NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus

For

Computer Science and Engineering (Artificial Intelligence & Machine Learning (AIML)
Second Year

(Effective from the Session: 2021-22)

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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B. TECH (AIML)
Evaluation Scheme
SEMESTER I

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
WEEKS COMPULSORY INDUCTION PROGRAM													
1		Mathematical Foundations – I	3	1	0	30	20	50		100		150	4
2		Engineering Physics	3	1	0	30	20	50		100		150	4
3		Problem Solving using Python	3	0	0	30	20	50		100		150	3
4		Professional Communication	2	0	0	30	20	50		100		150	2
5		Engineering Physics Lab	0	0	2				25		25	50	1
6		Problem Solving using Python Lab	0	0	2				25		25	50	1
7		Professional Communication Lab	0	0	2				25		25	50	1
8		Engineering Graphics & Solid Modelling	0	0	3				25		25	50	1.5
9		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										**800**	**17.5**

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NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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B. TECH (AIML)
Evaluation Scheme
SEMESTER II

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Mathematical Foundations – II	3	1	0	30	20	50		100		150	4
2		Design Thinking- I	3	1	0	30	20	50		100		150	4
3		Basic Electrical and Electronics Engineering	3	1	0	30	20	50		100		150	4
4		Problem Solving using Advanced Python	3	1	0	30	20	50		100		150	4
5		Foreign Language*	2	0	0	30	20	50		50		100	2
6		Basic Electrical and Electronics Engineering Lab	0	0	2				25		25	50	1
7		Problem Solving using Advanced Python Lab	0	0	2				25		25	50	1
8		Digital Manufacturing Practices	0	0	3				25		25	50	1.5
9		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										**850**	**21.5**
Mini Project or Internship (3-4 weeks) shall be conducted during summer break after II semester and will be assessed during III semester													

List of MOOCs (Coursera) Based Mandatory/recommended Courses for first year B. Tech Students

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

1. Python Basics-Odd Semester- 36 hours- 3 Credits
2. Introduction to Artificial Intelligence-Odd Semester- 9 hours- 0.5 Credit
3. Human Centered Design for Inclusive Innovation -14 hours- 1 Credit
4. Python for Data Science, AI & development-Even Semester- 17 hours- 1 Credit

* AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Coursera certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 30 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Coursera registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.
ii. Passed each subject of that degree program in the single attempt without any grace.
iii. Successful completion of MooCs based 20 credits.

Those students who successfully complete all the professional certification courses in the branch will get preference at the time of placement.

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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B. TECH (AIML)
Evaluation Scheme
SEMESTER III

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
WEEKS COMPULSORY INDUCTION PROGRAM													
1		Statistics and Probability	3	1	0	30	20	50		100		150	4
2		Discrete Structures	3	0	0	30	20	50		100		150	3
3		Computer Organization & Architecture	3	0	0	30	20	50		100		150	3
4		Object Oriented Techniques using Java	3	0	0	30	20	50		100		150	3
5		Data Structures	3	1	0	30	20	50		100		150	4
6		Introduction to Artificial Intelligence	3	0	0	30	20	50		100		150	3
7		Object Oriented Techniques using Java Lab	0	0	2				25		25	50	1
8		Data Structures Lab	0	0	2				25		25	50	1
9		Introduction to Artificial Intelligence Lab	0	0	2				25		25	50	1
10		Internship Assessment	0	0	2				50		50	50	1
11		Cyber Security/ Environmental Science	2	0	0								0
12		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										**1100**	**24**

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NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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B. TECH (AIML)
Evaluation Scheme
SEMESTER IV

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Optimization and Numerical Techniques	3	1	0	30	20	50		100		150	4
2		Technical Communication	2	1	0	30	20	50		100		150	3
3		Operating Systems	3	0	0	30	20	50		100		150	3
4		Database Management Systems	3	1	0	30	20	50		100		150	4
5		Machine Learning	3	0	0	30	20	50		100		150	3
6		Theory of Automata and Formal Languages	3	0	0	30	20	50		100		150	3
7		Operating Systems Lab	0	0	2				25		25	50	1
8		Database Management Systems Lab	0	0	2				25		25	50	1
9		Machine Learning Lab	0	0	2				25		25	50	1
10		Mini Project using Open Technology	0	0	2				50			50	1
11		Environmental Science/ Cyber Security	2	0	0								0
12		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										**1100**	**24**

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List of MOOCs (Coursera) Based Mandatory/recommended Courses for Second year B. Tech Students

1. Basic Data Descriptors, Statistical Distributions and Application to Business Decisions-Odd Semester- 21 hours- 1.5 Credits
2. Getting Started with AI using IBM Watson-Odd Semester- 10 hours- 0.5 Credit
3. Machine Learning Foundations: A case study -Even Semester-19 hours- 1.5 Credit
4. Building AI Powered Chatbots Without Programming-Even Semester- 9 hours- 0.5 Credit

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B. TECH. SECOND YEAR (3rd Semester)-Data Science/AI/AI-ML

Course code		L T P	Credit
Course title	STATISTICS AND PROBABILITY	3 1 0	4

Course objective: The objective of this course is to familiarize the engineers with concept of Statistical techniques, probability distribution, hypothesis testing and ANOVA and numerical aptitude. It aims to show case the students with standard concepts and tools from B. Tech to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Pre-requisites: Knowledge of Mathematics I and II of B. Tech or equivalent

Course Contents / Syllabus

UNIT-I	Descriptive measures	8 Hours

Measures of central tendency – mean, median, mode, measures of dispersion – mean deviation, standard deviation, quartile deviation, variance, Moment, Skewness and kurtosis, least squares principles of curve fitting,
Covariance, Correlation and Regression analysis, Correlation coefficient: Karl Pearson coefficient, rank correlation coefficient, uni-variate and multivariate linear regression, application of regression analysis, Logistic Regression, time series analysis- Trend analysis (Least square method).

UNIT-II	Probability and Random variable	8 Hours

Probability Definition, The Law of Addition, Multiplication and Conditional Probability, Bayes' Theorem,
Random variables: discrete and continuous, probability mass function, density function, distribution function, Mathematical expectation, mean, variance. Moment generating function, characteristic function, Two dimensional random variables: probability mass function, density function,

UNIT-III	Probability distribution	8 Hours

Probability Distribution (Continuous and discrete- Normal, Exponential, Binomial, Poisson distribution), Central Limit theorem

UNIT-IV	Test of Hypothesis & Statistical Inference	8 Hours

Sampling and population, uni-variate and bi-variate sampling, re-sampling, errors in sampling, Sampling distributions, Hypothesis testing- p value, z test, t test (For mean), Confidence intervals, F test; Chi-square test, ANOVA: One way ANOVA,
Statistical Inference, Parameter estimation, Least square estimation method, Maximum Likelihood estimation.

UNIT-V	Aptitude-III	8 Hours

Time & Work, Pipe & Cistern, Time, Speed & Distance, Boat & Stream, Sitting Arrangement, Clock & Calendar.

Course outcome: After completion of this course students will be able to:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

CO 1	Understand the concept of moments, skewness, kurtosis, correlation, curve fitting and regression analysis.	K1, K3
CO 2	Understand the concept of Probability and Random variables.	K1, K3
CO 3	Remember the concept of probability to evaluate probability distributions	K3, K4
CO 4	Apply the concept of hypothesis testing and estimation of parameter.	K2
CO 5	Solve the problems of Time & Work, Pipe & Cistern, Time, Speed & Distance, Boat & Stream, Sitting Arrangement, Clock & Calendar.	K3

Text books

(1) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint)

(2) S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002

(3) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books

(1) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

(2) T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi

(3) R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.

(4) J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.

(5) D.N.Elhance,V. Elhance& B.M. Aggarwal: Fundamentals of Statistics; KitabMahal Distributers, New Delhi.

Link:

Unit 1	https://youtu.be/wWenULjri40 https://youtu.be/mL9-WX7wLAo https://youtu.be/nPsfqz9EljY https://youtu.be/nqPS29IvnHk https://youtu.be/aaQXMbpbNKw https://youtu.be/wDXMYRPup0Y https://youtu.be/m9a6rg0tNSM https://youtu.be/Qy1YAKZDA7k https://youtu.be/Qy1YAKZDA7k https://youtu.be/s94k4H6AE54 https://youtu.be/lBB4stn3exM https://youtu.be/0WejW9MiTGg https://youtu.be/QAEZOhE13Wg https://youtu.be/ddYNq1TxtM0 https://youtu.be/YciBHHeswBM https://youtu.be/VCJdg7YBbAQ https://youtu.be/VCJdg7YBbAQ https://youtu.be/yhzJxftDgms
Unit 2	https://youtu.be/bhp4nVkqA9o https://youtu.be/8sJ9dFj_ydg https://youtu.be/u_x8zQvWWLk https://youtu.be/3rYYPWN_QS0 https://youtu.be/HZGCoVF3YvM https://youtu.be/z4e4E9igjIE https://youtu.be/dOr0NKyD31Q

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	https://youtu.be/YXLVjCKVP7U https://youtu.be/l0ecMiNUZu8 https://youtu.be/L0zWnBrjhng https://youtu.be/cbmfYoepHPk https://youtu.be/_DWnI-gk0ys https://youtu.be/d_9KT2abCAY https://youtu.be/sSUCwLvmCLg https://youtu.be/H2Ji-Q4MfqU https://youtu.be/TwN79BuwiMM https://youtu.be/yXsvMlqoiK4
Unit 3	https://youtu.be/gT26Y_VJmOM https://youtu.be/onFv73Btdno https://youtu.be/mYFygtQrDxc https://youtu.be/S8YrED3mf5s https://youtu.be/z5gongqrMv8 https://youtu.be/4vsGyghhxVg https://youtu.be/CW-3qjcw-GA https://youtu.be/RqiqhrZE6Uk
Unit 4	https://youtu.be/L3wQw0wva3g https://youtu.be/n9qpktdFfLU https://youtu.be/_Qlxt0HmuOo https://youtu.be/YSwmpAmLV2s https://youtu.be/KLnGOL_AUgA https://youtu.be/cQp_bJdxjWw https://youtu.be/geB0A7CPGaQ https://youtu.be/zmyh7nCjmsg https://youtu.be/ohquDY3fZqk https://youtu.be/izGZLnB-mEo https://youtu.be/q48uKU_KWas https://youtu.be/lZFmFuZGQTk https://youtu.be/iin6vthyzsQ https://youtu.be/ysjkkBspbYY https://youtu.be/pXjaMY29k1g https://youtu.be/pvvoK4rlzqQ
Unit 5	https://www.youtube.com/playlist?list=PLFqNfk5W2ZuzjUsRqDp1Zj3S8n9yfdmN9 https://youtu.be/x3SEYdBUGaA https://youtu.be/B7sMHZj_p18 https://youtu.be/4HRLswVPOG8 https://youtu.be/aHEWcn_bPYc https://youtu.be/ePQiVq8WtL8

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B. TECH. SECOND YEAR (3rd Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML/IoT

Course code		L T P	Credits
Course title	DISCRETE STRUCTURES	3 0 0	3

Course objective:

The subject enhances one's ability to develop logical thinking and ability to problem solving. The objective of discrete structure is to enables students to formulate problems precisely, solve the problems, apply formal proofs techniques and explain their reasoning clearly.

