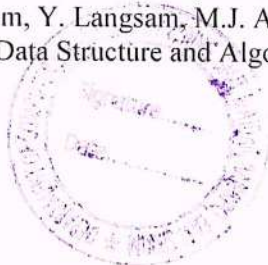| Module	Topics to be Covered	Topics	Hrs	CO	PO	PSO
Module 1: Introduction	in clas s	Tips on C programming, Searching an array-Linear, Binary Search	7.2	1		
	**Assignmen tTopics	Insertion and Deletion on specific array positions				
Module 2: Matrix, Stackand Queue	In Class	Matrix: Sparse and Compact Matrix Stack and Queue data structure	7.2	2		
	**Assignmen tTopics	Implementation of stack as a queue and vice versa				
Module 3: Linked List	In Class	Linked List: Singly, Doubly, Singly-Circular	7.2	3		
	**Assignmen tTopics	Doubly-Circular				
Module 4:Tree	in class	Tree Data Structure Tree Traversal Algorithms: InOrder, PreOrder,PostOrder	7.2	4		
	**Assignmen tTopics	Given InOrder and PreOrder, find out PostOrdertraversal				
Module 5:Graph	in class	Graph algorithms: Breadth First Search	7.2	5		
	**Assignmen tTopics	Depth First Search				
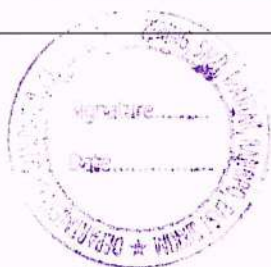
Text Books:

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures", Galgotia.
2. Samanta, D., "Classic Data Structures", PHI.

Reference Books:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson
2. E.M. Reingold and W.J. Hansen, "Data Structures", CBS.
3. A. S. Tanenbaum, Y. Langsam, M.J. Augenstein, "Data Structures using C", Pearson.
4. M. A. Weiss, "Data Structure and Algorithm Analysis in C", Pearson.

Sub Code : CSML202A4   **Credit: 1(L-0, T-0, P-2)**

OBJECT ORIENTED CONCEPTS & PROGRAMMING USING C++ LABORATORY

Course Objectives: The student should be able to explain the fundamental properties of the C++ Language and to combine the elements of C++ language in developing structured programs.

Pre-requisites: C Programming and corresponding theory paper CS 1308 Object Oriented Concepts & Programming using C++.
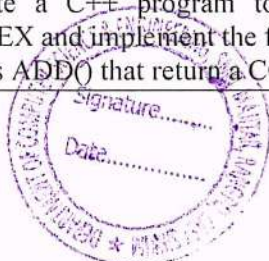
Course Outcomes(CO):

1. To demonstrate the skills necessary to correctly compile, debug and test programs in C++
2. Apply class and object to program design and implementation
3. Understand the concept of constructor and destructor and apply the same in developing programs.
4. Apply C++ features like operator overloading to program design
5. Use of inheritance and polymorphism in developing structured program

** not more than 20% of total topics to be allotted for assignment

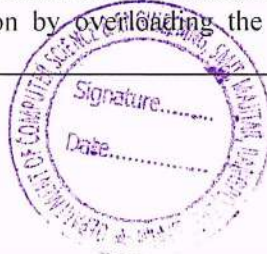| Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: **Structure concepts Implementing classes and objects**	in class	1.1 Write a program to create a structure named "cricket" with following details:- a. Player nameb. Team name c.Batting average Using structure cricket declare an array with 50 elements & read information about all the players and display team- wise list containing names of players with their batting average score. 1.2. Define a structure named "census" with following three members: i. A character array "city" to store the names. ii. A long integer to store population of the city. iii. A float number to store literacy level. Implement the following: i. Read the details for five cities randomly using an array variable. ii. Sort the city list alphabetically and display all the details. 1.3. Define a structure named "Date" with three integer members "day", "month" and "year". Develop an interactive modular program to perform the following tasks: i. To read the data into structure members using a function. ii. Create a function named validate() to validate the date Display the date in the format "April 29 2022" using a function. 2.1 Create a class named circle with data member Radius, pi (constant member) and area. Create following member functions: i. to accept the radius from the user ii. to calculate the area of the circle		1, 2		

|						
		iii. to display the details				
		2.2 Given that an EMPLOYEE class contains following data members: Employee_Number, Employee_Name, Basic, DA, IT, Net_Sal. Member Functions: to read the data, to calculate Net_Sal and to print data members. Write a C++ program to read the data of an employee and compute Net_Sal of the employee (DA= 52% of Basic and Income Tax(IT)=30% of the gross salary).While writing consider following: i. Initialize members using method. ii. Create more than two objects.				
	Assignment Topics	2.3 Write an OOP in C++ to prepare a student Record using class and object with the following data members and member functions: Data Members: Name, Regn Number, and Marks in three subjects Member functions: Read, display and average marks				
Module 2: **Array of objects Function overloading, passing objects as arguments and returning objects**	in class	3.1 Define a STUDENT class with USN, Name and marks in 3 tests of a subject, declare an array of 10 student objects find the average of two better marks for each student. Print USN, Name and average marks of all the students. 3.2 Write an OOP in C++ to create a class Employee with data members as Name, Employee code and Gross salary. Include member functions to read input and display output of individual objects. Create an array of 10 employees. Display the details of the employees with highest and lowest gross salary. 3.3 Write an OOP in C++ to create a class called BOOK with the following data members and member function: Data Members: Title, Author, Price,ISBN No. Member functions: Read, Display, Search_book(using ISBN No). 4.1 Create an array of 5 BOOK type objects and demonstrate all member functions. Create a class named C_POWER with a function power() to raise a number m to the power n. The function takes a double value for m and int value for n, returns the result correctly. Use a default value of 2 for n to make the function to calculate squares when this argument is omitted. Write another function that takes an int value of m. Both functions should have same name. Write a main function that gets values of m and n from user. 4.2 Write a C++ program to create a class called COMPLEX and implement the following by overloading functions ADD() that return a COMPLEX number.	2			

Signature.........
Date.............

|						
		ADD(a, s2)- where a is an integer (real part) and s2 is a complex number. ADD(s1, s2)- where s1 and s2 are complex numbers.				
	**Assignment Topics	4.3 Write a program in C++ to create a class named TIME that stores two time values in hours (float) and minutes (integer). Perform the following operations by using a function add():- Add T1+T2 where , T1 and T2 are time objects. Add T1+x where T1 is a TIME object and x is any integer. Return time objects from the member function tomain() and display.				
Module 3: **Programs on constructors and destructors Static data and static member function**	in class	5.1 Write a C++ program to create a class called STRING and implement the following operations. STRING s1="SMIT" STRING s2="MAJITAR" STRING s3=s1+s2 (Use copy constructor). 5.2 Write a program in C++ to create a class named student, create a constructor and destructor for the class and demonstrate sequence of execution of constructors and destructors. 6.1 Write a program in C++ to define a class named Bank. Include the following data members:- a. Name of account holder b. Account number c. type of account d. balance amount in account e. number of transactions in the bank(static data member) Create the following member functions:- i. To read inputs ii. To deposit an amount To withdraw amount after checking current balance Display number of transactions (use static function). 6.2 Write an OOP in C++ to demonstrate static members of a class. Include static data members to count the number of objects created for the class		3		
	**Assignment Topics	6.3 Write an OOP in C++ to demonstrate static members function of a class to pre-initialize private static data members. Also show restrictions that apply on static member functions.				
Module 4: **Friend function Implementing linked list in C++ Operator overloading**	in class	7.1 Create two classes DM and DB which stores the value in distances. DM stores distance in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display. Use the concept of friend function.		4		

7.2 Write an OOP in C++ to create a Class Twovalues with two integer type data members and member function to read values in those data members. Create another Class Min_Max and declare it as friend of Class Twovalues. Min_Max should have member functions to find the minimum and maximum of two values.

7.3 Write an OOP in C++ to demonstrate the advantage of overloading '+' operator using friend function.

8.1 Write a C++ program to create a class called LIST (linked list) with member functions to :-
Insert an element at any position and to display the list.
8.2 Write a C++ program to create a class called LIST (linked list) with member functions to :-
Delete an element from any position and to display the list.

8.3 Write an OOP in C++ to create a class called STACK with an array of integer type data member and member functions to PUSH/POP elements from the stack and display the elements on the stack.

9.1 Write a program in C++ to overload unary minus operator to change the sign of a number. Perform the addition on the entered values from text boxes.

9.2 Write a C++ program to create a class called COMPLEX and implement the following by overloading + operator:-
   i. a+ s2; where a is an integer (real part) and s2 is a complex number.
   ii. s1+ s2 ; where s1 and s2 are complex numbers.
Return object and display the result.

9.3 Write a C++ program to create a class called STACK using array of integers. Implement the following operations by overloading the operators + and --.
   i. s1=s1+element; where s1 is a object of the class STACK and element is an integer to be pushed on top of the stack.
   ii. s1=s1--;where s1 is a object of the class STACK, -- operator pops the element.
Note: Handle the STACK empty and STACK full conditions.

9.4 Write a C++ program to create a class called MATRIX using a two- dimensional array of integers. Implement the following operations by overloading the operator== which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading the operators + and − respectively :-

		if(m1==m2)
		{
		m3=m1-m2; m4=m1+m2;
		}
		else display error			

	**Assignment Topics	9.5 Write a C++ program to create a class called DATE. Accept two valid dates in the form dd/mm/yy. Implement the following operations by overloading the operators + and - .
		  i. no_of_days=d1-d2; where d1 and d2 are DATE objects. d1>=d2 and no_of_days is an integer.
		  ii. d2=d1-no_of_days; where d1 is a DATE object and no_of_days is an integer.			

Module 5: **Template class and template functions Inheritance Run-Time Polymorphism Files in C++**	in class	10.1 Write a program in C++ to create a template function and perform bubble sort. 10.2 Write a program, in C++ to create a template class STACK and perform push and pop operations. 10.3 Write an OOP in C++ to create a template class ARRAY and implement run time boundary checking by overloading [] operator. 11.1 Write a C++ program to create a class called STUDENT with data members USN, Name and Age. Using inheritance, create the classes UGSTUDENT and PGSTUDENT having fields as Semester, Fees and Stipend. Enter the data for at least 5 students. Find the semester wise average age for all UG and PG students separately. 11.2 Write an OOP in C++ to demonstrate accessing derived class objects' member using base class pointers. Also show the sequence of execution of constructors and destructors wheninheritance is involved. 12.1 WAP in C++ to create a class called Figure. Use this class to store two double type values that could be used to compute the area of various shapes (i.e., length, breadth for rectangle and base, height for triangle). Derive two specific classes called Triangle and Rectangle inherited from super class Figure. Create a virtual function called area( ) to compute and display the area of the basic shapes. Redefine this function in derived classes to suit its requirements. 12.2 Write a C++ to implement the following using the concept of inheritance.-		5	
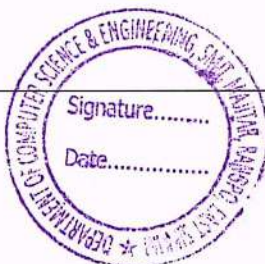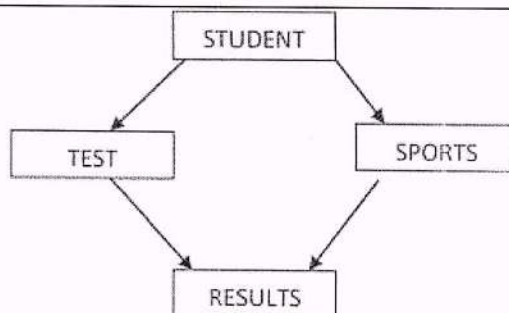
i. Create data member roll_no,reg_no and member function get_number() to take input and put_number() to display in the base class STUDENT.
ii. The class Test contains a data member part1 and part2.Redefine the above two functions.
iii. The class SCORE contains a member score. Redefine get_number and put_number ().
iv. Redefine display function in RESULT class as well to calculate total, where TOTAL=part1+part2+score.

