
w.e.f. batch started in 2024-25

Part A - Introduction

Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	3 rd
Name of the Course	Object Oriented Programming
Course Code	24-BTPC-301
Course Type	Programme Core
Course Objectives	The objective of this Course is to have a exposure of Object Oriented Programming. Object Oriented Programming is implemented in all the modern Programming Languages, therefore, the study of Object Oriented Programming will make the student capable to understand modern programming language for upgradation.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Understand the principles of OOP: encapsulation, inheritance, polymorphism, and abstraction. CLO-2 Differentiate between procedural and object-oriented paradigms CLO-3 Recognize the importance of modularity and code reuse in software development CLO-4 Apply constructors, destructors, and access specifiers effectively. CLO-5 Use the concepts of inheritance and implement polymorphism in programming CLO-6 Handle exceptions and apply error-handling mechanisms. Work with file I/O, templates
Max. Marks	Th. 75 Pr. 25
Internal Assessment Max Marks	Th. 15 Pr. 5
End Term Exam Max Marks	Th. 60 Pr. 20
Internal Min Pass Marks	Th. 6 Pr. 2
External Min Pass Marks	Th. 24 Pr. 8
Examination Time	Th. 3 Hrs Pr. 3 Hrs

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm, Classes and Objects: Prototyping, Referencing the variables in functions, Inline, static and friend functions. Memory allocation for classes and objects. Arrays of objects, Constructors.

II Overriding Methods, type conversions from basic data types to user defined and vice versa, Base classes and Derived classes, types of inheritance, various types of classes, Invocation of Constructors and Destructors in Inheritance, aggregation, composition, classification hierarchies, metaclass/abstract classes, Unit Testing and Exceptions.

III Function declaration and definition, Function overloading and default arguments, Inline functions, Structures and enumerations, Recursion
Classes and objects, Constructors and destructors, Access specifiers: `public`, `private`, `protected`, Static members and friend functions, `this` pointer

IV Types of inheritance: single, multiple, multilevel, hierarchical, hybrid, Function overriding, Virtual functions and dynamic binding, Abstract classes and pure virtual functions
Operator overloading, Templates: function and class templates, Exception handling: `try`, `catch`, `throw`, File handling: reading/writing files, file streams, Standard Template Library (STL): vectors, lists, maps, stacks, queues

Part C-Learning Resources

Reference Books:

- 1) Bjarne Stroustrup, *The C++ Programming Language*, Addison Wesley, 2013
 - 2) Schildt H., *C++ :The Complete Reference*, McGraw Hill, 2002
 - 3) E Balagurusamy, *Object Oriented Programming with C++*, McGraw Hill, 2024
 - 4) Kanetkar, Y.P., *Let Us C++*, BPB Publications, 1999
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Part A - Introduction		
Name of the Programme	B.Tech. (Computer Science – AI & ML)	
Semester	3 rd	
Name of the Course	Data Structures	
Course Code	24-BTPC-302	
Course Type	Programme Core	
Course Objectives	To develop a solid understanding of fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.	
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	<p>CLO-1. Understand and explain fundamental data structures and their operations.</p> <p>CLO-2. Analyze and compare the performance of different data structures in terms of time and space complexity.</p> <p>CLO-3. Design and implement programs using appropriate data structures for solving real-world computational problems.</p> <p>CLO-4. Demonstrate the ability to use data structures to support algorithm development..</p>	
Max. Marks	Th. 75	Pr. 25
Internal Assessment Max Marks	Th. 15	Pr. 5
End Term Exam Max Marks	Th. 60	Pr. 20
Internal Min Pass Marks	Th. 6	Pr. 2
External Min Pass Marks	Th. 24	Pr. 8
Examination Time	Th. 3 Hrs	Pr. 3 Hrs