Pre-requisites:

1. Basic Understanding of mathematics
2. Basic knowledge algebra.
3. Basic knowledge of mathematical notations

Course Contents / Syllabus

Unit 1	Set Theory, Relation, Function	8 Hours

Set Theory: Introduction to Sets and Elements, Types of sets, Venn Diagrams, Set Operations, Multisets, Ordered pairs. Proofs of some general Identities on sets.

Relations: Definition, Operations on relations, Pictorial Representatives of Relations, Properties of relations, Composite Relations, Recursive definition of relation, Order of relations.

Functions: Definition, Classification of functions, Operations on functions, Growth of Functions.

Combinatorics: Introduction, basic counting Techniques, Pigeonhole Principle.

Recurrence Relation & Generating function: Recursive definition of functions, Recursive Algorithms, Method of solving Recurrences.

Proof techniques: Mathematical Induction, Proof by Contradiction, Proof by Cases, Direct Proof.

Unit 2	Algebraic Structures	8 Hours

Algebraic Structures: Definition, Operation, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric Groups, Group Homomorphisms, Rings, Internal Domains, and Fields.

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Unit 3	Lattices and Boolean Algebra	8 Hours

Ordered set, Posets, Hasse Diagram of partially ordered set, Lattices: Introduction, Isomorphic Ordered set, Well ordered set, Properties of Lattices, Bounded and Complemented Lattices, Distributive Lattices.

Boolean Algebra: Introduction, Axioms and Theorems of Boolean Algebra, Algebraic Manipulation of Boolean Expressions, Simplification of Boolean Functions.

Unit 4	Propositional Logic	8 Hours

Propositional Logic: Introduction, Propositions and Compound Statements, Basic Logical Operations, Well-formed formula, Truth Tables, Tautology, Satisfiability, Contradiction, Algebra of Proposition, Theory of Inference.

Predicate Logic: First order predicate, Well-formed formula of Predicate, Quantifiers, Inference Theory of Predicate Logic.

Unit 5	Tree and Graph	8 Hours

Trees: Definition, Binary tree, Complete and Extended Binary Trees, Binary Tree Traversal, Binary Search Tree.

Graphs: Definition and terminology, Representation of Graphs, Various types of Graphs, Connectivity, Isomorphism and Homeomorphism of Graphs, Euler and Hamiltonian Paths, Graph Coloring

Course outcome: After completion of this course students will be able to:

Unit 1	Apply the basic principles of sets, relations & functions and mathematical induction in computer science & engineering related problems.	K3
Unit 2	Understand the algebraic structures and its properties to solve complex problems.	K2
Unit 3	Describe lattices and its types and apply Boolean algebra to simplify digital circuit.	K2, K3
Unit 4	Infer the validity of statements and construct proofs using predicate logic formulas.	K3, K5
Unit 5	Design and use the non-linear data structure like tree and graphs to solve real world problems.	K3, K6

Text books:

1) B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, 5/e, Prentice Hall, Edition 6th, 2018.

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2) Liptschutz, Seymour, “Discrete Mathematics”, McGraw Hill, Edition 3rd, 2017.

3) Trembley, J.P & R. Manohar, “Discrete Mathematical Structure with Application to Computer Science”, McGraw Hill, Edition 1st, 2017.

4) Liu and Mohapatra, “Elements of Discrete Mathematics”, McGraw Hill.

Reference Books:

1) Deo & Narsingh, “Graph Theory With application to Engineering and Computer Science.”, PHI.

2) Krishnamurthy, V., “Combinatorics Theory & Application”, East-West Press Pvt. Ltd., New Delhi.

3) Koshy, Discrete Structures, Elsevier Pub. 2008 Kenneth H. Rosen, Discrete Mathematics and Its Applications, 6/e, Mc Graw-Hill, Edition 7th, 2017.

Links:

Unit 1	https://www.youtube.com/watch?v=hGtOLG3SsjI&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=9 https://www.youtube.com/watch?v=rGcTcGFx9_s&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=10 https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11
Unit 2	https://www.youtube.com/watch?v=M8nh83bFJAA&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=38 https://www.youtube.com/watch?v=CjmWE-f3vEc&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=41
Unit 3	https://www.youtube.com/watch?v=c6ARWh6lVgc&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=24 https://www.youtube.com/watch?v=QKP6sOnu1vg&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=22
Unit 4	https://www.youtube.com/watch?v=hklHg9oMkGA&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=3 https://www.youtube.com/watch?v=ASDaXWCExzo&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=4

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Unit 5	https://www.youtube.com/watch?v=AtDgXyluW-Y&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=12 https://www.youtube.com/watch?v=cwbZUjfz_I0&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf&index=13

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B. TECH. SECOND YEAR (3rd Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML			
Course code		**L T P**	**Credit**
Course title	**COMPUTER ORGANIZATION & ARCHITECTURE**	**3 0 0**	**3**

Course objective:

To understand the types of organizations, structures and functions of computer, design of arithmetic and logic unit and float point arithmetic. To understand the concepts of memory system, communication with I/O devices and interfaces.

Pre-requisites:

- Basic knowledge of computer system.
- Logic gates and their operations.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 Hours**

Computer Organization and Architecture, Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration and it's types. Register, bus and memory transfer. Process or organization, general registers organization, stack organization and addressing modes.

UNIT-II	**ALU Unit**	**8 Hours**

Arithmetic and logic unit: Lookahead carries adders. Multiplication: Signed operand multiplication, Booth's algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.

UNIT-III	**Control Unit**	**8 Hours**

Control Unit: Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc.), micro-operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Complex Instruction Set Computer, Pipelining. Hardwire and microprogrammed control, Concept of horizontal and vertical microprogramming, Flynn's classification.

UNIT-IV	**Memory Unit**	**8 Hours**

Memory: Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation, Memory Latency, Memory Bandwidth, Memory Seek Time.

UNIT-V	**Input/Output**	**8 Hours**

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access. ,I/O channels and processors. Serial Communication: Synchronous & asynchronous communication.

Course outcome: After completion of this course students will be able to:

CO 1	Understand the basic structure and operation of a digital computer system.	K1, K2
CO 2	Analyze the design of arithmetic & logic unit and understand the fixed point and floating-point arithmetic operations.	K1, K4
CO 3	Implement control unit techniques and the concept of Pipelining	K3
CO 4	Understand the hierarchical memory system, cache memories and virtual memory.	K2
CO 5	Understand different ways of communicating with I/O devices and standard I/O interfaces.	K2

Text books:

1) M. Mano, "Computer System Architecture", 3rd Edition, Pearson Publication, 2007.
2) John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, Third Edition, 1998.
3) William Stallings, Computer Organization and Architecture-Designing for Performance, Pearson Education, Seventhedition,2006.

Reference Books:

1) Carl Hamacher, Zvonko Vranesic, Safwat Zaky Computer Organization, McGraw-Hill, Fifth Edition, Reprint2012
2) Ray A K, Bhurchandi K M, "Advanced Microprocessors and Peripherals", TM.

Links:

Unit 1	https://www.youtube.com/watch?v=L9X7XXfHYdU&list=PLxCzCOWd7aiHMonh3G6QNKq53C6oNXGrX
Unit 2	https://www.youtube.com/watch?v=WLgXUPOjKEc
Unit 3	https://www.youtube.com/watch?v=BPhWlFIU1rc
Unit 4	https://www.youtube.com/watch?v=6R7JDkpG1Wk&list=PLrjkTql3jnm8HbdMwBYIMAd3UdstWChFH
Unit 5	https://www.youtube.com/watch?v=nxryfWg5Hm4

B. TECH. SECOND YEAR (3rd Semester)- CSE/IT/M.Tech. Integrated/ Data Science/AI/AI-ML/IoT

4th Semester -CS

Course code		L T P	Credit
Course title	OBJECT ORIENTED TECHNIQUES USING JAVA	3 0 0	3

Course objective:

The objective of this course is to understand the object-oriented methodology and its techniques to design and develop conceptual models and demonstrate the standard concepts of object-oriented techniques modularity, I/O. and other standard language constructs. The basic objective of this course is to understand the fundamental concepts of object-oriented programming in Java language and also implement the Multithreading concepts, GUI based application and collection framework.

Pre-requisites:

- Student must know at least the basics of how to use a computer, and should be able to start a command line shell.
- Knowledge of basic programming concepts, as covered in 'Programming Basic" course is necessary.

Course Contents / Syllabus

UNIT-I	Introduction	8 Hours

Object Oriented Programming: Introduction and Features: Abstraction, Encapsulation, Polymorphism, and Inheritance.

Modeling Concepts: Introduction, Class Diagram and Object Diagram.

Control Statements: Decision Making, Looping and Branching, Argument Passing Mechanism: Command Line Argument.

UNIT-II	Basics of Java Programming	8 Hours

Class and Object: Object Reference, Constructor, Abstract Class, Interface and its uses, Defining Methods, Use of "this" and "super" keyword, Garbage Collection and finalize () Method.

Inheritance: Introduction and Types of Inheritance in Java, Constructors in Inheritance.

Polymorphism: Introduction and Types, Overloading and Overriding.

Lambda expression: Introduction and Working with Lambda Variables.

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

Arrays: Introduction and its Types.

UNIT-III	Packages, Exception Handling and String Handling	8 Hours

Packages: Introduction and Types, Access Protection in Packages, Import and Execution of Packages.