Note: Implement the concept of run-time polymorphism, and include constructors in all the classes.

12.3 Write an OOP in C++ to create a base class convert with two data members val1 and val2 and two member functions getinit() and getconvert() which return the initial values and converted values. It includes a pure virtual function compute() which must be defined by by two derived classes lit_to_gal and far_to_cel. Each of these classes have their own definition of compoute().

| **Assignment Topics** | 13.1 Write a program in C++ to create a file named "costs" and implement the following by creating menu driven program:-
 i. The file should contain two columns "item_name" and "cost".
 ii. Insert data under these two columns assuming the file is empty initially.
 iii. Allow user to add more data as and when he wants.
 iv. Retrieve the item details if item name is given as an input.
Display the entire content of the file.

13.2 Write a program in C++ to copy the contents of one file into another in reverse order.

13.3 Write a program in C++ to change a particular character in a file using command line. |

Text Books:

1. Herbert Schildt, "The Complete Reference C++", Tata McGraw Hill.

2. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill.

Reference Books:

1. Bjarne Stroustrup, "C++ Programming Language", Pearson.
2. Stanley B Lippman and Lajoie, "C++ Primer", Pearson.
3. Saurav Sahay, "OOP with C++", Oxford University Press.
4. B.L. Juneja and Anita Sethi, "Programming with C++", New Age International Publication.

Sub Code: MA206A1   **Credit: 4 (L-3, T-1, P-0)**

PROBABILITY, STATISTICS AND STOCHASTIC PROCESSES.

Questions to be set: 05 (All Compulsory)

Course Objectives: The objective of this course is to enhance the capability of students to analyze the problems related to random phenomena. Concepts on probability theory will be of immense help to the students in analyze random experiments. Statistical Analysis plays a big role in areas like data mining and information retrieval. Stochastic models have tremendous applications in queuing theory. Students will find adequate tools in these modules which will be effective enough to solve their problems.
Pre-requisites: Differential and Integral Calculus, Matrix Algebra, Permutation and Combination.
Course Outcomes (CO):

CO1: Demonstrate basic principles of probability and understand a random variable that describe randomness or an uncertainty in certain realistic situation.

CO2: Comprehend concepts of discrete, continuous probability distributions and able to solve problems of probability using Binomial, Poisson, Uniform Distribution, Exponential Distribution, Normal distributions.

CO3: Analyze the statistical data and apply various small or large sample tests for testing the Hypothesis.

CO4: Analyze the various classifications of Random Processes and characterize phenomena which evolvewith respect to time in a probabilistic manner.

CO5: Understand about different Queuing models and its applications.
** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: < Probability Theory, Random Variables, and distribution>	in class	Introduction, Classical definition of probability, Axiomatic definition of probability, Conditional probability, Baye's theorem. Random variables, Mean, Variance, Chebyshev's inequality, Central limit theorem	10	1		
	Assignment Topics			1		
Module 2: < Conditional Probability and known distribution >	in class	Correlation coefficient, conditional distributions, conditional expectations, and regression curves, Standard probability distributions (Binomial, Poisson, Uniform, Normal, exponential, chi-square.), Reliability and MTTF.	8	2		
	Assignment Topics			2		
Module 3: < Introduction to Statistics>	in class	Random sample, Sampling distribution, Statistic, Least square curve fitting Parameter estimation: Unbiased estimate, Consistent estimate, Maximum likelihood estimate, interval estimate. Testing of Hypothesis for mean with known variance for normal population.	6	3		
	Assignment Topics			3		
Module 4:	in class	Introduction to Stochastic Process, Poisson Process, Discrete parameter Markov Chains.	6	4		

				4	
< Stochastic Processes >	**Assignment Topics				
Module 5: < Queuing systems >	in class	Concept of a queues: Basic idea of continuous parameter Markov chain, Birth and death processes, M / M /1/∞, M / M /1/N, queuing systems.	4	5	
	**Assignment Topics			5	

Textbook:

1. K.S Trivedi, Probability & Statistics with Reliability, Queuing and Computer ScienceApplications, 2008, Wiley.
2. P.L. Meyer : Introductory Probability theory and statistical Applications, Second Ed.Oxford & IBM Publishers.
3. Miller & Freund: Probability & Statistics for Engineers, Eight Ed. Pearson Ltd.

Reference Books:

1. Introduction to Probability Theory and its Applications, William Feller, 2008, Wiley.
2. Introduction to Probability with Statistical Applications, Geza Schay, 2007, Brikhaus

Sub Code: CSML204A1   **Credit: 4 (L-3, T-1, P-0)**
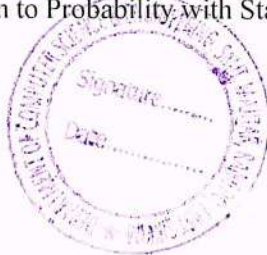
DESIGN AND ANALYSIS OF ALGORITHMS

Questions to be set: 05 (All Compulsory)

Course Objectives: This course builds upon preliminary knowledge delivered in Data Structures. The main objectives of the course are to provide thorough knowledge and understanding of different algorithm analysis techniques, design strategies and their applications. Special purpose machines, some critical problems and innovative techniques are used in solving them.
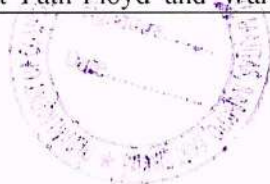
Pre-requisites: Data Structures and Programming concepts.

Course Outcomes(CO): On successful completion of this course, students should be able to:

1. Define asymptotic notations and solve problems related to it

2. Calculate time and space complexities for recursive/non-recursive algorithm based on following algorithm design techniques - divide and conquer, greedy, dynamic programming and branch and bound.

3. Select appropriate algorithm design technique to solve a given problem.

4. Explain the working of existing algorithm / algorithm design techniques

5. Discuss and describe the classes P, NP, and NP-Complete

** not more than 20% of total topics to be allotted for assignment

| Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: <Algorithms & Mathematical preliminaries >	in class	Definition, aim of the subject, designing algorithms and Analyzing algorithms: An introduction, Performance of a program: Space and Time complexity. Asymptotic notations and common functions	9	1		
	**Assignment Topics	Example Asymptotic notation: Insertion sort				
Module 2: < Recurrences and divide and conquer >	in class	The basics of divide & conquer method, Merge sort, Quick sort, Solving recurrences: Substitution method, Recursion tree method, Finding maximum and minimum, Strassen's matrix multiplication, Binary search.	7	2		
	**Assignment Topics	Master method: Proof of master method				
Module 3: < Greedy method >	in class	Basics of greedy method, Applications- 0/1 Knapsack Problem – Topological sorting-Heapsort, Huffman codes, Activity selection, Minimum spanning tree-Kruskal's algorithm, Prim's algorithm, Single source shortest path: Dijkstra's algorithm	7	3		
	**Assignment Topics	Topological sorting – Bipartite Cover				
Module 4: < Dynamic programming	in class	Basics of dynamic programming, Applications- Matrix chain multiplication, longest common subsequence, Traveling salesperson problem, all pair shortest Path-Floyd and Wars hall's algorithm.	9	4		

& Back Tracking >		Backtracking Method, Applications-Container Loading, 0/1 Knapsack Problem, Max Clique, Travelling Salesperson, Board Permutation				
	**Assignment Topics	Non-Crossing Subsets of Nets				
Module 5: < Branch And Bound & NP completeness >	in class	Branch and Bound Method, Applications-Container Loading, 0/1 Knapsack Problem, Max Clique, Travelling Salesperson. Basic Concepts, P NP, NP Complete, NP Hard problems, Travelling Salesman Problem.	8	5		
	**Assignment Topics	Board Permutations.				

Text Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "Introduction to Algorithms", PHI.
2. Sartaj Sahni, "Data Structures, Algorithms amd Applications in C++", University Press.

Reference Books:

1. Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education.
2. S. Basse, A. Van Gelder, "Computer Algorithms-Introduction to Design and Analysis", Pearson.
3. Alfred V. Aho, John E. Hop croft, Jeffrey D. Ullman, "Data Structures and Algorithms", Addison Wesley.
4. M. A. Weiss, "Data Structure and Algorithm Analysis in C", Pearson Education.

Signature..........
Date..........

Sub Code: CSML205A1   **Credit:4(L-3, T-1, P-0)**
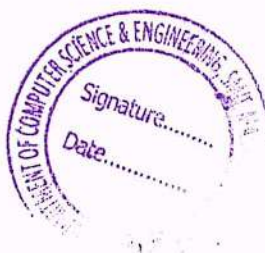
DATABASE MANAGEMENT SYSTEMS

Questions to be set: 05 (All Compulsory)

Course Objectives: This course provides the basic information about relational Database Management System and their development. The major objectives of the course is to provide an introduction of DBMS and their use, be familiar with the basic DBMS architecture, components, and interfaces, have experience using at least one modern Database Management System, understand and use database models in database and application design
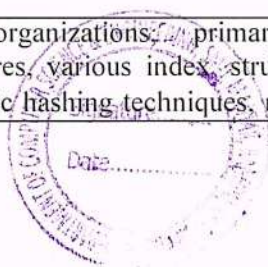
Pre-requisites: Programming Concepts

Course Outcomes (CO): On successful completion of this course, students should be able to:

1. Describe fundamental elements of a relational database management system.

2. Design entity-relationship diagrams to represent simple database application scenarios

3. Explain the basic concepts of relational data model, Entity-relationship model, Relational database design, relational algebra and database language SQL

4. Apply and relate the concept of transaction, concurrency control and recovery in database

5. Analyze various Normalization techniques and improve the database design by normalization
** not more than 20% of total topics to be allotted for assignment

Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: <Introduction & Data modelling >	in class	DBMS: Characteristics, Advantages, Architecture. Database concept and architecture, Data models, Instances and schema, Database languages, Database manager, Database administrator, Database users, Concept of centralized database management system and distributed database system. Entity sets, attributes types and keys, Entity Relationship (ER) diagram, Type role and structural constraints, Enhanced entity-relationship (EER), Object modelling, Specialization and generalization, Modelling of union types, Relational-algebra operations.	8	1,2		
	Assignment Topics	Data models: Definition, Purpose and Types, Hierarchical models, Network model, Relational model.				
Module 2: <Database design >	in class	Database design process, Relational database design, Relation schema, Functional dependencies, Membership and minimal covers, Normal forms, Multivalued dependencies, Join dependencies, Converting EER diagrams to relations.	8	3		
	Assignment Topics	Effect of de-normalization on database performance.				
Module 3: < Data Storage and	in class	File organizations: primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+	9	3,4		

Indexes & Database query languages >		trees. Query-by-example (QBE), Introduction to SQL, Use of some special data types, Overview of SQL 92, Basic queries in SQL, Advanced queries in SQL, Functions in SQL, Basic data retrieval, Aggregation, Categorization, Updates in SQL, Embedded SQL and 4GLs, Procedural extension to SQL: PL/SQL.				
	**Assignment Topics					
Module 4: < Transaction processing, Concurrency control and backup & recovery mechanisms >	in class	Desirable properties of transactions, Implementation of atomicity and durability, Reconsistent model, Read only and write only model, Concurrent executions, Schedules and recoverability, Serializability of schedules, Concurrency control, Precedence graph. Overview of concurrency control, Locking techniques, Lock based protocols, Time stamp based protocols, Commit protocols, Optimistic technique, Granularity of data items, Time stamp ordering multi version concurrency control, Deadlock handling, Recovery mechanisms, Database recovery techniques based on immediate and deferred update.	9	4		
	**Assignment Topics	Concepts of database security mechanisms, Case study of Distributed Database Systems				
Module 5: <Graph Database & NoSQL >	in class	Overview of graph database, Structure and advantages of graph database. An overview of NoSQL, Characteristics of NoSQL, Advantages and challenges of NoSQL, NoSQL storage types, Case study of MongoDB.	6	5		
	**Assignment Topics	high level view of graph space, Property graph model.				

Text Books:

1. Elmasri and Navathe: "Fundamentals of Database Systems", Addison Wesley.
2. Silberschatz, Korth, Sudarshan, "Database System Concepts", McGraw-Hill

Reference Books:

1. Thomas Connolly, Carolyn Begg, "Database Systems – A Practical Approach to Design, Implementation and Management", Pearson Education.
2. Jefrey D. Ullman, Jenifer Widom, "A First Course in Database Systems", Pearson Education.
3. Bipin C Desai, "An Introduction to Database Systems", Galgotia.
4. Atul Kahate, "Introduction to Database Management Systems", Pearson.
5. Ian Robinson, Jim Webber, Emil Eifrem,"Graph Databases",O'Reilly Media.
Gaurav Vaish, "Getting started with NoSQL", Packt

Sub Code: GN201A1   CREDIT 3: [L-2,T-1, P-0]

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT

Course Objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Pre-requisites: None. However, it is desired that students may have gone through UHV-I: Universal Human Values-Introduction

Course Outcome (CO):

1. Students are expected to understand self-exploration and Basic Human Aspirations.
2. To understand harmony in themselves (Human being).
3. To become more aware of their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
4. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Therefore, the course and further follow up is expected to positively impact common graduate attributes like:
1) Holistic vision of life
2) Socially responsible behaviour
3) Environmentally responsible work
4) Ethical human conduct
5) Having Competence and Capabilities for Maintaining Health and Hygiene
6) Appreciation and aspiration for excellence (merit) and gratitude for all

Module 1 –Introduction to Value Education   (9 Hrs)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session *PS1 Sharing about Oneself*
Lecture 3: Self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 *Exploring Human Consciousness*
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfil the Basic Human Aspirations
Tutorial 3: Practice Session PS3 *Exploring Natural Acceptance*

Module 2 – Harmony in the Human Being   (9 Hrs)

Lecture 7: Understanding Human being as the Co-existence of the Self and the Body
Lecture 8: Distinguishing between the Needs of the Self and the Body
Tutorial 4: Practice Session PS4 *Exploring the difference of Needs of Self and Body*
Lecture 9: The Body as an Instrument of the Self

Lecture 10: Understanding Harmony in the Self
Tutorial 5: Practice Session PS5 *Exploring Sources of Imagination in the Self*
Lecture 11: Harmony of the Self with the Body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 *Exploring Harmony of Self with the Body*

Module 3 – Harmony in the Family and Society (9 Hrs)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 *Exploring the Feeling of Trust*
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 *Exploring the Feeling of Respect*
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 *Exploring Systems to fulfil Human Goal*

Module 4 – Harmony in the Nature/Existence (6 Hrs)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation, and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 *Exploring the Four Orders of Nature*
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 *Exploring Co-existence in Existence*

Module 5 – Implications of the Holistic Understanding – a Look at Professional Ethics

(9 Hrs)

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 *Exploring Ethical Human Conduct*
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 *Exploring Humanistic Models in Education*
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 *Exploring Steps of Transition towards Universal Human Order*

Content for Practice Sessions (Tutorials)

In order to connect the content of the proposals with practice (living), 14 practice sessions have been designed. The full set of practice sessions is available in the Teacher's Manual as well as the website.

Practice Sessions for Module 1 – Introduction to Value Education
PS1   Sharing about Oneself
PS2   Exploring Human Consciousness
PS3   Exploring Natural Acceptance

Practice Sessions for Module 2 – Harmony in the Human Being
PS4   Exploring the difference of Needs of Self and Body
PS5   Exploring Sources of Imagination in the Self
PS6   Exploring Harmony of Self with the Body

Practice Sessions for Module 3 – Harmony in the Family and Society
PS7   Exploring the Feeling of Trust PS8   Exploring the Feeling of Respect
PS9   Exploring Systems to fulfil Human Goal

Practice Sessions for Module 4 – Harmony in the Nature (Existence)
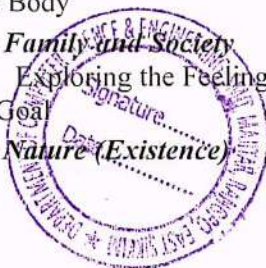
PS10   Exploring the Four Orders of Nature
PS11   Exploring Co-existence in Existence

Practice Sessions for Module 5 – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12   Exploring Ethical Human Conduct
PS13   Exploring Humanistic Models in Education
PS14   Exploring Steps of Transition towards Universal Human Order

Text Book

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1

The Teacher's Manual

Teachers' Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal

Sub Code: CSML203A4   **Credit:1 (L-0, T-0, P-2)**

ALGORITHM LABORATORY

Course Objectives: The objective of this course is to get insight into the practical applications of variousalgorithms.

Pre-requisites:

Theory paper CSML1107A Design and Analysis of Algorithms and associated pre-requisites.

Course Outcomes (CO): On successful completion of this course, the students will be able to:
Calculate time and space complexities for algorithms using mathematical models
Calculate time and space complexities for algorithms by performing an empirical measurement
Select appropriate algorithm design technique to solve a given problem
Write a computer program to implement any algorithm using a programming language
Choose the most optimal algorithm by comparing time and space complexities
   ** not more than 20% of total topics to be allotted for assignment

Module	Topics to be	Topics	Hrs	CO	PO	PSO

	covered					
Module 1: Introductionto Python	in class	Introduction to Python Programming, Workingwith Test Cases	7.2	1		
	**Assignme ntTopics	Calculation of Execution time				
Module 2: Sorting	in cla ss	Sorting Algorithms: Bubble Sort, Selection Sort	7.2	2,3		
	**Assignme ntTopics	Insertion Sort				
Module 3: Divide and Conquer	in cla ss	Divide and Conquer strategy: Merge Sort andQuick Sort	7.2	2,4		
	**Assignme ntTopics	Binary Search using Divid e and Conquer strategy				
Module 4: Greedy and Dynamic Programming	in class	Greedy Algorithms and Dynamic Programmingalgorithms	7.2	5		
	**Assignme ntTopics	Prim's and Kruskal's algorithm				
Module 5: Backtracking and Branch & Bound	in class	Backtracking and Branch & Bound algorithms: N-queen Problem, Subset sum problem	7.2	5		
	**Assignme ntTopics	Knapsack problem using Branch and Bound				

Text Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "Introduction to Algorithms", PHI.
2. Sartaj Sahni, "Data Structures, Algorithms amd Applications in C++ ", University Press
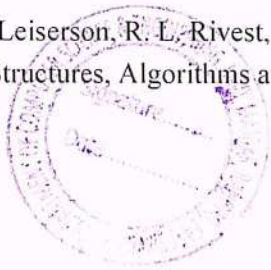
Sub Code: CSML204A4   **Credit:1 (L-0, T-0, P-2)**

DATABASE MANAGEMENT SYSTEM LABORATORY

Questions to be set: 05 (All Compulsory)

Course Objectives: At least 10 experiments covering the entire syllabus of the corresponding theory paper to be carried out using the theory studied /programming skill of the subject concerned to get insight into the practical applications of the theoretical studies. The outcome of the lab classes must lead to a skilled and self-sustained program developer.
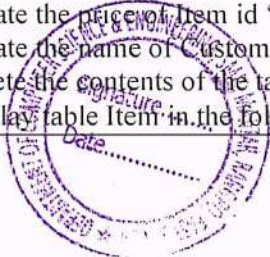
Pre-requisites: Corresponding theory paper Database Management Systems and associated prerequisites.

Course Outcomes(CO): On successful completion of this course, the student should be able to:
1. Select appropriate SQL/MongoDB commands and functions for a given query on the database.
2. Infer constraints and relationships between tables from conceptual/logical level schema and

convert them into relationship and integrity constraints at the physical level schema.

3. Write Oracle PL/SQL Programs for data processing.
4. Design nested queries for efficient data processing on the database.
5. Test an SQL interface of a multi-user relational DBMS package to create, secure, populate,

maintain, and query a database.

** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: **Implementation of DDL and DML commands, functions and operators of SQL**	In Class	Implementation of DDL and DML commands of SQL with suitable examples	0.5	1		
	**Assignment Topics	**Write SQL queries for following question:** **Customer** (Cust id : integer, cust_name: string) **Item** (item_id: integer, item_name: string, price: integer) **For the above schema, perform the following—** a) Create the tables and insert five records in each Table b) Display the schema of each table c) Change the data type of price from integer to number. d) Change the name of column/field item name to I_name. e) Delete the record of customer having cust_id _6' f) Add a column age in table Customer g) Rename the attribute price in table Item to Costprice h) Add an attribute in table Item i) Update the price of Item id '4' from 1000 to 2000 j) Update the name of Customer having id _001' k) Delete the contents of the table Customer l) Display table Item in the following way:	2.5	1		

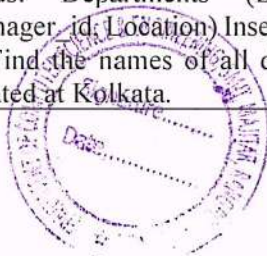|						
		i) Selected rows all columns ii) All rows selected columns iii) All rows selected columns iv) Selected rows selected columns m) Drop table Customer				
	in class	Implementation of different types of functions with suitable examples.	0.5	1		
	**Assignment Topics	**Create a table EMPLOYEE with following schema:** **(Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id, Designation , Salary,** **DOJ)** **Write SQL statements for the following query.** 1. List the E_no, E_name, and Salary of all employees working as MANAGER. 2. Display all the details of the employee whose salary is more than the Salary of any manager 3. List the employees in the ascending order of Designations of those joined after 1981. 4. Display the sum and average of salary of all employees 5. List the employees who are either _CLERK' or _ANALYST'. 6. List the employees who joined on 1-MAY-81, 3-DEC-81, 17-DEC-81,19-JAN-80 . 7. List the employees who are working for the Dept no 10 or20. 8. List the Employee names those starting with 'S'. 9. Display the name as well as the first five characters of name(s) starting with 'H' 10. List the Employee names ending with 'a'. 11. Display the maximum and minimum salary of employees 12. Display the count of employees in each designation	2.5	1		
	In class	Implementation of different types of operators in SQL	0.5	1		
	**Assignment Topics	**Create a table Salesmen with following schema:** **(salesman_id, name , city , age, commission)** **Write SQL statements for the following query.** 1. Filter those salesmen with all information who comes from any of the cities Paris and Rome 2. Make a list of salesman_id, name, city and commission of each salesman who live in cities other than Paris and Rome 3. Write a SQL statement to find those salesmen with all information who gets the commission within a range of 100 and 500. 4. Write a query to sort out those salesmen with all information whose ID value is within any of 3007, 3008 and 3009.	2.5	1	.	