Exception Handling, Assertions and Localizations: Introduction and Types, Exceptions vs. Errors, Handling of Exception. Finally, Throws and Throw keyword, Multiple Catch Block, Nested Try and Finally Block, Tokenizer. Assertions and Localizations Concepts and its working.

String Handling: Introduction and Types, Operations, Immutable String, Method of String class, String Buffer and String Builder class.

UNIT-IV	Concurrency in Java and I/O Stream	8 Hours

Threads: Introduction and Types, Creating Threads, Thread Life-Cycle, Thread Priorities, Daemon Thread, Runnable Class, Synchronizing Threads.

I/O Stream: Introduction and Types, Common I/O Stream Operations, Interaction with I/O Streams Classes.

Annotations: Introduction, Custom Annotations and Applying Annotations.

UNIT-V	GUI Programming, Generics and Collections	8 Hours

GUI Programming: Introduction and Types, Swing, AWT, Components and Containers, Layout Managers and User-Defined Layout and Event Handling.

Generics and Collections: Introduction, Using Method References, Using Wrapper Class, Using Lists, Sets, Maps and Queues, Working with Generics.

Course outcome: After completion of this course students will be able to:

CO1	Identify the concepts of object-oriented programming and relationships among them needed in modeling.	K2
CO2	Demonstrate the Java programs using OOP principles and also implement the concepts of lambda expressions.	K3
CO3	Implement packages with different protection level resolving namespace collision and evaluate the error handling concepts for uninterrupted execution of Java program.	K3, K5

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CO4	Implement Concurrency control, I/O Streams and Annotations concepts by using Java program.	K3
CO5	Design and develop the GUI based application, Generics and Collections in Java programming language to solve the real-world problem.	K6

Text books:

1) Herbert Schildt," Java - The Complete Reference", McGraw Hill Education 12th edition
2) Herbert Schildt," Java: A Beginner's Guide", McGraw-Hill Education 2nd edition
3) James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI 2nd Edition

Reference Books:

1) Cay S. Horstmann, "Core Java Volume I – Fundamentals", Prentice Hall
2) Joshua Bloch," Effective Java", Addison Wesley
3) E Balagurusamy, "Programming with Java A Primer", TMH, 4th edition.

Link:

Unit 1	https://www.youtube.com/watch?v=r59xYe3Vyks&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al
Unit 2	https://www.youtube.com/watch?v=ZHLdVRXIuC8&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al&index=18
Unit 3	https://www.youtube.com/watch?v=hBh_CC5y8-s
Unit 4	https://www.youtube.com/watch?v=qQVqfvs3p48
Unit 5	https://www.youtube.com/watch?v=2qWPpgALJyw

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B. TECH. SECOND YEAR (3rd Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML

Course code		L T P	Credits
Course title	DATA STRUCTURES	3 1 0	4

Course objective:

Learn the basic concepts of algorithm analysis, along with implementation of linear and non-linear data structures, hashing and file structures.

Pre-requisites: Basics of C/Python programming, Identifiers, Constants, Operators, Conditional statements, Switch-case statements, Iterative statements, Functions, Structures.

Course Contents / Syllabus

UNIT-I	Introduction to data structure, Arrays, Searching, Sorting and Hashing	8 Hours

Data types: Primitive and non-primitive, Types of Data Structures- Linear & Non-Linear Data Structures. Time and Space Complexity of an algorithm, Asymptotic notations (Big Oh, Big Theta and Big Omega), Abstract Data Types (ADT).

Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of Arrays, Sparse Matrices and their Representations.

Searching: Linear search, Binary search. Sorting: Bubble sort, Insertion sort, Selection sort, Radix Sort, Merge sort, Quick sort.

Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques.

UNIT-II	Stacks and Queues	8 hours

Stacks: Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack, Application of stack: Infix, Prefix, Postfix Expressions and their mutual conversion, Evaluation of postfix expression.

Recursion: Principles of recursion, Tail recursion, Removal of recursion, Problem solving using iteration and recursion with examples such as binary search, Fibonacci series, and Tower of Hanoi, Trade-offs between iteration and recursion.

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

Queues: Array and linked implementation of queues, Operations on Queue: Create, Insert, Delete, Full and Empty, Circular queues, Dequeue and Priority Queue.		
UNIT-III	**Linked lists**	**8 hours**
Advantages of linked list over array, Self-referential structure, Singly Linked List, Doubly Linked List, Circular Linked List. Operations on a Linked List: Insertion, Deletion, Traversal, Reversal, Searching, Polynomial Representation and Addition of Polynomials. Implementation of Stack and Queue using Linked lists.		
UNIT-IV	**Trees**	**8 hours**
Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, An Extended Binary Trees. Tree Traversal algorithms: In-order, Pre-order and Post-order. Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search tree, Binary Heaps, Heap sort, Threaded Binary trees, Traversing Threaded Binary trees, AVL Tree, B-Tree & Binary Heaps, Heap sort.		
UNIT-V	**Graphs and File Structure**	**8 hours**
Graphs: Terminology used with Graph, Data Structure for Graph Representations: Adjacency matrices, Adjacency List. **Graph Traversal**: Depth First Search and Breadth First Search. Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prim' s and Kruskal's algorithm. Transitive Closure and Shortest Path algorithms: Dijkstra Algorithm. **File Structure**: Concepts of files, records and files, Sequential, Indexed and Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and Access Methods.		
Course outcome: After completion of this course students will be able to:		
CO 1	Describe the need of data structure and algorithms in problem solving and analyze Time space trade-off.	K2, K4

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CO 2	Describe how arrays are represented in memory and how to use them for implementation of matrix operations, searching and sorting along with their computational efficiency.	K2, K6
CO 3	Compare and contrast the advantages and disadvantages of linked lists over arrays and implement operations on different types of linked list.	K4, K6
CO 4	Design, implement and evaluate the real-world applications using stacks, queues and non-linear data structures.	K5, K6
CO 5	Identify and develop the alternative implementations of data structures with respect to its performance to solve a real-world problem.	K1, K3, K5, K6

Text books:

1) Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India
2) Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
3) Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.

Reference Books:

1) Thareja, "Data Structure Using C" Oxford Higher Education.
2) AK Sharma, "Data Structure Using C", Pearson Education India.
3) P. S. Deshpandey, "C and Data structure", Wiley Dreamtech Publication.
4) R. Kruse etal, "Data Structures and Program Design in C", Pearson Education.
5) Berztiss, AT: Data structures, Theory and Practice, Academic Press.
6) Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.

Link:

Unit 1	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F https://www.youtube.com/watch?v=4OxBvBXon5w&list=PLBF3763AF2E1C572F&index=22 https://www.youtube.com/watch?v=cR4rxllyiCs&list=PLBF3763AF2E1C572F&index=23
Unit 2	https://nptel.ac.in/courses/106/106/106106127/
Unit 3	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=g1USSZVWDsY&list=PLBF3763AF2E1C572F&index=2
Unit 4	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=tORLeHHtazM&list=PLBF3763AF2E1C572F&index=6 https://www.youtube.com/watch?v=eWeqqVpgNPg&list=PLBF3763AF2E1C572F&index=7

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Unit 5	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24 https://www.youtube.com/watch?v=hk5rQs7TQ7E&list=PLBF3763AF2E1C572F&index=25 https://www.youtube.com/watch?v=KW0UvOW0XIo&list=PLBF3763AF2E1C572F&index=5

B. TECH. SECOND YEAR (3rd Semester) -AI/AI-ML
4th Semester-Data Science

Course code		L T P	Credits
Course title	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**	**3 0 0**	**3**

Course objective:
Introductory knowledge of historical perspective of AI and its foundations and familiarity with principles of AI toward problem solving, inference, perception, knowledge representation, and learning. Acquiring the knowledge various forms of learning and computation statistics.

Pre-requisites: Basic knowledge of AI and Machine Learning Concepts.

Course Contents / Syllabus

UNIT-1	**Introduction**	**8 Hours**

Introduction to Artificial Intelligence, Historical developments of Artificial Intelligence, well defined learning problems, Designing a Learning System, Basics of problem-solving: problem representation paradigms, state space, satisfiability vs optimality, pattern classification problems, example domains.

UNIT-2	**Search Techniques**	**8 Hours**

Searching for solutions, Uninformed Search Strategies: DFS, BFS, Informed Search Strategies: Local search algorithms and optimistic problems, adversarial Search, Search for games, minimax, Alpha - Beta pruning, Heuristic Search techniques, Hill Climbing, Best-first search, Problem reduction, Constraint satisfaction, Means Ends Analysis, Iterative deepening Heuristic Search and A*.

UNIT-3	**Logic and Knowledge Representation**	**8 Hours**

Introduction of Logic, Propositional Logic Concepts, Semantic Tableaux and Resolution in Propositional logic, FOPL, Semantic Tableaux and Resolution in FOPL, Logic Programming in Prolog. Production systems and rules for some AI problems: Water Jug Problem, Missionaries-Cannibals Problem, n-Queen problem, monkey banana problem, Travelling Salesman Problem. Knowledge representation, semantic nets, partitioned nets, parallel implementation of semantic nets. Frames, Common Sense reasoning and thematic role frames.

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UNIT-4	Expert System	8 Hours
Architecture of knowledge-Based System, Rule-based systems, Forward and Backward Chaining, Frame Based systems. Architecture of Expert System, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.		
UNIT-5	**Planning and Uncertainty**	**8 Hours**
Planning with state Space Search, Conditional Planning, Continuous planning, Multi-Agent Planning, Forms of learning, inductive learning, Reinforcement Learning, learning decision trees, Neural Net learning and Genetic learning. Probabilistic Methods, Bayesian Theory, Dempster Shafer Theory, Bayes Network. Evolutionary computation: Swarm Intelligence, ant colony optimization Agents, Intelligent Agents, Structure of Intelligent Agents, Virtual Agents, Multi-agent systems. **Case Study:** Health Care, E Commerce, Smart Cities.		

Course outcome: After completion of this course students will be able to

CO 1	Understand fundamental understanding of the history of artificial intelligence (AI) and its foundations	K2
CO 2	Apply principles of AI in solutions that require problem solving, inference and perception	K3
CO 3	Explain strong familiarity with a number of important AI techniques, including in particular intelligent search methods and solutions	K3
CO 4	Apply the concepts of knowledge & reasoning of predicate logic and representing knowledge using rules, Probabilistic reasoning.	K3
CO 5	Assess/ Evaluate critically the techniques presented and apply them to real world problems	K5

Text books:

1) Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education. Fourth Edition 2021
2) Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill 3rdEdition 2010

Reference Books:

1) Patrick Henry Winston, "Artificial Intelligence", Pearson Education Inc., Third edition.
2) Python Machine Learning: Learn Python in a Week and Master It. An Hands-On Introduction to Artificial Intelligence Coding, a Project-Based Guide with Practical Exercises (7 Days Crash Course, Book 2) 2020.
3) Nils J.Nilsson, "Artificial Intelligence - A New Synthesis", Harcourt Asia Pvt. Ltd.
4) AI in the Wild: Sustainability in the Age of Artificial Intelligence 2020.
5) Knowledge-Based Systems Techniques and Applications (4-Volume Set).

Links:

Unit 1	https://nptel.ac.in/courses/106/106/106106198/

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Unit 2	https://nptel.ac.in/courses/111/107/111107137/
Unit 3	https://nptel.ac.in/courses/106/106/106106202/
Unit 4	https://nptel.ac.in/courses/106/106/106106213/
Unit 5	https://nptel.ac.in/courses/106/105/106105152/

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B. TECH. SECOND YEAR (3rd Semester)- CSE/IT/M.Tech. Integrated/ Data Science/AI/AI-ML/IoT

4th Semester -CS

Course Code		L T P	Credit
Course title	OBJECT ORIENTED TECHNIQUES USING JAVA LAB	0 0 2	1

List of Experiments:

Sr. No.	Name of Experiments	Q.NO. (Codetantra)	CO
1.	Write a simple program in Java.	1	CO1
2.	Write a Java program to display default values of all primitive data types	2	CO1
3.	Write a Java program to understand Command line arguments.	3	CO1
4.	Write a Java program to understand if-then-else statement	5	CO1
5.	Write a Java Program to find the Factorial of a given number	6	CO1
6.	Write a Java Program to check whether the given number is Palindrome or not	7	CO1
7.	Write a JAVA program to display Fibonacci series.	8	CO1
8.	Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.	-	CO2
9.	Write a Java program to illustrate the abstract class concept	24	CO2
10.	Write a Java program to Access the instance variables by using this keyword	27	CO2
11.	Write a Java class to show the concept of static class	26	CO2
12.	Write a Java program to Access the Class members using super Keyword	20	CO2

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13.	Write a JAVA program to implement Single Inheritance.	-	CO2
14.	Write a JAVA program to implement multi-level inheritance.	19	CO2
15.	Write a Java program to implement Interface	22	CO2
16.	Write a JAVA program to implement constructor and constructor overloading.	18	CO2
17.	Write a JAVA program implement method overloading and method overriding.	-	CO2
18.	Write a JAVA program to implement a user defined functional interface using lambda expressions.	-	CO2
19.	Write a program prints a multidimensional array of integers.	9	CO2
20.	Write a JAVA program to show the multiplication of two matrices using arrays.	11	CO2
21.	Write a Java program to Search an element using Linear Search	13	CO2
22.	Write a Java program to Search an element using Binary Search	14	CO2
23.	Write a Java Program to Sort elements using Insertion Sort	15	CO2
24.	Write a Java Program to Sort elements using Selection Sort - Largest element method	16	CO2
25.	Write a Java program to Sort elements using Bubble Sort	17	CO2
26.	Write a Java program to handle an Arithmetic Exception - divided by zero	33	CO3
27.	Write a program to implement user defined exception in java.	-	CO3
28.	Write a Java program to illustrate Finally block	34	CO3
29.	Write a Java program to illustrate Multiple catch blocks	35	CO3
30.	Write a Java program for creation of illustrating throw	36	CO3
31.	To implement the concept of assertions in JAVA programming language.	-	CO3
32.	To implement the concept of localization in JAVA programming language.	-	CO3

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33.	Write a Java program to print the output by appending all the capital letters in the input in a string.	30	CO3
34.	Write a JAVA program to show the usage of string builder.	31	CO3
35.	Write a JAVA program to show the usage of string buffer.	32	CO3
36.	Write a JAVA program to implement even and odd thread by using Thread class and Runnable interface.	-	CO4
37.	Write a JAVA program to synchronize the threads by using Synchronize statements and Synchronize block	-	CO4
38.	To demonstrate the concept of type annotations in JAVA programming language.	-	CO4
39.	To demonstrate the concept of user defined annotations in JAVA programming language.	-	CO5
40.	Write a JAVA program to implement the concept of Generic and Collection classes.	-	CO5

Lab Course Outcome: After completion of this course students will be able to

CO1	To understand how to design and implement basic data types, command line arguments and control statements	K2
CO2	To demonstrate the Java programs using OOP principles and also implement the concepts of lambda expressions and arrays.	K3
CO3	To demonstrate, understand and use of different exceptional handling mechanisms, assertions, localizations and string handling.	K3
CO4	To solve the real time problems using multithreading and annotations concept.	K3
CO5	To design and develop collections and generic classes in JAVA programming language	K6

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B. TECH. SECOND YEAR (3rd Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML			
Course Code		**L T P**	**Credit**
Course title	**DATA STRUCTURES LAB**	**0 0 2**	**1**

List of Experiments:

Sr. No.	Name of Experiment	CO
1	Program to create and display Linear Array	CO1
2	Program to insert a data item at any location in a linear Array	CO1
3	Program to delete a data item from a Linear Array	CO1
4	Program to implement multiplication of two matrices.	CO1
5	Program to create sparse matrix.	CO1
6	Program to implement linear search in an Array.	CO4
7	Program to implement binary search in an Array.	CO4
8	Program to implement bubble sort in a non-recursive way.	CO4
9	Program to implement selection sort in a non-recursive way.	CO4
10	Program to implement insertion sort in a non-recursive way.	CO4
11	Program to implement Merge sort in a non-recursive way.	CO4
12	Program to implement Merge sort in a recursive way.	CO4
13	Program to implement Quick sort in a recursive way.	CO4
14	Program to implement Queue Using array.	CO3
15	Program to implement Circular Queue Using array.	CO3
16	Program to implement Stack Operation using array.	CO3
17	Program to implement the Single Linked List a. Insertion b. Deletion c. Traversal d. Reversal e. Searching f. Updation g. Sorting h. Merging	CO2
18	Program to implement the doubly Linked List a. Insertion b. Deletion c. Traversal d. Reversal e. Searching f. Updation g. Merging	CO2

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19	Program to implement the circularly Single Linked List a. Insertion b. Deletion c. Traversal d. Reversal e. Searching f. Updation	CO2
20	Program to implement Queue Using linked list.	CO3
21	Program to implement Circular Queue Using linked list.	CO3
22	Program to implement Priority Queue Using linked list.	CO3
23	Program to implement Stack Operation using Linked list.	CO3
24	Program to convert infix to postfix expression.	CO3
25	Program to evaluate postfix expression.	CO3
26	Program to compute factorial using tail recursion	CO3
27	Program to implement Tower of Hanoi.	CO3
28	Program implementing Addition of two polynomials via Linked Lists.	CO2
29	Program to implement binary tree using linked list a. Insertion b. Deletion c. Traversal d. Searching	CO5
30	Program to implement binary search tree using linked list a. Insertion b. Deletion c. Traversal d. Searching	CO5
31	Program to implement Heap sort in a non-recursive way	CO5
32	Program to implement Radix sort.	CO4
33	Program to implement BFS algorithm.	CO5
34	Program to implement DFS algorithm.	CO5
35	Program to implement the minimum cost spanning tree.	CO5
36	Program to implement the shortest path algorithm.	CO5
Lab Course Outcome: After completion of this course students will be able to		
CO 1	Implement operations on single and multi-dimensional array.	K3
CO 2	Implement various linear data structures like single Linked-list, doubly Linked-list, Circular linked-list.	K3, K6
CO 3	Implement Stack and Queue using array and linked list.	K3
CO 4	Analyze and Implement sorting and searching algorithms.	K4, K6
CO5	Solve complex problems using non-linear data structures like tree and graph.	K6

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B. TECH. SECOND YEAR (3rd Semester) -AI/AI-ML
4th Semester-Data Science

Course Code		L T P	Credit
Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB	0 0 2	1

List of Experiments:

Sr. No.	Name of Experiment	CO
1	Write a python program to implement simple Chat-bot.	CO1
2	Implement Tic-Tac-Toe using A* algorithm.	CO1
3	Implement alpha-beta pruning graphically with proper example and justify the pruning.	CO2
4	Write a python program to implement Water Jug Problem.	CO2
5	Use Heuristic Search Techniques to Implement Best first search (Best-Solution but not always optimal) and A* algorithm (Always gives optimal solution).	CO3
6	Use Heuristic Search Techniques to Implement Hill-Climbing Algorithm.	CO5
7	Write a program to implement Hangman game using python.	CO5
8	Write a program to solve the Monkey Banana problem	CO4
9	Write a python program to implement Simple Calculator program.	CO4
10	Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK	CO5
11	Solve 8-puzzle problem using best first search	CO5
12	Solve Robot (traversal) problem using means End Analysis.	CO5
13	Implementation of Image features Processing using OPENCV AND OPEN VINO	CO4
14	Write a program to implement Naïve Bayes Algorithm	CO5
15	Write a Program to implement alpha-beta Pruning.	CO2

Lab Course Outcome: After completion of this course students will be able to

CO 1	Apply searching problems using various algorithms. Explain functionality of Chat-bot.	K3

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CO 2	Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.	K1
CO 3	Implement the program to POS (Parts of Speech) tagging for the give sentence using NLTK.	K3
CO 4	Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.	K3
CO5	Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).	K3

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B. TECH. SECOND YEAR (3rd Semester/4th Semester)- Data Science/AI/AI-ML/IoT/CSE/IT/CS/M.Tech. Integrated

Course code		L T P	Credits
Course title	ENVIRONMENTAL SCIENCE	2 0 0	0

Course objective:

1	To help the students in realizing the inter-relationship between man and environment. and help the students in acquiring basic knowledge about environment.
2	To develop the sense of awareness among the students about environment and its various problems.
3	To create positive attitude about environment among the student.
4	To develop proper skill required for the fulfilment of the aims of environmental education and educational evaluations
5	To develop the capability of using skills to fulfil the required aims, to realise and solve environmental problems through social, political, cultural and educational processes

Pre-requisites: Basic knowledge of nature.