		5. Write a SQL statement to find those salesmen with all other information and name started with any letter within 'A' and 'K' 6. Write a SQL statement to find that salesman with all information whose name begins with the letter 'B'. 7. Write a SQL statement to find all those salesmen with all information whose names are ending with the letter 'n' 8. Write a SQL statement to find those salesmen with all information whose name containing the 1st character is 'N' and the 4th character is 'l' and rests may be any character 9. Display the salesman details in ascending order of his age 10. Display names of salesman containing two a's in his name 11. Display the count of salesman within the age group 25 to 35 12. Display the total number of salesman staying in each city				
Module 2: **Java Connectivity**	In class	Implementation of JAVA Database connectivity.	0.5	5		
	**Assignment Topics	1. Write a program to do the following: i) Develop the following JSP page: Employee Information Emp ID Emp Name Basic salary: DA: HRA: TAX: Submit ii) After giving the details of an employee, the information should be stored in the database. The message should be displayed as "Employee information are stored successfully". Create a table named as "Login" having two columns User Id and Password. Write a program to create a login page. Once the user performs the login, the authentication should be checked from the login table and "Valid Login" or "Invalid Login" should be displayed.	2.5	5		
Module 3: **SQL Joins, Subqueries and Constraints**	In class	Implementation of different types of Joins	0.5	2		
	**Assignment Topics	**Consider the following schema:** **Sailors (sid, sname, rating, age)** **Boats (bid, bname, color)** **Reserves (sid, bid, day(date))**	2.5	2		

		1. Find all information of sailors who have reserved boat number 101. 2. Find the name of boat reserved by Bob. 3. Find the names of sailors who have reserved a red boat, and list in the order of age. 4. Find the names of sailors who have reserved at least one boat. 5. Find the ids and names of sailors who have reserved two different boats on the same day. 6. Find the ids of sailors who have reserved a red boat or a green boat. 7. Find the name and the age of the youngest sailor. 8. Count the number of different sailor names. 9. Find the average age of sailors for each rating level. 10. Find the average age of sailors for each rating level that has at least two sailors.				
	in class	Implementation of Subqueries and Views	0.5	4		
	**Assignment Topics	**Consider the following schema:** **Sailors (sid, sname, rating, age)** **Boats (bid, bname, color)** **Reserves (sid, bid, day(date))** Write subquery statement for the following queries. 1. Find all information of sailors who have reserved boat number 101. 2. Find the name of boat reserved by Bob. 3. Find the names of sailors who have reserved a red boat, and list in the order of age. 4. Find the names of sailors who have reserved at least one boat. 5. Find the ids and names of sailors who have reserved two different boats on the same day. Database Management System Lab(CS 1462) Computer Science and Engineering Page 39 6. Find the ids of sailors who have reserved a red boat or a green boat. 7. Find the name and the age of the youngest sailor. 8. Count the number of different sailor names. 9. Find the average age of sailors for each rating level. 10. Find the average age of sailors for each rating level that has at least two sailors.	2.5	4		
	in class	Implementation of different types of constraints	0.5	2		
	**Assignment Topics	Create a table called EMP with the following structure. **Name Type** ---------- ---------------------- **EMPNO NUMBER (6)** **ENAME VARCHAR2 (20)** **JOB VARCHAR2(10)** **DEPTNO NUMBER (3)** **SAL NUMBER (7,2)**	2.5	2		

		1. Allow NULL for all columns except ename and job. 2. Add constraints to check, while entering the empno value (i.e) empno > 100. 3. Define the field DEPTNO as unique. 4. Create a primary key constraint for the table (EMPNO). 5. Create another table and add foreign key in table emp				
	in class	Implementation of Database Backup & Recovery Commands, Rollback, Commit, save point.	0.5	2		
	**Assignment Topics	1. Write a query to implement the save point. 2. Write a query to implement the rollback. 3. Write a query to implement the commit.	2.5	2		
Module 4: PL/SQL	in class	Basics of PL/SQL	0.5	3		
	**Assignment Topics	1. Write a PL/SQL block to find the largest of two numbers. 2. Write a PL/SQL block to calculate the area of a circle. 3. Write a PL/SQL block to calculate simple interest and compound interest. 4. Write a PL/SQL block to find the sum of first 100 odd nos. and even nos. 5. Write a PL/SQL block to find the sum of first 100 natural nos.	2.5	3		
	in class	PL/SQL Continued	0.5	3		
	**Assignment Topics	1. Write a PL/SQL block to find the sum of digits of a number. 2. Write a PL/SQL block to reverse the digits of a number. 3. Write a PL/SQL block to raise the salary by 20% of given employee on following table. Emp_Salary (eno, ename, city, salary) 4. Write a PL/SQL block to check whether a string is a palindrome or not. 5. Write a PL/SQL block to check whether a given number is a Armstrong number. 6. Write a PL/SQL block to find factorial of a number. 7. Write a PL/SQL block to check whether a number is prime or not. 8. Write a program to generate all prime numbers below 100.	2.5	3		
Module 5: MongoDB	in class	Basics of MongoDB	0.5	1		
	**Assignment Topics	Write a MongoDB query for the following: The collection in the database should have the name 'Departments'. It should have the following fields: Departments (Dept_id, Dept_name, Manager_id, Location) Insert at-least SIX records. a) Find the names of all departments which are located at Kolkata.	2.5	1		

|						
		b) Sort the departments according to increasingorder of their 'Dept_id'. c) Find the names of all departments which arelocated either in _Delhi' or 'Bombay'. d) Rename the department name whereManager_id is 100.				
	in class	MongoDB continued	0.5	1		
	**Assignme ntTopics	Write a MongoDB query for the following: The collection in the database should have the name 'Project'. It should have the following fields: Project(Project_id, P_name, Department, no_of_member, P_cost) Insert at-least SIX records. a) Find the Project_id and P_name of allprojects belongs to 'CSE' department. b) Sort the projects alphabetically with respect toproject name. c) Find the names of all projects belong to both'ECE' and 'EE' department. d) Change the P_cost for project_id=5 to1,00,000.	2.5	1		

Text Books:

1. Elmasri and Navathe: "Fundamentals of Database Systems", Addison Wesley.
2. Silberschatz, Korth, Sudarshan, "Database System Concepts", McGraw-Hill

Reference Books:

1. Thomas Connolly, Carolyn Begg, "Database Systems – A Practical Approach to Design, Implementationand Management", Pearson Education.
2. Jefrey D. Ullman, Jenifer Widom, "A First Course in Database Systems", Pearson Education.
3. Bipin C Desai, "An Introduction to Database Systems", Galgotia.
4. Atul Kahate, "Introduction to Database Management Systems", Pearson.
5. Ian Robinson, Jim Webber, Emil Eifrem,"Graph Databases",O'Reilly Media.
6. Gaurav Vaish, "Getting started with NoSQL", Packt.

Sub Code: CSML301A1   **Credit: 4(L-3, T-0, P-0)**
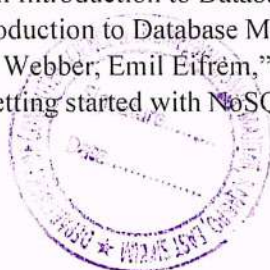
ARTIFICIAL INTELLIGENCE

Questions to be set: 05 (All Compulsory)

Course Objectives: The aim of this course is to provide an introduction to some fundamental issues and algorithms in artificial intelligence (AI). The course approaches AI from an algorithmic, computer science-centric perspective. The course aims to provide some fundamental tools and algorithms required to produce AI systems able to exhibit limited human-like abilities, particularly in the form of problem solving by search, representing and reasoning with knowledge, planning, natural language understanding, computer vision, automatic programming and machine learning.

Pre-requisites: Algorithms will be an essential component, in addition the course requires some mathematicsspecially Calculus, Probability and statistics. Natural Sciences Mathematics or equivalent, and Discrete Mathematics, are likely to be helpful although not essential. Mathematical Methods for Computer Science, Probability, Logic and Proof, Prolog and Complexity Theory are likely to be useful.

Course Outcomes(CO): On completion of the course it is expected to endow the students with skills to:

1. Distinguish between the popular view of the field and the actual research results.
2. Appreciate the fact that the computational complexity of most AI problems requires us regularly to deal with approximate techniques.
3. Describe different perspectives on what the problems of artificial intelligence are and how different approaches are justified.
4. Design basic problem solving methods based on AI-based search, knowledge representation, reasoning, planning, and machine learning algorithms.
5. Identify problems requiring AI based solutions.

** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: < Introduction to Artificial Intelligence & Machine Learning>	in class	Introduction: Definition of Artificial Intelligence (AI), Overview of Artificial Intelligence- Problems of AI, AI techniques, Typical AI problems: Tic -Tac- Toe problem, 8-puzzle problem, **Essentials of Generative AI, Prompt Engineering and ChatGPT, Future Trends of AI.** Machine Learning: Learning- Supervised and Unsupervised learning, adaptive Learning, Reinforcement learning, Linear classification, Loss minimization, Stochastic gradient descent, K-Means Algorithm, **Introduction to Neural Networks and Its Applications**, The perceptron, **Multi-Layered Neural Networks**, Deep learning, Auto-encoders, CNNs, RNNs, Introduction to Natural Language Processing **and Its Applications**	10	1,2		

	**Assignme nt Topics	Intelligent and Rational agents , Practical impact of AI, **Conversational AI, Explainable AI, Understanding AI Ethics and Safety, Latest Trends in AI, Hands on ML Model Development**				
Module 2: < Problem solving by Search & Informed Search Techniques>	in class	Problem solving by Search : Tic -Tac-Toe problem, 8-puzzle problem, State space search, Uninformed search strategies: BFS, DFS, Depth Limited search, Iterative Deepening DFS, Bi- directional depth first search. Informed Search Techniques : Informed (Heuristic) Search Strategies, Best First Search (BFS), Greedy BFS, A* Search, Heuristic Functions, Hill Climbing Search. **Evolutionary Computation: Genetic Algorithm, Ant Colony Optimization, Differential Evolution.**	11	2,3		
	**Assignm ent Topics	Problems, Problem Space & search, Formulating problems: Pegs and Disks problem, Missionary Cannibals problem ,Simulated Annealing Search, Local Search, **Particle Swarm Optimization.**				
Module 3: < Adversarial Search & Bayesian Networks >	in class	Adversarial Search : Game Trees, Optimal Decision in Games: Minimax Algorithm, Alpha Beta Pruning, TD learning, Game theory. Bayesian Networks : Bayesian inference, Marginal independence, Hidden Markov models, Learning Bayesian networks, Laplace smoothing, Expectation Maximization, Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory.	7	4,5		

	Assignment Topics / in class					
	Assignme nt Topics	**Application : Fuzzy Sets and Fuzzy Logics**				
Module 4: < Constraint Satisfaction Problems >	in class	Constraint Satisfaction Problems: N-Queen problem, Crossword puzzle, Map coloring problem, Boolean satisfiability problem (SAT). The backtracking algorithm for CSPs. Heuristics for improving the search for a solution. Forward checking.	7	3,4,5		
	Assignme nt Topics	Constraint propagation and arc consistency. Backtracking, Back jumping using Gaschnig's algorithm, Graph-based back jumping				
Module 5: < Knowledge representation and Reasoning >	in class	**Representation & mapping, approaches to knowledge representation, representing simple fact in Logic**, Logic programming, **Proportional and Predicate Calculus, Semantic Nets**, forward verses backward reasoning, **Probabilistic Reasoning**, matching, control knowledge, **Automated Planning**	8			
	Assignme nt Topics	Knowledge representation issues, Syntax versus semantics, Horn clauses, First-order logic Resolution, Procedural verses declarative knowledge.		4,5		
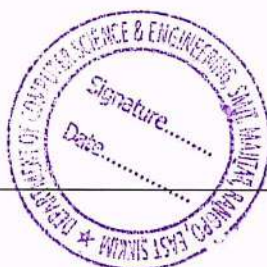
Text Books:

1. Russell, S. & Norvig, P. (2010). Artificial intelligence: a modern approach. Prentice Hall (3rd ed.).
2. Elaine Rich, Kevin Knight & Shivashankar B. Nair (2008). Artificial Intelligence (Third Edition) TMH.
3. Bishop, C. M. (2006) Machine Learning and Pattern Recognition. Berlin: Springer.

Reference Book:

1. Poole, D. L. & Mackworth, A. K. (2010). Artificial intelligence: foundations of computational agents. Cambridge University Press.