Course Contents / Syllabus

UNIT-I	Definition, Scope and basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem. Food chains and food webs. Ecological pyramids, Energy flow in ecological systems, Characteristics of different ecosystems. Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles. Basic concepts of sustainable development, SDGs, Ecosystem services, UN Decade for Ecorestoration.	**8 Hours**
UNIT-II	Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Land resources: Land as a resource, land degradation, man induced landslides. Equitable use of resources for sustainable lifestyles.	**8 Hours**

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

	Non-Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects, Renewable Energy Resources: hydropower, Solar energy, geothermal, tidal and wind energy, Biomass energy, biogas and its advantages.	
UNIT-III	Biodiversity and their importance, Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, IUCN threat categories, Red data book. Strategies for biodiversity conservation, principles of biodiversity conservation in-situ and ex-situ conservation strategies Mega diversity zones and Hot spots, concepts, distribution and importance. Succession: Concepts of succession, Types of Succession. Trends in succession. Climax and stability.	**8 Hours**
UNIT-IV	Air pollution: sources of air pollution, Primary and secondary air pollutants. Origin and effects of SOX, NOX, Cox, CFC, Hydrocarbon, control of air pollution. Water pollution: sources and types of water pollution, Effects of water pollution, Eutrophication, Soil pollution: Causes of soil pollution, Effects of soil pollution, Major sources of and effects of noise pollution on health, Radioactive and thermal pollution sources and their effects on surrounding environment. Solid waste disposal and its effects on surrounding environment, Climate change, global warming, acid rain, ozone layer depletion.	**8 Hours**
UNIT-V	Role of community, women and NGOs in environmental protection, Bioindicators and their role, Natural hazards, Chemical accidents and disasters risk management, Environmental Impact Assessment (EIA), Salient features of following Acts: a. Environmental Protection Act, 1986, Wildlife (Protection) Act, 1972.b. Water (Prevention and control of pollution) Act, 1974.c. Air (Prevention and control of pollution) Act, 1981. Forest (Conservation) Act, 1980.d. Wetlands (Conservation and Management) Rules, 2017; e. Chemical safety and Disaster Management law. F. District Environmental Action Plan. Climate action plans.	**8 Hours**
Course outcome: After completion of this course students will be able to		
CO 1	Understand the basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem., food chains and food webs. Ecological pyramids	K2
CO 2	Understand the different types of natural recourses like food, forest, minerals and energy and their conservation	K2

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CO 3	Understand the importance of biodiversity, Threats of biodiversity and different methods of biodiversity conservation.	K2
CO 4	Understand the different types of pollution, pollutants, their sources, effects and their control methods	K3
CO 5	Understand the basic concepts of sustainable development, Environmental Impact Assessment (EIA) and different acts related to environment	K3

Text books:

1. Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.

2. Botkin, D.B and Kodler E.A., 2000, Environmental Studies : The earth as a living planet. John Wiley and Sons Inc.

3. Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi

4. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

5.Environmental Studies -Benny Joseph-Tata McgrawHill-2005

6. Environmental Studies- Dr. D.L. Manjunath, Pearson Education-2006.

7. Environmental studies- R, Rajagopalan -Oxford Pubtiotion2005.

Reference Books:

1.Sodhi G.S. 2005, Fundamentals of Environmental Chemistry: Narosa Publishing House, New Delhi.

2.Dash, M.C. (1994), Fundamentals of Ecology, Tata Mc Graw Hill, New Delhi.

3. Sharma P. D. (1996). Environmental Biology, Rastogi Publications, Meerut.

4. Verma P.S. and V.K. Agarwal. (1985). Principles of Ecology. S. Chand and Company (Pub.), New Delhi.

5.Principles of Environmental Sciences and Engineering -P. Venugoplan Rao, Prenitice Hall of India.
6. Environmental Science and Engineering Meenakshi, Prentice Hall India.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=T21OO0sBBfc, https://www.youtube.com/watch?v=qt8AMjKKPDohttps://www.youtube.com/watch?v=yAK-m91Nxrshttps://www.youtube.com/watch?v=ha_O-1uOWkk, https://www.youtube.com/watch?v=brF0RWJyx9w
Unit 2	https://www.youtube.com/watch?v=mOwyPENHhbc, https://www.youtube.com/watch?v=yqev1G2iy20, https://www.youtube.com/watch?v=_74S3z3IO_I, https://www.youtube.com/watch?v=jXVw6M6m2g0

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Unit 3	https://www.youtube.com/watch?v=GK_vRtHJZu4, https://www.youtube.com/watch?v=b6Ua_zWDH6U, https://www.youtube.com/watch?v=7tgNamjTRkk, https://www.youtube.com/watch?v=ErATB1aMiSU, https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-human-impact-on-ecosystems/v/conservation-and-the-race-to-save-biodiversity
Unit 4	https://www.youtube.com/watch?v=7qkaz8ChelI, https://www.youtube.com/watch?v=NuQE5fKmfME, https://www.youtube.com/watch?v=9CpAjOVLHII, https://www.youtube.com/watch?v=yEci6iDkXYw, https://www.youtube.com/watch?v=yEci6iDkXYw
Unit 5	https://www.youtube.com/watch?v=ad9KhgGw5iA, https://www.youtube.com/watch?v=nW5g83NSH9M, https://www.youtube.com/watch?v=xqSZL4Ka8xo, https://www.youtube.com/watch?v=WAI-hPRoBqs, https://www.youtube.com/watch?v=o-WpeyGlV9Y, https://www.youtube.com/watch?v=EDmtawhADnY

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B. TECH. SECOND YEAR (4th Semester)- Data Science/AI/AIML

Course code		L T P	Credit
Course title	**OPTIMIZATION AND NUMERICAL TECHNIQUES**	**3 1 0**	**4**

Course objective: The objective of this course is to familiarize the engineers with concept of Linear Programming Problem (LPP), Integer Programming Problems, Constraint programming, various numerical techniques for mathematical task such as roots, integration, differential equations and numerical aptitude. It aims to show case the students with standard concepts and tools from B. Tech to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Pre-requisites: Knowledge of Mathematics I and II of B. Tech or equivalent.

Course Contents / Syllabus

UNIT-I	**Linear Programming**	**8 Hours**

Introduction, Mathematical formulation of LP Models, Graphical Method, Description of simplex method, Big-M method, Two phase method, Alternative optimum solutions, unbounded solutions, Degeneracy, Duality in LPP.

UNIT-II	**Integer Programming**	**8 Hours**

Introduction, Importance of Integer Programming Problems, Gomory's Cutting Plane method, Branch-and-Bound Method, Cargo Loading for Knapsack problem, Applications of Integer Programming.

UNIT-III	**Non-linear programming**	**8 Hours**

Basic facts of maxima, minima & convex optimization, Convex sets and convex functions, Continuity and differentiable properties of convex functions, Constrained Optimization- Local and Global Solution Introduction, Elements of Constraint Programming, Lagrange multiplier method, Kuhn Tucker Condition.

UNIT-IV	**Numerical Techniques**	**8 Hours**

Errors analysis, Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals.

Solution of system of linear equations, Crout's method, Gauss- Seidel method. Numerical integration, Trapezoidal rule, Simpson's one third and three-eight rules, Solution of first order ordinary differential equations by fourth-order Runge- Kutta methods.

UNIT-V	**Aptitude-IV**	**8 Hours**

Number System, Permutation & Combination, Probability, Function, Data Interpretation, Syllogism.

Course outcome: After completion of this course students will be able to

CO 1	Understand the concepts to formulate and to solve a Linear Programming Problem.	K1, K3
CO 2	Understand the concepts of Integer Programming Problem.	K1, K3

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CO 4	Apply the concept of numerical techniques to evaluate the zeroes of the Equation, concept of interpolation and numerical methods for various mathematical operations and tasks, such as integration, the solution of linear system of equations and the solution of differential equation.	K3
CO 5	Solve the problems of Number System, Permutation & Combination, Probability, Function, Data Interpretation, Syllogism.	K3

Text books:

(1) Sharma J K - Operations Research (Pearson, 3rd Edition.

(2) Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979.

(3) Introduction to Linear Optimization by Dimitris Bertsimas & John N. Tsitsiklis, Athena Scientific 1997.

(4) TahaHamdy - Operations Research - An Introduction (Prentice-Hall, 9th edition).

(5) B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.

Reference Books:

(1) An introduction to Optimization by Edwin P K Chong, Stainslaw Zak.

(2) Hillier F S and Lieberman G J, Operations Research, Holden Day Inc., San Francisco.

(3) David G.Luerbeggan, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.

(4)Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970.

Link:

Unit 1	https://youtu.be/a2QgdDk4Xjw https://youtu.be/XEA1pOtyrfo https://youtu.be/qxls3cYg8to https://youtu.be/DUFcNysR-w8 https://youtu.be/OUduOnhO94k https://youtu.be/_uRKG9tkrew https://youtu.be/7w30ueP5ayI https://youtu.be/gmDwUCvOJQ8
Unit 2	https://youtu.be/gxLQ7Q26SkE https://youtu.be/PkFKuoJQrN4 https://youtu.be/-cBkrzNdQn4 https://youtu.be/-Cg-aL1D8CM https://youtu.be/-cLsEHP0qt0
Unit 3	https://youtu.be/jGwA4hknYp4 https://youtu.be/ejol5TMpYJc https://youtu.be/tJfizPGPo34 https://youtu.be/nZ40jnChzbs https://youtu.be/nZ40jnChzbs https://youtu.be/PlpJShHvNfQ
Unit 4	https://youtu.be/QH2WL92bzLs https://youtu.be/DGmNbs5Cywo https://youtu.be/FliKUWUVrEI https://youtu.be/7eHuQXMCOvA https://youtu.be/ZkvQR3ajm3k

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	https://youtu.be/zdyUwzOm1zw https://youtu.be/BBuV14-isyU https://youtu.be/xPr7YFSnmiQ https://youtu.be/ajJD0Df5CsY https://youtu.be/iviiGB5vxLA https://youtu.be/Ym1EUjTWMnE
Unit 5	https://youtu.be/Dsi7x-A89Mw https://youtu.be/mrCrjeqJv6U https://youtu.be/jZXHzpq-vmM https://youtu.be/KSFnfUYcxoI https://youtu.be/i72ptXTEmkk

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B. TECH. SECOND YEAR (4th Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML/IoT			
Course code		**L T P**	**Credit**
Course title	**TECHNICAL COMMUNICATION**	**2 1 0**	**3**
Course objective:			
1	To help the students develop communication and critical thinking skills necessary for securing a job, and succeeding in the diverse and ever-changing workplace of the twenty first century		
2	To enable students to communicate effectively in English at the workplace.		