Sub Code: CSML302A1   **Credit:4 (L-3, T-0, P-0)**
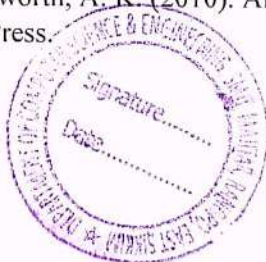
PYTHON PROGRAMMING

Questions to be set: 05 (All Compulsory)

Course Objectives: This course introduces Python as imperative, functional, procedural and object oriented programming language. Python also serves as a scripting language for web applications. The units cover the Python language with a focus on its object-oriented features, web applicability and how these can be implemented as part of program designs and implementation. The students shall also gain knowledge on practical applications of python in scientific computing using libraries such as NumPy, Matplotlib etc.
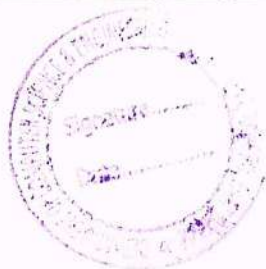
Pre-requisites: Computer Programming concepts of C, C++ etc.

Course Outcomes (CO): On successful completion of this course, students will be able to:
1. Define the basic structure of python programming.
2. Differentiate imperative, functional and procedural programming features in Python
3. Practice features for designing and implementing python program.
4. Compose applications using various libraries and concepts of Python.
5. Select methods to build and package Python modules for reusability
** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: <Introduction & Python Program Flow Control>	in class	History, need of python programming, data types, variables, expressions, operators, sequence, list, tuple, set, dictionary, print statement, etc. Conditional blocks using if, else and elseif, Simple for loops in python, For loop using ranges, string, Use of while loops in python, Loop manipulation using pass, continue, break and else,	8	1,2		
	**Assignment Topics	Programming using Python conditional and loops block, Functions.				
Module 2: < Python Object–based programming >	in class	Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class, Inheritance, overlapping and overloading operators,	8	2,3		
	**Assignment Topics	Adding and retrieving dynamic attributes of classes.				
Module 3: < Error and Exceptions & Python Regular Expression	in class	Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions. Powerful pattern matching and searching, Real time parsing of networking or system data,	8	3		

		Widgets and basic components, Layout options, Event handling.				
and GUI design >	**Assignme ntTopics	Real time parsing of networking or system data, Widgets and basic components				
Module 4: <Python Database Interaction and F ile Operation>	in class	SQL Database connection using python, Creating and searching tables, Reading and storing config information on database, Programming using database connections, Reading config files in python, Writing log files in python, Understanding read functions: read(), readline() and readlines().	8	4		
	**Assignme ntTopics					
Module 5: < Python Standard Library & Application s>	in class	Study of modules for creating graphical user interfaces, connecting to relational databases, generating pseudorandom numbers, arithmetic with arbitrary precision decimals, manipulating regular expressions, unit testing, Python Package Index (PyPI). APIs for scripting: Web Server Gateway Interface, Web frameworks like Django,Libraries for scientific computing such as NumPy, SciPy and Matplotlib.	8	4,5		
	**Assignme ntTopics	Pylons, Pyramid, TurboGears,web2py,Tornado, Flask, Bottle, Zope etc.				

Text Books:

1.   Mark Lutz, "Programming Python", O'Reilly.
2.   W.Chun, "Core Python Programming", Pearson.

Reference Books:

1.   Allen Downey, "Think Python", Green Tea Press
2.   Mark Lutz, "Learning Python", 3rd Edition, O'Reilly
3.   Guido van Rossum and Jr. Fred L. Drake , "An Introduction to Python", Network Theory Ltd.

Sub Code: CSML303A1   **Credit: 4 (L-3, T-0, P-0)**

OPERATING SYSTEMS

Questions to be set: 05 (All Compulsory)

Course Objectives: The principles and concepts that govern the design of modern computer operating systems are studied. Managing computing resources such as the memory, the processor and the Input/outputdevices are covered. Algorithms for CPU scheduling, memory and general resource allocation; process coordination and management; deadlocks and memory management techniques; case studies of Linux operating systems are also covered.
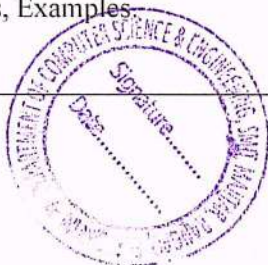
Pre-requisites: Computer Organization and Programming Language concepts.

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Describe the different operating system architectures and structures.

2. Select the appropriate scheduling algorithms or techniques for efficient utilization of computer resource like CPU, Memory, etc.

3. Interpret theory of data inconsistency problem and provide a procedure for synchronization problem.

4. Manage various technical issues related to operating systems' services using principles of computer science and engineering.

5. Compose methods for analyzing the performance of various identified algorithms or techniques in operating systems

** not more than 20% of total topics to be allotted for assignment

Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: \<Introduction>	in class	Basics of Computer Organization, Interrupt, Bus, ISA, CPU Operation. What operating systems do? Operating system structure, Operating system operations, Special-purpose systems, Operating system services, User-operating system interface, System calls, Types of system calls.	7	1		
	**Assignmen tTopics	Operating system design and implementation. Casestudy: Linux Design Principles				
Module 2: \<Process management>	in class	Process: Concept, Multithreaded programming, Multithreaded models, Thread libraries, Threadingissues, Process scheduling criteria and algorithms, Thread scheduling, Operating-system examples.	9	2,5		
	**Assignmen tTopics	Case study: Linux Process and I/O Scheduler.				
Module 3: \<Process synchronization>	in class	Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classicproblems.	8	3		
	**Assignmen tTopics	Monitors, Examples.				

Module 4: < Deadlock &Memory management >	in class	System model, Characterization, Methods of handling deadlocks, Prevention, Avoidance, Detection and recovery. Fixed and variable partition, Swapping, Paging and segmentation, Structure of page table, Combined systems, Virtual memory: Overlays, Demand paging, Copy-on- write, Page replacement, Allocation of frames, Thrashing, Allocating kernel memory. Case study:Linux Memory Management	9	2,4		
	**Assignme ntTopics					
Module 5: < File systems &I/O systems>	in class	File system concept, Access methods, Directory structure, File- system mounting, File sharing, Protection. Overview, Kernel I/O subsystem, Kernel Data Structure, Transforming I/O requests to Hardware Operations,	7	2		
	**Assignme ntTopics	Allocation methods. Case Study: Linux I/O Systems.				

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Wiley & Sons.Inc..
2. D M Dhamdhere, "Systems Programming & Operating Systems", Tata McGraw-Hill.

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating systems", PHI.
2. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw-Hill.
3. P. Balakrishna Prasad, "Operating Systems", Scitech Publication.
4. William Stallings, "Operating Systems-Internals and Design Principles", Pearson Education

Sub Code: CSML304A1   **Credit: 4(L-3, T-1, P-0)**

COMPUTER NETWORKS

Questions to be set: 05 (All Compulsory)

Course Objectives: This course emphasizes on several computer network concepts, applications and protocols in OSI as well as TCP/IP layered architecture. It also covers the various protocols of various layers, their operations and applications. Further it discusses the concept of network security, challenges and their counter measures.
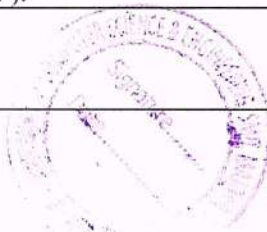
Pre-requisites: Communication Techniques.

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Understand and identify the engineering fundamentals concerning Data Communication and Computer Network.

2. Identify the complex engineering problem involved in Data communication and its architecture for a successful network based communication.

3. Ability to Practice and formulate a solution for an engineering problem concerning any layers inData Communication model

4. Demonstrate an ability to formulate and interpret a model based on the fundamentals of Computer Networks

5. Compare and understand the IOS reference model and TCP-IP reference model for data communication

** not more than 20% of total topics to be allotted for assignment

Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: <Overview & Data Link Layer >	in class	Introduction to data communications, Types of Network, Store and forward, Packet Switching, Circuit Switching, Layered architecture: OSI and TCP/IP, Performance Metric: Delay, Throughput, Jitter Data link layer design issue, Error detection and correction: Parity bit, Polynomial: CRC. Elementary data link protocol: Random Access: ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Controlled Access: Reservation, Polling. Ethernet Frame Structure, L2 Addressing, ARP.	9	1,5		
	**Assignment Topics					
Module 2: < Network Layer & Routing>	in class	Network Topology and performance evaluation, Internet Protocol: IPv4 and IP addressing and sub-netting. Internet Control Message Protocol (ICMP), Mapping Physical to Logical Address: Reverse Address Resolution Protocol (RARP), . Dynamic Host Configuration Protocol (DHCP). Structure of IP datagram, Network Address Translation (NAT). Distance Vector routing (DVR), Link state routing, and Interior gateway protocol: Routing Information Prortocol (RIP) and Open Shortest Path First (OSPF), Exterior gateway protocol: Border Gateway Protocol (BGP).	9	1,2		
	**Assignment Topics					

|							
Module 3: < Transport Layer>	in class	Functions of transport layer protocols: Reliable and unreliable service, Introduction to Transmission Control Protocol (TCP) and User Datagram Protocol (UDP), Header description of TCP and User Datagram Protocol (UDP), Congestion control mechanism of TCP.	9	1,3			
	**Assignment Topics						
Module 4: < Application Layer>	in class	Brief overview of protocols in Application Layer: Domain Name Systems, Hyper Text Transmission Protocol,), Multimedia Application: Audio and video streaming using UDP, VoIP.	9	1,4			
	**Assignment Topics						
Module 5: < Network Security & Other Network Technologies >	in class	Confidentiality, Authenticity, Integrity and Non-repudiation, Attacks, Introduction to Symmetric and asymmetric Cryptography. Wireless LAN: IEEE 802.11 specification, CSMA/CA. Introduction to Cellular Network, Ad Hoc Network and Software Defined Network	4	1,2			
	**Assignment Topics	.					

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw Hill.

2. William Stallings, "Data and Computer Communications", PHI.

Reference Books:
1. Andrew S. Tanenbaum, "Computer Networks", PHI.
2. A S Godbole, "Data Communication and Networking", Tata McGraw Hill.
3. William C Y Lee, "Mobile Communication Engineering", Tata McGraw Hill.
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Wiley
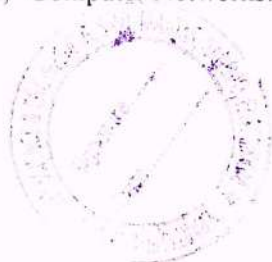
MACHINE LEARNING USING PYTHON LABORATORY

Prerequisites:
1. Programming concepts.
2. Basics of Python language.
3. Theoretical base on Machine Learning concepts.

The lab will be comprised of **12 lab tasks** followed by **02 additional** practice sessions.
Total=12+2=14 sessions. Necessary data sets (and/or links) will be provided to the students prior to the lab work.

Course Outcome: On successful execution of the project, students will be able to:
1. Explore and identify appropriate functions from the NumPy library.
2. Explore and identify appropriate functions from the Pandas and matplotlib libraries.
3. Pre-process available data using standard techniques.
4. Compare, choose and implement appropriate classification algorithm for a given dataset.
5. Deploy a finished model using Pickle and joblib.

Sl. No	Description of the experiments	Remarks
1	Revisit Python basics, advanced data structures (lists, dictionaries, tuples, sets). Introduction to **NumPy** Library in python. Explore available functions with suitable examples.	
2	Introduction to **Pandas** and **matplotlib** library in python. Explore available functions from each library mentioned with suitable examples.	
3	Concepts of datasets, data preprocessing. Explore "**ourworldindata.org**" and "**kaggle.com**" and note the observation.	
4	Introduction to **simple** and **multiple linear regression**.	
5	Introduction to classification problems. Study and practice on K Nearest Neighbor (KNN) algorithm.	
6	Classification problem using **Support Vector Machine**.	
7	Introduction to **Decision Tree algorithm**.	
8	Introduction to **Naïve Bayes approach**.	
9	Unsupervised Learning using **K-Means clustering**.	
10	Introduction to **ANN** and implementation of ANN as classifier.	
11	Model Deployment using **Pickle** and **joblib**.	
12.	Implementation of **k-Nearest Neighbor** algorithm to classify the **iris data set**.	
13.	Perform a comparison study on the classifications done in **Q-6**, **Q-7** and **Q-8**. Show the results as obtained accuracy and plot each.	
14.	A demo project (from Farm to Plate).	