Pre-requisites:

- The student must have a good degree of control over simple grammatical forms and some complex grammatical forms of English language.
- The student should be able to speak English intelligibly.

Course Content / Syllabus

UNIT-I	**Introduction to Technical Communication and Reading**	**4 Hours**

- Fundamentals of technical communication
- Role of technical communication
- Reading Comprehension - central idea, tone, and intention
- Critical reading strategies

UNIT-II	**Technical Writing 1**	**5 Hours**

- Characteristics of technical writing; technical vocabulary, etymology
- Business letters /emails – types, format, style and language
- Notices, agenda and minutes
- Job application, CV and resume

UNIT-III	**Technical Writing 2**	**5 Hours**

- Technical reports – types & formats
- Structure of a report
- Technical Proposal - structure and types
- Technical/ Scientific paper writing

UNIT-IV	**Public Speaking**	**5 Hours**

- Components of effective speaking (emphasis on voice dynamics)
- Seminar and conference presentation
- Conducting/ participating in meetings
- Appearing for a job interview

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- Mobile etiquettes

UNIT-V	Manuscript Preparation	5 Hours

- Short report writing
- Copy editing and referencing
- Developing writing style – Jargons, Abbreviations
- Ethical writing

Course outcome: At the end of the course the students will be able to Levels.

CO 1	Comprehend the fundamental principles of technical communication with special reference to reading.	K2
CO 2	Write various kinds of professional correspondence.	K5
CO 3	Recognise and produce different kinds of technical documents.	K2
CO 4	Apply effective speaking skills to communicate at the workplace.	K3
CO 5	Demonstrate their understanding of various ethical concerns in written communication.	K3

Textbook:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

Reference Books:

1. Personality Development and Soft Skills by Barun K Mitra, Oxford Univ. Press, 2012, New Delhi.

2. Spoken English- A Manual of Speech and Phonetics by R K Bansal & J B Harrison, Orient Blackswan, 2013, New Delhi.

3. Business Correspondence and Report Writing by Prof. R C Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

4. Practical Communication: Process and Practice by L U B Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.

5. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; USA.

6. A Textbook of Scientific and Technical Writing by S D Sharma; Vikas Publication, Delhi.

7. Skills for Effective Business Communication by Michael Murphy, Harvard University, USA.

8. A Complete Guide to Write Right by Agarwal, Deepa. Scholastic, 1st edition.

9. Technical writing and communication, R S Sharma, V.P. Publication, 1st edition.

10. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

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B. TECH. SECOND YEAR (4th Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML

Course code		L T P	Credits
Course title	OPERATING SYSTEMS	3 0 0	3

Course objective:

The objective of the course is to provide an understanding of the basic modules and architecture of an operating system and the functions of the modules to manage, coordinate and control all the parts of the computer system. This course cover processor scheduling, deadlocks, memory management, process synchronization, system call and file system management.

Pre-requisites:

1. Basic knowledge of computer fundamentals, Data structure and Computer organization.

Course Contents / Syllabus

UNIT-I	Fundamental Concepts of Operating System	8 Hours

Introduction, Functions of Operating System, Characteristics of Operating System, Computer System Structure, Evolution of Operating Systems-Bare Machine, Single Processing, Batch Processing, Multiprogramming, Multitasking, Multithreaded, Interactive, Time sharing, Real Time System, Distributed System, Multiprocessor Systems, Multithreaded Systems, System Calls, System Programs and System Boot, Interrupt Handling, Operating System Structure- Simple structure, Layered Structure, Monolithic, Microkernel and Hybrid, System Components, Operating System Services, Case Studies: Windows, Unix and Linux.

UNIT-II	Process Management	8 Hours

Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process Address Space, Process Identification Information, Threads and their management, Types of Scheduling: Long Term Scheduling, Mid Term Scheduling, Short Term Scheduling, Pre-emptive and Non Pre-emptive Scheduling, Dispatcher, Scheduling Algorithm: FCFS, Non Pre-emptive SJF, Pre-emptive SJF, Non Pre-emptive Priority, Pre-emptive Priority, Round Robin, Multilevel Queue Scheduling and Multilevel Feedback Queue Scheduling.

UNIT-III	Deadlock and Concurrent Processing	8 Hours

Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from Deadlock, Principle of Concurrency, Process Synchronization, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Peterson's Solution, Lamport Bakery Solution, Semaphores, Test and Set Operation; Critical Section Problems and their solutions - Bound Buffer Problem, Reader-Writer Problem, Dining Philosopher Problem, Sleeping Barber Problem; Inter Process Communication Models and Schemes, Process Generation.

UNIT-IV	Memory Management	8 Hours

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Memory Management function, Address Binding Loading : Compile Time, Load Time and Execution Time, MMU, Types of Linking, Types of Loading, Swapping, Multiprogramming with Fixed Partitions, Multiprogramming with variable partitions, Memory Allocation: Allocation Strategies First Fit, Best Fit, and Worst Fit, Paging, Segmentation, Paged Segmentation, Virtual Memory Concepts, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms: FIFO, LRU, Optimal and LFU, Belady's Anomaly, Thrashing, Cache Memory Organization, Locality of Reference.

UNIT-V	**I/O Management and Disk Scheduling**	**8 Hours**

I/O Devices, and I/O Subsystems, I/O Buffering, I/O Ports, Disk Storage: Seek Time, Rotational Latency, Data Transfer Time, Average Access Time and Controller Time, Disk Storage Strategies, Disk Scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK and C-LOOK. Directory and Directory Structure, File System: File concept, File Access Mechanism: - Sequential Access, Direct Access and Index Access methods, File Allocation Method: Contiguous, Linked and Indexed, Free Space Management: -Bit Vector, Linked List, Grouping and Counting File System Implementation Issues, File System Protection and Security, RAID.

Course outcome: After completion of this course students will be able to:

CO 1	Understand the fundamentals of an operating systems, functions and their structure and functions.	K1, K2
CO 2	Implement concept of process management policies, CPU Scheduling and thread management.	K5
CO 3	Understand and implement the requirement of process synchronization and apply deadlock handling algorithms.	K2, K5
CO 4	Evaluate the memory management and its allocation policies.	K5
CO 5	Understand and analyze the I/O management and File systems	K2, K4

Text books:

1) Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

1) Operating Systems: Internals and Design Principles. William Stallings.
2) Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3) Operating Systems: A Modern Perspective. Gary J. Nutt.
4) Design of the Unix Operating Systems. Maurice J. Bach.
5) Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.

Link:

Unit 1	https://www.youtube.com/watch?v=783KAB-tuE4 https://www.youtube.com/watch?v=Bxx2_aQVeeg https://www.youtube.com/watch?v=ZaGGKFCLNc0 https://nptel.ac.in/courses/106/105/106105214/
Unit 2	https://www.youtube.com/watch?v=NShBeqTkXnQ https://www.youtube.com/watch?v=4hCih9eLc7M

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	https://www.youtube.com/watch?v=9YRxhlvt9Zo
Unit 3	https://www.youtube.com/watch?v=UczJ7misUEk https://www.youtube.com/watch?v=_IxqinTs2Yo
Unit 4	https://www.youtube.com/watch?v=IwESijQs9sM https://www.youtube.com/watch?v=-orfFhvNBzY https://www.youtube.com/watch?v=2OobPx246zg&list=PL3-wYxbt4yCjpcfUDz-TgD_ainZ2K3MUZ&index=10
Unit 5	https://www.youtube.com/watch?v=AnGOeYJCv6s https://www.youtube.com/watch?v=U1Jpvni0Aak

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B. TECH. SECOND YEAR (4th Semester)- IT/ Data Science/AI/AI-ML/IoT

Course code		L T P	Credit
Course title	DATABASE MANAGEMENT SYSTEMS	3 1 0	4

Course objective:

The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information in relational and non-relation Database.

Pre-requisites: The student should have basic knowledge of discrete mathematics and data structures.

Course Contents / Syllabus

UNIT-I	Introduction	8 Hours

Overview, Database system Vs File system, Database system concepts, architecture and structures, data model schema and instances, Data independence and Database language and Interfaces, DDL, DML.

Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, Candidate key, Primary key, Generalization, Aggregation, Reduction of an ER diagrams to tables, Extended ER model, Relationship of higher degree.

UNIT-II	Relational Data Model and Language	8 Hours

Relational data model Concepts, Integrity constraints, Entity integrity, Referential integrity, Keys constraints, Domain constraints, Relational algebra, Relational calculus, Tuple and Domain calculus.

Introduction on SQL: Characteristics of SQL, advantage of SQL. SQL data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, Views and indexes. Queries and sub queries. Aggregate functions. Insert, Update and Delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL.

UNIT-III	Database Design-Normalization	8 Hours

Normalization, Normal Form (NF), Functional Dependencies (FD), Closure of an attribute set and FD sets, Canonical Cover of FD Sets, Normal Forms based on Functional Dependencies (1 NF, 2 NF, 3 NF, BCNF), Multivalued Dependencies (MVDs) and 4NF, Join Dependencies (JDs) and 5NF and Domain Key Normal Formal (DKNF or 6NF), Inclusion Dependencies, Loss-Less Join Decompositions.

UNIT-IV	Transaction Processing and Recovery Concept	8 Hours

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

Transaction system, Testing of serializability, Serializability of schedules, Conflict & View serializable schedule, Recoverability, Recovery from transaction failures, Log based recovery, Checkpoints, Deadlock handling.

Control Concurrency Techniques: Concurrency Control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, Validation-based protocol, Multiple granularity, Multi version schemes, Recovery with concurrent transaction, Case study of Oracle.

Distributed Database: -Introduction Distributed Database, Centralized and Distributed System Database System.

UNIT-V	**Introduction No-SQL with cloud Database**	**8 Hours**

Definition of NoSQL, History of NoSQL and Different NoSQL products, Exploring Mongo DB, Interfacing and Interacting with NoSQL, NoSQL Storage Architecture, CRUD operations with MongoDB, Querying, Modifying and Managing NoSQL Data stores, Indexing and ordering datasets (MongoDB).