Sub-Code: CSML302A4   **Credit:1 (L-0, T-0, P-2)**

COMPUTER NETWORKS LABORATORY

Course Objectives: At least 10 experiments covering the entire syllabus of the corresponding theory paper to be carried out using the theory studied /programming skill of the subject concerned to get insight into thepractical applications of the theoretical studies. The outcome of the lab classes must lead to a skilled and self-sustained program developer.

Pre-requisites: Communication Technique and Data Communication

Course Outcomes (CO):

1. Identify and understand various functions used in socket programs
2. Develop and test of socket program for client server interaction for various purpose.
3. Implementing and Validate Sub network with static and various dynamic routing protocols.
4. Analyze the packet structure of various protocols used for communication
5. Understand the fundamentals of SDN

** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: TCP Socket Programs	in class	Introduction to client-server architecture, Introduction to working of TCP, functions related to TCP Socket Programming.	4	1,2		
	**Assignment Topics	Program to write a simple Message passing TCP socket program, TCP Socket program with specific aim, TCP socket program involving multiple clients.	3	1,2		
Module 2: UDP Socket Programs	in class	Introduction to client-server architecture, Introduction to working of UDP, functions related to UDP Socket Programming.	4	1,2		
	**Assignment Topics	Program to write a simple Message passing UDP socket program, UDP Socket program with specific aim.	3	1,2		
Module 3: Creating/Designing Sub-network with Static routing	In Class	Introduction to classless IP, Introduction to CIDR and VLSM, Introduction to Network Devices and Sub-netting, Basic Router configuration followed by Static route configuration	3	3		
	**Assignment Topics	To configure the sub-network with given requirements and configure the static route in the topology for routing.	3	3		
Module 4: Creating/Designing Sub-network with Dynamic routing	in class	Revision to CIDR and VLSM, revision to Basic Router configuration followed by Dynamic route configuration	3	3		
	**Assignment Topics	To configure the sub-network with given requirements and configure the Dynamic route in the topology for routing.	3	3		
Module 5: Introduction to SDN and traffic Monitoring	in class	Introduction to Software Defined Network, Introduction to Installation of Mininet, Overview of Mininet environment, Introduction to tools like ipref and wire shark.	3	4,5		

	Assignment Topics	To establish and configure the simple SDN network topology and use tools like ipref and wire shark for necessary analysis.	3	4,5		

Text Books:

[1] Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill

[2] Andrew S. Tanenbaum, "Computer Networks", PHI.

Reference Books:

[1] William Stallings, "Data and Computer Communications", PHI.

[2] Alberto Leon-Garcia, Indra Widjaja, "Communication Networks – Fundamental Concepts and KeyArchitectures", Tata McGraw-Hill

Sub-Code: CSML301A9   Credit:1 (L-0, T-0, P-2)

INDUSTRIAL TRAINING-I

Course Objectives: The students are required either to undergo after 4th semester in the summer break/Vacation Straining in industries or to attend summer training course on courses beyond the scope of normal curriculum organized by the Department by calling experts from outside or to visit in industry for gaining valuable knowledge

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Select and provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
2. Adapt and enhance knowledge in one particular technology
3. Express and demonstrate self-confidence and helps in finding their own proficiency.
4. Develop leadership ability and responsibility to perform or execute the given task
5. Illustrate and practice within a real job situation.

Sub Code: CSML305A1   **Credit:4 (L-3, T-1, P-0)**

SOFTWARE ENGINEERING

Questions to be set: 05 (All Compulsory)

Course Objectives: This course presents a comprehensive study of software quality assurance, including software quality control management, processes, systems, methods, standards, certification, and reliability measurement.

Pre-requisites: Procedure oriented and object-oriented programming paradigm.

Course Outcomes(CO): On successful completion of this course, students will be able to:

1. Demonstrate competence in using engineering fundamentals to visualize solutions using knowledge ofsoftware engineering skills.

2. Extend an ability to formulate a solution plan and methodology for an engineering problem using software engineering.

3. Apply an ability to formulate and interpret a model for project management

4. Explain an ability to define complex problem, find and analyze requirements

5. Apply new software models, techniques and technologies to bring out innovative and novelistic solutionsfor the growth of the society in all aspects and evolving into their continuous professional development.
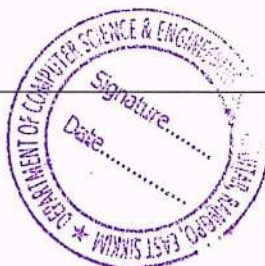
** not more than 20% of total topics to be allotted for assignment

Module	Mode	Topics	Hrs	CO	PO	PSO

Module 1: < INTRODUCTION TO SOFTWARE ENGINEERING >	in class	• Software Development Challenges Software Scope
		 • Software Engineering Discipline
		 • Introduction to Agile Software Engineering
		 • Evolution of Software
		 • Process Models and Software Life Cycle Phases
		 • Traditional Life Cycle Models
		  • Waterfall
		  • V
		  • Evolutionary
		  • Spiral
		 • Alternative Techniques
		  • DevOps
		  • CICD
		  • Prototyping
			8	1		

	**Assignment Topics	• Traditional Life Cycle Model Vs CBSE • Alternative Techniques • RAD				

Module 2: < SOFTWARE REQUIREMENTS AND REQUIREMENT ENGINEERING PROCESS >	in class	• Definition and importance of software requirements
		 • Feasibility study
		 • Functional and Non-Functional Requirements
		 • Requirements from the customer's perspective/WRSPM (World, Requirement, Specification, Platform, and Machine) model
		  • Requirement elicitation and analysis
		  • Good practices
		  • SRS Validation
			8	3		

	**Assignment Topics	Real Time use of JIRA / Rally (can create real time mockups), CI/CD like Jenkins, how and why stories are				

		blocked (blockers), or marked on various stages, addressing requirement ambiguities as developers				

Module 3: < Design >	in class	• Basic Design Concepts and Principle • Modularity • Cohesion • Coupling • Refactoring of Design • Object oriented design • Function oriented design • Software Architecture • Architectural Styles: • Data-centric, Data-flow, function oriented metrics, Halstead metrics	8	2		
	**Assignment Topics	• UML				
Module 4: < VALIDATION AND VERIFICATION >	in class	• Introduction to Validation and Verification • Verification & Verification Techniques: • Unit, System & Integration, Black/White box testing, Regression, Use Case Testing, • Acceptance Testing Fuzzy, Robustness, Security Testing, Automated Testing	8	4		
	**Assignment Topics	Evaluating the Efficacy of Validation and Verification in Software Development: A Case Study Approach				
Module 5: < SOFTWARE PROJECT MANAGEMENT AND RISK MANAGEMENT >	in class	• Project Estimation: Cost estimation techniques: COCOMO, Intermediate COCOMO, Function Point Analysis ,Delphi, PERT/CPM • software risks and Risk management: Reactive vs Proactive. • Risk identification and Projection	8	5		
	**Assignment Topics					

Text Books:

1. Rajib Mall, "Fundamentals of Software Engineering", PHI.
2. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill.

Reference Books:

1. Jalote Pankaj, "An integrated approach to Software Engineering", Narosa.
2. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.
3. Somerville, "Software Engineering", Pearson
4. Budgen, "Software Design", Pearson

QUANTITATIVE APTITUDE AND LOGICAL REASONING - I

Questions to be set: 05 (All Compulsory)

Course Objective: The main aim of introducing "Quantitative Aptitude & Logical Reasoning" to university students is to develop numerical skills among students and to prepare them for various examinations to enhance better job prospects. This initiative is being taken to include essential mathematical principles to build students' confidence. It is expected to expand students' knowledge and foster their logical reasoning and analytical thinking abilities.

Pre-requisites: NIL

Course Outcomes (CO): On successful completion of the course

CO	STATEMENT
CO1	Student will be able to solve variety of simple problems in the space of quantitative domain.
CO2	Students will be able to use data to determine or to deduce other facts from a set of given data of less complexity.
CO3	Students will be able to use shortcuts, tricks and techniques to solve the problems with moderate accuracy.
CO4	Students will be able to demonstrate essential skills pertaining to public speaking, resume writing and telephone etiquette.
CO5	Students will be able to demonstrate basic skills during the placement interviews

Module	Topics to be covered	Topics	Hrs.	CO	PO	PSO
Module 1: Quantitative Aptitude	In class	Problems on Trains, Time and Distance, Height and Distance, Time and Work, Simple Interest, Compound Interest, Profit and Loss, Partnership, Percentage, Problems on Ages, Calendar, Clocks, Average, Area, Volume and Surface Area	6	1		
Module 2: Puzzles, Problem Solving and Analysis	In class	Sudoku, Number Puzzles, Missing Letter Puzzles, Playing Card Puzzles, Clock Puzzles.	3	2		
Module 3: Logical Reasoning	In class	Number Series, Letter and Symbol series, Verbal Classification Essential Part, odd man out and visual reasoning, Analogies, Artificial Language, Matching Definitions, Making Judgements.	5	3		
Module 4: Professional Builder	In class	Resume Writing, Public Speaking, Extempore, Telephone etiquette.	4	4		
Module 5: Use Cases	In Class	Mock Interview – Hard and Soft Skills Sector: FMCG, IT, Production, Manufacturing etc.	2	5		

Text books:

1. Aggarwal, R. S. (2008). *Quantitative Aptitude*. S. Chand., ISBN: 9788121924986, 8121924987
2. Devi, S. (2005). *Puzzles to puzzle you*. Orient Paperbacks. ISBN: 8122200141, 9788122200140
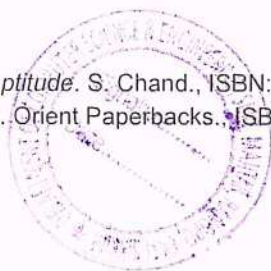
INDUSTRIAL MANAGEMENT

Questions to be set: 05 (All compulsory)

Course Objective: To provide basic knowledge of functions of management along with their practical implications

Pre-requisites: No pre-requisites

Course Outcomes (CO):

CO1: To provide basic knowledge and application of functions of management
CO2: To help students to understand and apply principles of management evolved by pioneers of management.
CO3: To enable students to apply basic quantitative techniques for making decisions related to operations management
CO4: To help student apply various techniques for optimal production management
CO5: To apply concepts of materials management for maintaining optimal inventory

** Not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Introduction	In Class	Philosophy and Development of Management thought. Concept and definition of management, Functions and Roles of Management, Social Responsibilities of Management.	3	1		
	** Assignment Topics			1		
Pioneers in Management	In Class	Taylor's Scientific Management, Contribution of Henry Fayol, Maslow, McGregor, Gilbreth and Mayo.	3	2		
	** Assignment Topics			2		
Quantitative Techniques in Managerial Decisions	In Class	Concept of budget and budgetary control. Time-event network analysis; ABC Analysis, Break-even Analysis; Decision Tables; Concept of productivity, measuring productivity, Use information technology	5	3		
	** Assignment Topics			3		
Production Management	In Class	Types of production; Types of Planning, Manufacturing Planning; Production planning, Scheduling; Work study & Method Study; Systems of wage payments, bonus, Automation. Organization of production, planning and control department.	5	4		
	** Assignment Topics			4		
Materials Management	In Class	Practice of purchasing and materials management, quality, Inventory Management, EOQ model; Value Analysis and Value Engineering.	4	5		
	** Assignment Topics			5		

Text Books:

a) H. Koontz and H. Weihrich, "Management", McGraw Hill
b) Dobler W.D. "Pur
c) chasing & Materials Management", TMHC, New Delhi

Sub Code: CSML306A1   **Credit: 4(L-3, T-0, P-0)**

DATA ANALYTICS

Questions to be set: 05 (All Compulsory)

Course Objective: Data Analytics is the science of analyzing data in order to come up with some decision-making useful knowledge. The course presents wide range of data analytics techniques and tools for extraction of knowledge.
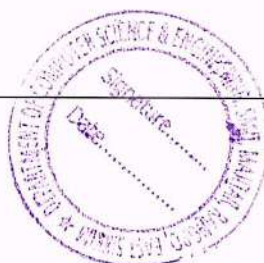**Pre-requisites:** Database Systems.

Course Outcomes: On completion of the course, it is expected to endow the students with skills to:
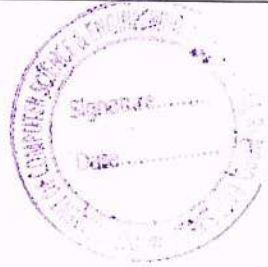1. Apply data analytics techniques and tools to produce knowledge from a given dataset.
2. Analyze and apply statistical and probabilistic approach for the development of a model using large dataset.
3. Create and evaluate the model using suitable machine learning algorithms.
4. Formulate statistical hypothesis testing and inference for the model development.
5. Explain the dataset using different data representation tools.

** not more than 20% of total topics to be allotted for assignment

Module	Mode	Topics	Hrs	CO	PO	PSO
Module 1: Introduction and Data Analytics Lifecycle and methodology	in class	Introduction to data analytics (DA), data preparation, and data cleaning, Big Data Overview, what is data sciences, The rising and importance of data sciences, Understanding Business Data, Data Preparation, Data, Modelling, Data Evaluation, Communicating results	8	1,2		
	**Assignment Topics	**Big data analytics in industry**, **Deployment of Data**.				
Module 2: Statistical Analysis	in class	Basic statistical concepts. Mean, standard deviation, Distributions, Covariance, correlation, analysis of variance, Statistical tests, confidence and hypothesis testing, Tools such as R.	6	4		
	**Assignment Topics	Rank statistics and percentiles				
Module 3: Probabilistic Analysis	in class	Dependence and Independence, Conditional Probability, Bayes's Theorem, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.	6	5		
	**Assignment Topics	Random Variables				

| Module 4: Data Analytics: Theory & | in class | Data features, Classification, Supervised and unsupervised learning, Supervised learning - Linear/Logistic regression, Decision trees, Naïve Bayes, Unsupervised learning - K-means clustering, Association rules, Clustering | 10 | 1,3 | | |

Methods and Hypothesis and Inference		algorithms, Statistical Hypothesis Testing, Example: Flipping a Coin, Confidence Intervals, Example: Running an A/B Test				
	**Assignment Topics	Knowledge discovery, Anomaly detection, P-hacking, Bayesian Inference.				
Module 5: Tools for Data Analytics and Data Representation and Analysis	in class	Globally distributed data stores, Tools for big data, Introduction to Hadoop, HDFS, MapReduce, , HBase, Hive, Pig, NoSQL. Log Data Analysis – HDFS scenario: Write once & Read often, , Fraud Detection, Risk Modeling, Social Sentiment Analysis, Image Classification,.	10	2,5		
	**Assignment Topics	YARN, Sqoop, Zookeeper, Flume, Data Warehouse, Graph Analysis				
	"					

Text Books:

1. Daniel T. Larose & Chantal D. Larose, "Discovering Knowledge in Data: An Introduction to Data Mining", Wiley 2nd Edition.
2. Ron Klimberg and B. D. McCullough, "Fundamentals of Predictive Analytics with JMP" SAS Institute Publishers, 2013.

Reference Books:

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" Wiley Publications.
2. Joel Grus, "Data Science from Scratch First Principles with Python", O'Reilly Media, 2015.

Sub Code: CS303A4   **Credit: 1 (L-0, T-0, P-2)**

SOFTWARE ENGINEERING LABORATORY

Course Objectives: Experiments covering the entire syllabus of the corresponding theory paper to be carried out

using the theory studied /programming skill of the subject concerned to get insight into the practical applications of the theoretical studies. The outcome of the lab classes must lead to a skilled and self-sustained program developer.

Pre-requisites: Corresponding theory paper Software Engineering and the associated prerequisites.

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Demonstrate competence in using engineering fundamentals to visualize solutions using knowledge of software engineering skills.

2. Extend an ability to formulate a solution plan and methodology for an engineering problem using software engineering.

3. Apply an ability to formulate and interpret a model for project management

4. Intergrate an ability to identify/create modern engineering tools, techniques, and resources to solve software related problems.

5. Develop a quality software product by possessing the leadership skills as an individual or contributing to the team development and demonstrating effective and modern working strategies by applying both communication and negotiation management skill.

Sub Code: CS304A4   **Credit: 1 (L-0, T-0, P-2)**

DATA ANALYTICS USING PYTHON LAB

Prerequisites:
1. Programming concepts.
2. Basics of Python language.
3. Theoretical base on linear algebra and probability concepts.
The lab will be comprised of **12 lab tasks** followed by **02 additional** practice sessions.

Total=12+2=14 sessions. Necessary data sets (and/or links) will be provided to the students prior to the lab work.

Course Outcome: On successful completion students will be able to:

1. Implement solutions involving advanced data structures like lists, dictionaries and tuples in Python
2. Explore and identify appropriate functions from the NumPy and Pandas libraries.
3. Represent data visually using the Matplotlib and Seaborn libraries.
4. Perform exploratory data analysis.
5. Perform pattern mining using association rules and other standard techniques available.

Sl. No	Description of the experiments	Remarks
1	Advanced data structures in Python (lists, dictionaries, tuples, sets). Introduction to **random** and **math** module in python.	
2	**Data Module:** Introduction to **NumPy** and **Pandas** Library in python. Explore available functions with suitable examples.	
3	**Data Visualization Module:** Introduction to **Matplotlib and Seaborn** library in python. Explore available functions from each library mentioned with suitable examples.	
4	**Datasets:** Concepts of **datasets**, data **repositories,** different **formats of data.** Explore popular open-source datasets and note the observation.	
5	**Data Wrangling:** Data pre-processing. Handling missing values in data, Data Standardization, Data Consistency, Data Normalization, Data Grouping, Data Grouping, Categorization.	
6	**Exploratory data analysis and probabilistic distributions:** Basic statististical information including mean, median, mode, quartile.	
7	**Simple** and **Multiple linear regression.**	
8	**Model development** and **tuning hyperparameters, Ridge Regression** to regularize and reduce standard errors to prevent overfitting a regression model and use the **Grid Search method** to tune the hyperparameters of an estimator.	
9	Introduction to **likelihood** and **Maximum Likelihood Estimation (MLE).**	
10	Implementing **Apriori algorithm** (Mining frequent itemset using Apriori algorithm)	
11	**Pattern Mining** using **Association rules** (suggested: Mining frequent itemset using FP tree without candidate generation).	
12	Introduction to **classification problems.** Study and practice on **K Nearest Neighbor (KNN)** algorithm and **Decision Tree** algorithm.	
13	Introduction to **unsupervised learning.** Study and practice on **K-Means clustering.**	
14	Study on **Principal Component Analysis** (PCA).	

Sub Code: CSML302A5   **Credit:2 (L-0, T-0, P-4)**

Signature

MINI PROJECT

Course Objective: The students are required to undertake innovative and research-oriented project under the direct supervision of a faculty member of the department. The mini project should not only to reflect their knowledge gained in the previous semesters but also to acquire additional knowledge and skill of their own effort.

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Describe the basic concepts of computer science related to the problem under consideration
2. Identify an appropriate engineering problem to be solved
3. Construct an appropriate design methodology for software development and demonstrate effective communication and writing skills

4. Experiment on a designed model and develop an ability to work in a team.
5. Evaluate the project based on application of knowledge and practical understanding of the model.

Sub Code: GN302A2   Credit: 1 (L-1, T-0, P-0)

QUANTITATIVE APTITUDE AND LOGICAL REASONING - II

Questions to be set: 05 (All Compulsory)

Course Objective:
The key objective of this course is to strengthen the numerical skills and logical abilities & skills of university students and prepare them for various competitive exams, thereby improving their employment opportunities. This initiative aims to incorporate fundamental mathematical principles to build students' confidence. Additionally, it seeks to broaden their knowledge and foster their logical reasoning and analytical thinking skills.

Pre-requisites: NIL

Course Outcomes (CO): On successful completion of the course

CO	STATEMENT
CO1	Student will be able to solve variety of problems simple to complex in the space of quantitative domain.
CO2	Students will be able to use data to determine or to deduce other facts from a set of given data which are simple to complex.
CO3	Students will be able to use shortcuts, tricks and techniques to solve the problems with high accuracy.
CO4	Students will be able to demonstrate essential skills pertaining to business communications.

| CO5 | Students will be able to demonstrate advanced skills required at the time of placement interviews. |

Module	Topics to be covered	Topics	Hrs.	CO	PO	PSO
Module 1: Quantitative Aptitude	In class	Problems on Permutations and Combinations, Probability, Numbers, Problems on Numbers, Problems on HCF and LCM, Decimal Fraction, Simplification, Square Root and Cube Root, Surds and Indices, Ratio and Proportion, Chain Rule, Pipes and Cistern, Boats and Streams, Allegation and Mixtures, Logarithm, Races and Games, Stocks and Shares, Probability, True Discount, Odd man out and Series.	8	1		
Module 2: Puzzles, Problem Solving and Analysis	In class	Logical Connectives and Syllogisms, Data Interpretation, Cases, Venn Diagrams.	3	2		
Module 3: Logical Reasoning	In class	Verbal Reasoning, Logical Problems, Logical Games, Data Arrangement and Blood Relations, Analyzing Arguments, Statement and Assumption, Course of action, Statement and Conclusion, Theme Detection, Cause and Effect, Statement and Argument, Logical Deduction.	4	3		
Module 4: Professional Builder	In class	CV Writing, Verbal & Non Verbal Communication, Group Discussion, Netiquettes,	2	4		
Module 5: Use Cases	In Class	Mock Interview on Hard and Soft Skills Sector - IT, FMCG, Product, Financials, Manufacturing, Production, Construction etc.	3	5		

Text books:

1. Aggarwal, R. S. (2008). *Quantitative Aptitude*. S. Chand., ISBN: 9788121924986, 8121924987
2. Devi, S. (2005). *Puzzles to puzzle you*. Orient Paperbacks., ISBN: 8122200141, 9788122200140

Sub Code: CSML401A6   **Credit:7 (L-0, T-0, P-14)**

MAJOR PROJECT-PHASE I

Course Objective: The students are required to undertake innovative and research-oriented project, not only to reflect their knowledge gained in the previous semesters but also to acquire additional knowledge and skill of their own effort.

During this phase, the students are required to submit progress of their work in phases to make the department aware of his/her project. At the end, students have to report to the internal guides/faculty members for final refinement and documentation. It is mandatory to follow the engineering methodologies in carrying out the project work. The project is evaluated through internal presentation before the panel of faculty members followed by the evaluation by external examiner appointed by the university.

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Analyse, design and implement a computational system to meet desired needs within realistic constraints.
2. Apply modern programming languages and technologies to develop a sustainable and robust software / hardware application or perform qualitative analysis on computational systems using appropriate tools.
3. Propose set of alternative design solutions to problems for which standard algorithmic solutions do not exist.
4. Express ethics, values and respects legal as well as social issues for the computing profession or computational application.

5. Justify the technical design incorporated in the computational system with the help of in-depth analysis, presentation as well as document pertaining to the project work.
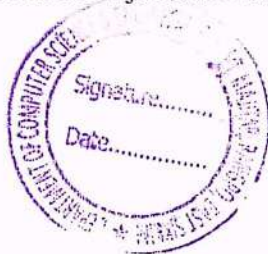
Sub-Code: CS401A9   **Credit:1 (L-0, T-0, P-2)**

INDUSTRIAL TRAINING-II

Course Objectives: The students are required either to undergo after 6th semester in the summer break/Vacation Straining in industries or to attend summer training course on courses beyond the scope of normal curriculum organized by the Department by calling experts from outside or to visit in industry for gaining valuable knowledge.