Cloud database: - Introduction of Cloud database, NoSQL with Cloud Database, Introduction to Real time Database.

Course outcome: After completion of this course students will be able to:

CO 1	Analyze database used to solve real world and complex problem and design the ER, EER Model.	K4
CO 2	Analyze and apply Structured Query Language (SQL) or Procedural Query Language (PL/SQL) to solve the complex queries. Implement relational model, integrity constraints.	K4, K3
CO 3	Design and implement database for storing, managing data efficiently by applying the Normalization process on the database.	K6
CO 4	Synthesize the concepts of transaction management, concurrency control and recovery.	K5
CO 5	Understand and implement the concepts of NOSQL with cloud database.	K2, K5

Text books:

1) Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.

2) Elmasri, Navathe, " Fundamentals of Database Systems", Seventh Edition, Addision Wesley.

3) Ivan Bayross "SQL,PL/SQL The programming language Oracle, Forth Edition, BPB Publication.

Reference Books:

1) Thomas Cannolly and Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.

2) Raghu Ramakrishan and Johannes Gehrke "Database Management Systems" Third Edition, McGraw-Hill.

3) NoSQL and SQL Data Modeling: Bringing Together Data, Semantics, and Software First Edition by Ted Hills.

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

4) Brad Dayley "NoSQL with MongoDB in 24 Hours" First Edition, Sams Publisher.	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=TlbJk78TqYY http://www.nptelvideos.com/lecture.php?id=6472 http://www.nptelvideos.com/lecture.php?id=6473
Unit 2	http://www.nptelvideos.com/lecture.php?id=6474 http://www.nptelvideos.com/lecture.php?id=6475 http://www.nptelvideos.com/lecture.php?id=6476 http://www.nptelvideos.com/lecture.php?id=6477 http://www.nptelvideos.com/lecture.php?id=6478 http://www.nptelvideos.com/lecture.php?id=6479 http://www.nptelvideos.com/lecture.php?id=6480 http://www.nptelvideos.com/lecture.php?id=6481
Unit 3	http://www.nptelvideos.com/lecture.php?id=6484 http://www.nptelvideos.com/lecture.php?id=6485 http://www.nptelvideos.com/lecture.php?id=6486 http://www.nptelvideos.com/lecture.php?id=6487 http://www.nptelvideos.com/lecture.php?id=6493 http://www.nptelvideos.com/lecture.php?id=6495 http://www.nptelvideos.com/lecture.php?id=6496 http://www.nptelvideos.com/lecture.php?id=6497
Unit 4	http://www.nptelvideos.com/lecture.php?id=6499 http://www.nptelvideos.com/lecture.php?id=6500 http://www.nptelvideos.com/lecture.php?id=6501 http://www.nptelvideos.com/lecture.php?id=6502 http://www.nptelvideos.com/lecture.php?id=6503 http://www.nptelvideos.com/lecture.php?id=6504 http://www.nptelvideos.com/lecture.php?id=6505 http://www.nptelvideos.com/lecture.php?id=6506 http://www.nptelvideos.com/lecture.php?id=6508 http://www.nptelvideos.com/lecture.php?id=6509 http://www.nptelvideos.com/lecture.php?id=6514 http://www.nptelvideos.com/lecture.php?id=6516 http://www.nptelvideos.com/lecture.php?id=6517 http://www.nptelvideos.com/lecture.php?id=6518 http://www.nptelvideos.com/lecture.php?id=6519
Unit 5	http://www.nptelvideos.com/lecture.php?id=6516 http://www.nptelvideos.com/lecture.php?id=6517 http://www.nptelvideos.com/lecture.php?id=6518 http://www.nptelvideos.com/lecture.php?id=6519 https://www.youtube.com/watch?v=2yQ9TGFpDuM

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B. TECH. SECOND YEAR (4th Semester)- AI-ML

Course code		L T P	Credits
Course title	MACHINE LEARNING	3 0 0	3

Course objective:

Introduce to the basic techniques of Machine Learning. Develop the skills of understanding the challenges of Machine Learning. Capability to enhance the skills for problem solving. Analytic power for underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

Pre-requisites: Basic Knowledge of Machine Learning Concepts.

Course Contents / Syllabus

UNIT-1	Introduction	8 Hours

INTRODUCTION-Learning, Types of Learning, well defined learning problems, designing a Learning System, History of ML, Introduction of Machine Learning Approaches, General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias, Issues in Machine Learning and Data Science Vs Machine Learning.

UNIT-2	Machine Learning Regression Techniques	6 Hours

REGRESSION AND ITS TYPES: Regression Terminologies: Dependent variable, independent variable, outliers, Multicollinearity, Underfitting and overfitting, Types of Regression: Linear Regression Logistic Regression, Polynomial Regression etc. Application of Regression in Machine Learning.

UNIT-3	Machine Learning Techniques	10 Hours

INSTANCE-BASED LEARNING: k-Nearest Neighbor Learning.

DECISION TREE LEARNING - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning.

SUPPORT VECTOR MACHINE: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussian kernel, Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.

BAYESIAN LEARNING - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM Algorithm.

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CLUSTERING AND ITS TYPES: k-means clustering, Hierarchical Clustering, partitioning clustering, Training and Evaluation of a model, Loss functions, Evaluation, Confusion Matrix, Dataset split and Cross-validation, Underfitting and Overfitting, Feature Engineering.

UNIT-4	**ARTIFICIAL NEURAL NETWORKS**	**8 Hours**

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: Single layer and Multilayer feed forward networks, recurrent networks. Various learning techniques; Perception and Convergence rule, Hebb Learning. Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm.

Introduction to Deep Learning.

UNIT-5	**REINFORCEMENT LEARNING**	**8 Hours**

Introduction to Reinforcement Learning, Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning – Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning.

Case study: Health Care, E Commerce, Smart Cities

Course outcome: After completion of this course students will be able to

CO 1	Understand the need for machine learning for various problem solving	K2
CO 2	apply knowledge of machine learning algorithm to solve various types of learning task/ Understand a wide variety of learning algorithms and how to evaluate models generated from data	K3
CO 3	Apply decision tree and Bayesian learning techniques.	K3
CO 4	Apply machine learning solutions to classification, regression, and clustering problems	K3
CO 5	Evaluate and interpret the results of machine learning algorithms.	K4

Text books:

1) Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited 2013.
2) EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation andMachine Learning), The MIT Press. 2014

Reference Books:

1) Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press 2015.
2) Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.2011

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://nptel.ac.in/courses/106/106/106106198/
Unit 2	https://nptel.ac.in/courses/111/107/111107137/

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Unit 3	https://nptel.ac.in/courses/106/106/106106202/
Unit 4	https://nptel.ac.in/courses/106/106/106106213/
Unit 5	https://nptel.ac.in/courses/106/105/106105152/

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B. TECH. SECOND YEAR (4th Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML/IoT

Course code		L T P	Credits
Course title	**THEORY OF AUTOMATA AND FORMAL LANGUAGES**	**3 0 0**	**3**

Course objective:

To teach mathematical foundations of computation including automata theory, provide the design concepts of abstract computation model of finite automata, push down automata and turing Machine and familiarize the notions of algorithm, decidability, complexity, and computability.

Pre-requisites:

- Discrete Mathematics
- Fundamental of Computer System

Course Contents / Syllabus

UNIT-I	**Basic Concepts of Formal Language and Automata Theory**	**8 Hours**

Introduction to Theory of Computation- Alphabet, Symbol, String, Formal Languages, Grammar, Derivation and Language generation by Grammar, Chomsky Hierarchy, Finite Automata, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non-Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ∈-Transition, Equivalence of NFA's with and without ∈-Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, Myhill-Nerode Theorem, Simulation of DFA and NFA.

UNIT-II	**Regular Language and Finite Automata**	**8 Hours**

Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into Regular grammar and Regular grammar into FA, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma.

Decidability- Decision properties, Finite Automata and Regular Languages, Simulation of Transition Graph and Regular language.

UNIT-III	**Context Free Language and Grammar**	**8 Hours**

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Context Free Grammar (CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Simplification of CFG, Normal Forms- Chomsky Normal Form (CNF), Greibach Normal Form (GNF), Pumping Lemma for CFL, Closure properties of CFL, Decision Properties of CFL

UNIT-IV	**Push Down Automata**	**8 Hours**

Pushdown Automata- Definition, Representation, Instantaneous Description (ID), Acceptance by PDA, Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, Pushdown Automata and Context Free Language, Pushdown Automata and Context Free Grammar, Two stack Pushdown Automata.

UNIT-V	**Turing Machine and Undecidability**	**8 Hours**

Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Variations of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Closure Properties of Recursive and Recursively Enumerable Languages, Non-Recursively Enumerable and Non-Recursive Languages, Undecidability, Halting Problem, Undecidability of Halting Problem, Post's Correspondence Problem.

Course outcome: After completion of this course students will be able to:

CO 1	Design and Simplify automata for formal languages and transform non-deterministic finite automata to deterministic finite automata.	K6
CO 2	Identify the equivalence between the regular expression and finite automata and apply closure properties of formal languages to construct finite automata for complex problems.	K3
CO 3	Define grammar for context free languages and use pumping lemma to disprove a formal language being context- free.	K3
CO 4	Design pushdown automata (PDA) for context free languages and Transform the PDA to context free grammar and vice-versa.	K6
CO 5	Construct Turing Machine for recursive and recursive enumerable languages. Identify the decidable and undecidable problems.	K6

Text books:

(1) Introduction to Automata theory, Languages and Computation, J.E. Hopcraft, R. Motwani, and Ullman. 3rd edition, Pearson Education Asia.
(2) Theory of Computer Science-Automata Language and Computation, K.L.P. Mishra, and N. Chandrasekharan, 3rd Edition, PHI.
(3) An Introduction to Formal Languages and Automata, P. Linz, 6th Edition, Jones & Bartlett Learning Publication.