Course Outcomes (CO): On successful completion of this course, students will be able to:
1. Select and provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
2. Adapt and enhance knowledge in one particular technology
3. Express and demonstrate self-confidence and helps in finding their own proficiency.
4. Develop leadership ability and responsibility to perform or execute the given task
5. Illustrate and practice within a real job situation.

Sub Code: CSML201A3

Credit: 4(L-3, T-1, P-0)

JAVA PROGRAMMING

Questions to be set: 05 (All Compulsory)

Course Objectives: The Java Programming Language course provides students with a solid foundation for programming with JAVA. It also highlights the creation of graphical user interfaces (GUIs), exceptions, file input/output (I/O), and threads; and network programming.
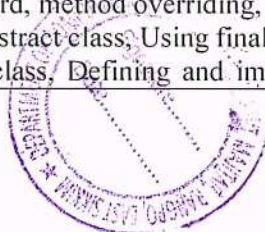
Pre-requisites: Object Oriented Programming.

Course Outcomes (CO): On successful completion of this course, students will be able to:

1. Demonstrate an ability describe and recall the various object-oriented concept

2. Formulate and interpret an object-oriented model and design solution using object oriented concepts.

3. Ability to illustrate a diverse set of design solutions using techniques of Interface, Packages, File Handling, Multi-threading, etc.

4. Select and design methodology using bottom up approach and solve open ended problems using Java.

5. Define and create modern engineering tools, techniques and resources to build software using Java programming language.

** not more than 20% of total topics to be allotted for assignment

| Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: <Introduction to Java & Classes>	In Class	Evolution and features of java, Overview of java, Data types, Variables and arrays, Type conversion and casting, Type promotion in expression, arrays. Class fundamentals, Declaring objects, Assigning object reference Variables, Introducing methods, Constructors, 'this' keyword, The finalize() method.	8	1,2		
	**Assignment Topics	Two control statements, Lexical issues, Literals, Variables, Operators, Bitwise operators, Relational operators, Boolean and logical operators, Assignment Operators, The '?' operator, Operator precedence, JAVA statements. Garbage collection and stack class.				
Module 2: <Methods and classes & Strings handling>	In Class	Overloading methods and constructors, using object as parameters, Argument passing, Returning objects, Access control, Static methods, Nested and inner classes, Command line argument. String constructors, String length, Special string operators, Character extraction, String comparison, String searching, String modification, Changing case of characters within a string, Compression and String buffer, String builder.	8	2,3		
	**Assignment Topics	Recursion				
Module 3: < Inheritance, Interfaces and Packages,	In Class	Basics of inheritance, Types of inheritance, Using super keyword, method overriding, Dynamic method dispatch, Abstract class, Using final with inheritance, The object class, Defining and implementing	8	2,3		

Exception Handling >		interface, Extending interfaces, Nested interfaces, Applying interfaces, Defining and creating packages, Access protection, Importing packages. Fundamentals, Exception types, Uncaught exceptions, Using try and catch, Multiple catch clauses, Nested try statements, Finally, Java's built in exceptions, Creating own exception classes				
	**Assignment Topics	Throws				
Module 4: <Input/Output and file handling & Multithreaded programming>	in class	Java I/O classes and interfaces, The stream classes, Byte streams, The character streams, The console class, File class, Byte-stream class, Random access files. Thread basics, Java's thread model, Thread priorities, Messaging, Thread class and runnable interface. The main thread, Creating a thread, Creating multiple threads, Interthread communication, Suspending/resuming and stopping threads.	8	4,5		
	**Assignment Topics	Synchronization.				
Module 5: < Network programming & Event Based Programming>	in class	Networking basics, The networking classes and interfaces, The InetAddress class, Inet4Address, TCP socket. The applet class, Repaint(), The HTML applet tag, Passing Parameter to applet, Event handling,	8	5		
	**Assignment Topics	URL, URLConnection, HTTP/URL Connection, TCP/IP server sockets, Datagram socket and Datagram Packet. Using delegation event model, Abstract Window program, Displaying information within a window, AWT controls.				

Text Books:

1. Programming With JAVA, 2nd Edition, E. Balaguruswami and TMH Publication.
2. Java: The Complete Reference, 7th Edition, Herbert Scheldt, TMH Publication

Reference Books:

1. The Java Programming Language: K.Arnold and J. Gosling.
2. Professional java Server Programming: Allamaraju.
3. JAVA2: The Complete Reference, 3rd Edition, Patrick Naughton and HarbertSchildt, TMH Publication.
4. Internet & Java Program: R.Krishnamoorthy& S. Prabhu, New Age Internet Publisher

Sub Code: CSML202A3   **Credit: 4(L-3, T-1, P-0)**
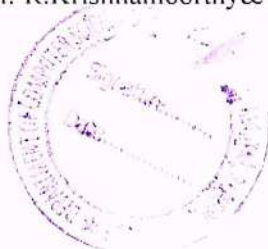
FUNDAMENTALS OF WEB TECHNOLOGIES

Questions to be set: 05 (All Compulsory)

Course Objectives:

1. To equip learners with adequate skills to conceptualize, design and develop well-engineered websystems.

2. To enable learners to apply free and open source web technologies for developing powerful andscalable web applications.

Pre-requisites: Programming language concepts, Computer Networks, Database Systems.

Course Outcomes (CO): On successful completion of this course, students will be able to:

     1. Identify the various terms and components of HTML, CSS, JavaScript, PHP and Drupal

     2. Illustrate various components of web development languages

     3. Connect different modules of open source technologies for website development

     4. Select appropriate web technology for implementing solution to a given problem

     5. Construct a web domain using appropriate tools and techniques

    ** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: < Introduction & HTML AND XHTML>	in class	History of internet and world wide web, World Wide Web consortium, Web architecture, Web 2.0, HTTP protocol, Personal, distributed and client-server computing. Introduction, editing XHTML, w3c XHTML validation service, headers, linking, images, special characters, unsorted lists, nested and ordered lists, XHTML tables, XHTML forms, internal linking.	8	1,2		
	**Assignment Topics	Web browser basics, Browser portability, meta elements.				
Module 2: < HTML5>	in class	HTML5 Basics, HTML5 Syntax, New HTML5 Elements, Times and Dates, Browser Support, Semantic Formatting, New Input Types and Attributes, New Form Elements and Attributes, Playing Audio, Playing Video.	7	2		
	**Assignment Topics	The Canvas, Other HTML5 Technologies.				
Module 3: <Style Sheets, JQuery and Ajax>	in class	Inline styles, embedded style sheets, conflicting styles, linking external style sheets, positioning elements, backgrounds, element dimensions, Box Model and text flow, Media Types, Building a CSS drop-down menu. JQuery: Introduction, What JQuery does, Functions, Selecting elements, Useful predefined Jquery functions, Add page elements, Adding events, Ajax: Introduction to Ajax: Overview of Ajax; The basics of Ajax.	9	1,3		

	**Assignment Topics	User style sheets. Formatting elements				
Module 4: <Server Side Programming & Database Access through the Web >	in class	LAMP Technology, PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristic, Primitives, operations and expressions, Control statements, Looping, Arrays, Functions, Form handling, Files. Relational Databases, An introduction to SQL, The MySQL Database system, Database access with PHP and MySQL.		3,5		
	**Assignment Topics	Cookies, Session tracking. Architectures for Database access				
Module 5: <Case studies: Drupal as a Content Management System >	in class	Basics of CMS, Workflow management using CMS, Free and open source content management frameworks in PHP: Drupal. Drupal: Drupal technology Stack in LAMP Platform, Drupal modules: Core, contributed and custom modules, Drupal Theme Configuration, Site Building: Content Type, Entity, Nodes, Views, Blocks, Taxonmoy, User management.		4,5		
	**Assignment Topics	Wordpress, Joomlaand, permission and roles.				

Text Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg, "Internet & World Wide Web How to program", 3rd Edition, Pearson Education, 4 th edition, PHI, 2011.
2. Robert W. Sebesta, "Programming the World Wide Web", 4th Edition, Pearson Education.

Reference Books:

1. Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India.

2. Joyce Farrell, XueBai, Michael Ekedahl, "The Web Warrior Guide to Web Programming", Thomson

USER INTERFACE / USER EXPERIENCE DESIGN (UI/UX DESIGN)

Questions to be set: 05 (All Compulsory)

Course Objectives: To understand the basic process of web designing. To grasp the concept of user experience with respect to the user interface. To understand the trends of UI/UX development.
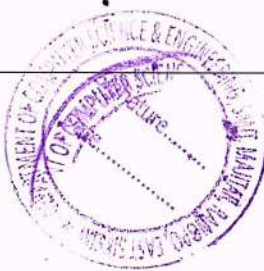
Pre-requisites: Coordinate Geometry, Basic Computing Knowledge

Course Outcomes (CO): On successful completion of this course, students will be able to:
1. Select and utilize design thinking processes and UX/UI tools
2. Differentiate between user interface and user experience design
3. Discover how typography and layout enrich the user experience
4. Distinguish various tools available for user interface design
5. Assess various HCI (human-computer interaction) and the psychology behind user decision-making.

** not more than 20% of total topics to be allotted for assignment

Module	Topics to be covered	Topics	Hrs	CO	PO	PSO
Module 1: <Introduction to UI/UX design history>	In Class	What is UI? What is UX? History of UI and UX Design	7	1,2		
	**Assignment Topics					
Module 2: < UI Design Tools & UX Design>	In Class	Wireframing - Introduction, Designing Process, Picking Tools, Setting a grid and determine a layout box, Typography, Grayscale, Conclusion, UI Design and Prototyping – Introduction, General Prototyping Scheme, Other Tools – Golden Ratio Typography Calculator, Zeplin. Introduction – An overview of UX Design Process and Documentation, How They All Relate, Guiding Principles, Objective Processes In a Subjective Environment.	8	2,4		
	**Assignment Topics					
Module 3: < Defining and Researching a Product before Diving Into Design &>	In Class	Why Product Definition Matters, The Kickoff Meeting, Lean & Business Model Canvas, Concept Maps & Mockups, Defining Your Vision. Why Research Matters, Market Segmentation Report, Survey Results, Heuristic Evaluations, User Research Report, Analytics Reports, Research, Test, Validate.	9	3		
	**Assignment Topics					

Module 4: < Analyzing Users Before Diving Into Design & Product Design Process & Documentation Essentials>	in class	Why Analysis is Important, Personas, User Stories & Job Stories, Defining Your Vision, User Task Matrix, User Content Matrix, Prioritized Requirements Spreadsheet. Iterated Sketching & Wireframing, Detailed Mockups, Prototypes, Design Specifications, Define, Design and Refine.	8	3,4		
	**Assignment Topics					
Module 5: <Product Implementation & lunch Process & Documentation Essentials>	in class	Build It, Eat Your Own Dogfood, Feed Your Dogfood to Others, Use What Works and Scrap the Rest. Create a Product Launch, Plan, Create content to empower customers and sales teams, Pack a punch with your product launch.	8	4,5		
	**Assignment Topics					

Text Books:

1. Dominik Pacholczyk, Web UI Design Best Practices, UXPin
2. Jerry Cao, Chris Bank, The Guide To UX DESIGN PROCESS & DOCUMENTATION ,- UXPin – 2015
3. Frank Chimero, The Shape of Design, First Edition 2012, Licensed under the Creative Commons Attribution Non-Commercial Share-Alike 3.0 Unported License
http://creativecommons.org/licenses/by-nc-sa/3.0/

Reference Books:

1. https://pidoco.com/en/help/ux/user-interface-design
2. https://www.interaction-design.org/literature/topics/ui-design
3. https://ebooks.webflow.com/ebook/the-modern-web-design-process