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Reference Books:	
(1) Finite Automata and Formal Languages- A simple Approach, A. M. Padma Reddy, Cengage Learning Inc. (2) Elements and Theory of Computation, C Papadimitrou and C. L. Lewis, PHI. (3) Introduction to languages and the theory of computation, J Martin, 3rd Edition, Tata McGraw Hill. (4) Introduction to The Theory of Computation, M Sipser, 3rd Edition, Cengage Learning Inc.	
Links:	
Unit I	https://nptel.ac.in/courses/106/104/106104028/Lecture 1 -10, Lecture 16, 17 18, 19 https://nptel.ac.in/courses/113/11111/1003016/ https://www.youtube.com/results?search_query=%23AutomataTheory
Unit II	https://nptel.ac.in/courses/106/104/106104028/Lecture 11 -15 https://nptel.ac.in/courses/113/11111/1003016/ https://www.youtube.com/results?search_query=%23AutomataTheory
Unit III	https://nptel.ac.in/courses/106/104/106104028/Lecture 20 -30 https://nptel.ac.in/courses/106/106/106106049/ https://www.youtube.com/results?search_query=%23AutomataTheory
Unit IV	https://nptel.ac.in/courses/106/104/106104028/Lecture 31 -33 https://nptel.ac.in/courses/113/11111/1003016/ https://www.youtube.com/results?search_query=%23AutomataTheory
Unit V	https://nptel.ac.in/courses/106/104/106104028/Lecture 34-42 https://nptel.ac.in/courses/113/11111/1003016/ https://www.youtube.com/results?search_query=%23AutomataTheory

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B. TECH. SECOND YEAR (4th Semester)- CSE/IT/CS/M.Tech. Integrated/ Data Science/AI/AI-ML			
Course code		**L T P**	**Credits**
Course title	**OPERATING SYSTEMS LAB**	**0 0 2**	**1**
List of Experiments:			
Sr. No.	**Name of Experiment**	**CO**	
1. Linux based Commands	**Lab1:** Execute Various types of Linux Commands (Miscellaneous, File oriented, Directory oriented) **Lab2:** Shell Programming Write a shell program, which accepts the name of a file from standard input and perform the following test on it: i. File readable ii. File writable iii. Both readable and writable	CO1	
2. CPU Scheduling Algorithms	**Lab3:** Implement CPU Scheduling Algorithms: 1. FCFS 2. SJF 3. PRIORITY **Lab4:** 4. Round Robin 5. Multi-level Queue Scheduling	CO3	
3. Deadlock Management	**Lab5:** Implementation of Banker's algorithm for the purpose of Deadlock Avoidance.	CO3	
4. Memory Management Techniques	**Lab6:** Write a program to simulate the following contiguous memory allocation techniques: a) First fit b) Best fit c) Worst Fit **Lab7:** a) Write a Program for implementation of Contiguous memory fixed partition technique. b) Write a program for implementation of Contiguous memory variable partition technique. **Lab8:** Write a program to simulate page replacement algorithms: a) FIFO b) LRU c) Optimal	CO4	
5. Disk Scheduling Techniques	**Lab9:** Write a program to simulate Disk Scheduling Algorithms: a) FCFS b) SSTF **Lab 10:** c) SCAN & C-SCAN d) Look & C-LOOK	CO5	

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6. Process Synchronization	**Lab11:** Write a program to simulate Producer Consumer problem	CO2
Lab Course Outcome: After completion of this course students will be able to		
CO1	Gain all round knowledge of various Linux Commands.	K2
CO2	Analyze and implement Process Synchronization technique.	K4, K5
CO3	Analyze and implement CPU scheduling algorithms.	K4, K5
CO4	Analyze and implement Memory allocation and Memory management techniques.	K4, K5
CO5	Analyze and implement Disk Scheduling Policies.	K4, K5

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B. TECH. SECOND YEAR (4th Semester)- IT/ Data Science/AI/AI-ML/IoT			
Course code		**L T P**	**Credit**
Course title	**DATABASE MANAGEMENT SYSTEMS LAB**	**0 0 2**	**1**
List of Experiments:			
Sr. No.	**Name of Experiment**		**CO**
1.	Installing ORACLE/ MYSQL/NOSQL.		CO1
2.	Creating Entity-Relationship Diagram using case tools with Identifying (entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)		CO1
3.	I. Implement DDL commands –Create, Alter, Drop etc. II. Implement DML commands- Insert, Select, Update, Delete		CO2
4.	I. Implement DCL commands-Grant and Revoke II. Implement TCL commands- Rollback, Commit, Save point III. Implement different type key: -Primary Key, Foreign Key and Unique etc.		CO2
5.	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys).		CO1, CO2
6.	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping.		CO2
7.	Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc.		CO2
8.	Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).		CO2
9.	**Practicing on Triggers** - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger		CO4
10.	**Procedures-** Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure		CO4
11.	**Cursors**- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.		CO4
12.	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution)		CO5
13.	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)		CO5
14.	Implement aggregation and indexing with suitable example using MongoDB.		CO5

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15.	Mini project (Design & Development of Data and Application) for following: - a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System	CO1
Lab Course Outcome: After completion of this course students will be able to		
CO 1	Design and implement the ER, EER model to solve the real-world problem and transform an information model into a relational database schema and to use a data.	K6
CO 2	Formulate and evaluate query using SQL solutions to a broad range of query and data update problems.	K6
CO 3	Apply and create PL/SQL blocks, procedure functions, packages and triggers, cursors.	K3, K6
CO 4	Analyze entity integrity, referential integrity, key constraints, and domain constraints on database.	K4
CO5	Demonstrate understanding of MongoDB and its query operations.	K3

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B. TECH. SECOND YEAR (4th Semester)- AI-ML			
Course Code		**L T P**	**Credit**
Course Title	**MACHINE LEARNING LAB**	**0 0 2**	**1**

List of Experiments:

Sr. No.	Name of Experiment	CO
1.	Write a program to perform various types of regression (Linear & Logistic)	CO1, CO2, CO3, CO4
2.	Demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO1, CO2, CO3, CO4
3.	Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.	CO1, CO2, CO3, CO4
4.	Implement naïve Bayesian Classifier model. Write the program to calculate the accuracy, precision, and recall for your data set.	CO1, CO2, CO3, CO4
5.	Apply EM algorithm to cluster a set of data. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.	CO1, CO2, CO3, CO4
6.	Implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.	CO1, CO2, CO3, CO4
7.	Implement Support Vector Machine using Scikit-learn	CO1, CO2, CO 3, CO4
8.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	CO1, CO2, CO3, CO4
9.	Implementation of Image features Processing using OPENCV AND OPEN VINO	CO3
10.	For a given set of training data examples stored in a. CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	CO3, CO4

Lab Course Outcome: On completion of the course, student will be able to

CO 1	Understand the implementation procedures for the ML algorithms.	K2
CO 2	Design python programs for various learning algorithms.	K6

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CO 3	Apply appropriate data sets to the machine learning algorithms.	K3
CO 4	Identify and apply machine learning algorithms to solve real world problems.	K2

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B. TECH. SECOND YEAR (3rd Semester/4th Semester)- Data Science/AI/AI-ML/IoT/CSE/IT/CS/M.Tech. Integrated

Course code		L T P	Credit
Course title	CYBER SECURITY	2 0 0	0

Course objective:

Achieve knowledge about Security of Information system and Risk factors and examine security threats and vulnerability in various scenarios, understand concept of cryptography and encryption technique to protect the data from cyber-attack and provide protection for software and hardware.

Pre-requisites: Basics recognition in the domain of Computer Science.
Concept of network and operating system.
Commands of programming language.

Course Contents / Syllabus

UNIT-I	INTRODUCTION	8 Hours

Introduction to Information Systems: Types of Information Systems, Development of Information Systems, Need for Information Security, Threats to Information Systems, Information Assurance, Guidelines for Secure Password and WI-FI Security and social media and Windows Security, Security Risk Analysis, and Risk Management.

UNIT-II	APPLICATION LAYER SECURITY	8 Hours

Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall, Intrusion Detection, Access Control, Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack, Security, Threats to E-Commerce: Electronic Payment System, e- Cash, Issues with Credit/Debit Cards.

UNIT-III	SECURE SYSTEM DEVELOPMENT	8 Hours

Application Development Security, Architecture & Design, Security Issues in Hardware: Data Storage and Downloadable Devices, Mobile Protection, Security Threats involving in social media, Physical Security of IT Assets, Access Control, CCTV and Intrusion Detection Systems, Backup Security Measures.

UNIT-IV	CRYPTOGRAPHY AND NETWORK SECURITY	8 Hours

Public key cryptography: RSA Public Key Crypto with implementation in Python, Digital Signature Hash Functions, Public Key Distribution.

Symmetric key cryptography: DES (Data Encryption Standard), AES (Advanced Encryption Standard), Secure hash algorithm (SHA-1).

Real World Protocols: Basic Terminologies, VPN, Email Security Certificates, Transport Layer Security, TLS, IP security, DNS Security.

UNIT-V	SECURITY POLICY	8 Hours

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Policy design Task, WWW Policies, Email based Policies, Policy Revaluation Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the updated and new Policies.
Resent trends in security.

Course outcome: At the end of course, the student will be able to

CO 1	Analyze the cyber security needs of an organization.	K4
CO 2	Identify and examine software vulnerabilities and security solutions.	K1, K3
CO 3	Comprehend IT Assets security (hardware and Software) and performance indicators	K2
CO 4	Measure the performance and encoding strategies of security systems.	K3, K5
CO 5	Understand and apply cyber security methods and policies to enhance current scenario security.	K2, K3

Text books:

1) Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security", Pearson Education India
2) V.K.Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India
3) Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House
4) Michael E.Whitman and Herbert J Mattord "Principle of Information Security" Cengage

Reference Books:

1) Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
2) CHANDER, HARISH," Cyber Laws and It Protection", PHI Learning Private Limited,Delhi
3) V.K. Jain, Cryptography and Network Security, Khanna Publishing House, Delhi
4) William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010

E-books& E-Contents:

1) https://prutor.ai/welcome/
2) https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/03-ctrl-hijack.pdf
3) https://cybermap.kaspersky.com/stats
4) https://www.fireeye.com/cyber-map/threat-map.html

Reference Links:

1) https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/03-ctrl-hijack.pdf
2) https://cs155.stanford.edu/lectures/03-isolation.pdf
3) http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf

NPTEL/ Youtube/ Faculty Video Link:

1) https://www.youtube.com/watch?v=vv1ODDhXW8Q
2) https://www.youtube.com/watch?v=fQ3ESFfvchg&list=PLUtfVcb-iqn834VGI9faVXGIGSDXZMGp8
3) https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2
4) https://www.youtube.com/watch?v=1plMO7ChXMU&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2gYtev
5) https://www.youtube.com/watch?v=_9QayISruzo

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