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Introduction: Algorithmic notation – Programming principles – Creating programs- Analyzing programs. Arrays: One dimensional array, multidimensional array, pointer arrays. Searching: Linear search, Binary Search, Fibonacci search. Sorting techniques: Internal sorting - Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort and Radix Sort.
II	Stacks: Definition – operations - applications of stack. Queues: Definition - operations - Priority queues – Dequeues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, linked stacks, Linked queues, Applications of Linked List – Dynamic storage management – Generalized list.
III	Trees: Binary tree, Terminology, Representation, Traversals, Applications – Binary search tree – AVL tree. B Trees: B Tree indexing, operations on a B Tree, Lower and upper bounds of a B Tree - B + Tree Indexing – Trie Tree Indexing.

IV Graph: Terminology, Representation, Traversals – Applications - spanning trees, shortest path and Transitive closure, Topological sort. Sets: Representation - Operations on sets – Applications. Files: queries - Sequential organization – Index techniques. External sorting.

Part C-Learning Resources

Reference Books:

- 1) Horowitz, E., & Sahni, S, *Fundamentals of Data Structures*. Galgotia Book Source Pvt. Ltd., 2004
 - 2) Samanta, D., *Classic Data Structures* (2nd ed.). Prentice-Hall of India Pvt. Ltd., India., 2012
 - 3) Kruse, R., Tondo, C. L., & Leung, B. (2007). *Data Structures and Program Design in C* (2nd ed.). Prentice-Hall of India Pvt. Ltd., 2007
 - 4) Weiss, M. A., *Data Structures and Algorithm Analysis in C* (2nd ed.). Pearson Education., 2006
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Part A - Introduction	
Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	3 rd
Name of the Course	Machine Learning
Course Code	24-BTPC-304
Course Type	Programme Core
Course Objectives	Students should learn the concept and importance of Machine Learning. They should be able to develop a solid understanding of core algorithms and models used in Machine Learning, their selection and evaluation. They should learn strengths and weaknesses of various Software Engineering Techniques used in industrial applications.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	<p>CLO-1. Explain fundamental concepts, types, and techniques of machine learning..</p> <p>CLO-2. Apply appropriate supervised and unsupervised learning algorithms to solve real-world problems.</p> <p>CLO-3. Analyze and evaluate machine learning models using performance metrics.</p> <p>CLO-4. Demonstrate an understanding of ethical and societal considerations in the design and deployment of machine learning systems.</p>
Max. Marks	Th. 100
Internal Assessment Max Marks	Th. 20
End Term Exam Max Marks	Th. 80
Internal Min Pass Marks	Th. 8
External Min Pass Marks	Th. 32
Examination Time	Th. 3 Hrs
Part B- Contents of the Course	
Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.	
Unit	Topics
I	<p>What Is Machine Learning?, How Do We Define Learning?, How Do We Evaluate Our Networks?, How Do We Learn Our Network?, What are datasets and how to handle them?, Feature sets, Dataset division: test, train and validation sets, cross validation.</p> <p>Applications of Machine Learning, processes involved in Machine Learning,</p>

II Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.

Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve.

III Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering.

IV Dimensionality reduction techniques: PCA, LDA, ICA. Introduction to Deep Learning, Gaussian Mixture Models, Natural Language Processing, Computer Vision.

Part C-Learning Resources

Reference Books:

- 1) Jeeva Rose, *Introduction to Machine Learning*, Khanna Book Publishing Co., 2020
 - 2) Chopra Rajiv, *Machine Learning*, Khanna Book Publishing Co., 2021
 - 3) Ethem A., *Machine Learning: The New AI*, MIT Press, 2016
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Part A - Introduction		
Name of the Programme	B.Tech. (Computer Science – AI & ML)	
Semester	3 rd	
Name of the Course	Artificial Intelligence	
Course Code	24-BTPC-305	
Course Type	Programme Core	
Course Objectives	Students should learn the concept and importance of Artificial Intelligence. They should be able to develop a solid understanding of core algorithms and models used in Artificial Intelligence. They should learn strengths and weaknesses of various Artificial Intelligence Techniques used in industrial applications.	
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	<p>CLO-1. Explain fundamental concepts, types, and techniques of Artificial Intelligence.</p> <p>CLO-2. Apply appropriate supervised and unsupervised learning algorithms to solve real-world problems.</p> <p>CLO-3. Analyze and evaluate machine learning models using performance metrics.</p> <p>CLO-4. Demonstrate an understanding of ethical and societal considerations in the design and deployment of machine learning systems.</p>	
Max. Marks	Th. 75	Pr. 25
Internal Assessment Max Marks	Th. 15	Pr. 5
End Term Exam Max Marks	Th. 60	Pr. 20
Internal Min Pass Marks	Th. 6	Pr. 2
External Min Pass Marks	Th. 24	Pr. 8
Examination Time	Th. 75	Pr. 25

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI. The AI Ladder - The Journey for Adopting AI Successfully, Advice for a career in AI, Hotbeds of AI Innovation. State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.
II	Propositional logic, predicate logic, Resolution, Resolution in propositional logic and predicate logic, Clause form, unification algorithm,

III Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts

IV The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

Part C-Learning Resources

Reference Books:

- 1) Trivedi M.C., *A Classical Approach to Artificial Intelligence*, Khanna Book Publishing Co., 2019
 - 2) R.Stuart, *Artificial Intelligence : A Modern Approach*, Pearson Education, 2010
 - 3) Rich & Knight, *Artificial Intelligence*, McGraw Hill, 2017
 - 4) Nils & Nilson, *Artificial Intelligence : A New Synthesis*, Elsevier, 1997
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Part A - Introduction	
Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	3 rd
Name of the Course	Universal Human Values
Course Code	24-BTHS-301
Course Type	Humanities and Social Science
Course Objectives	<p>To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.</p> <p>To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.</p> <p>To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.</p>
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	<p>CLO-1. Student will be able to make balance with Values and Skills.</p> <p>CLO-2. Student will be able to work with Holistic perspective towards life and profession leads to happiness and prosperity.</p> <p>CLO-3. Student will work with Human Values and move towards value based living in a natural value..</p> <p>CLO-4. Student will become an ethical person.</p>
Max. Marks	Th. 75
Internal Assessment Max Marks	Th. 15
End Term Exam Max Marks	Th. 60
Internal Min Pass Marks	Th. 6
External Min Pass Marks	Th. 24
Examination Time	Th. 3 Hrs
Part B- Contents of the Course	
<u>Instructions for Paper- Setter:</u> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.	
Unit	Topics

I	<p>Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.</p> <p>Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order,</p>
II	<p>Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health</p>
III	<p>Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order</p>
IV	<p>Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence</p> <p>A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Strategies for Transition towards Value-based Life and Profession</p>

Part C-Learning Resources

Reference Books:

- 1) Gaur R R et.al., *A Foundation Course in Human Values and Professional Ethics*, Excel Books, 2019
 - 2) Nagraj A., *Jeevan Vidya : Ek Parichay*, Jeevan Vidya Parkashan, 1999
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Part A - Introduction		
Name of the Programme	B.Tech. (Computer Science – AI & ML)	
Semester	3 rd	
Name of the Course	Programming with Python	
Course Code	24-BTPE-301	
Course Type	Professional Elective	
Course Objectives	<p><i>To understand the basics of Python programming, detail of various components of Python, strings and lists in Python, working of dictionaries and tuples, files in Python.</i></p> <p><i>To work with Python Libraries and execute Data Analytics Programs with Python.</i></p>	
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	<p>CLO-1. Student will be able to make basic programs in Python.</p> <p>CLO-2. Student will be able to handle strings, lists, dictionary, tuples and files in python.</p> <p>CLO-3. Student will have knowledge about python libraries.</p> <p>CLO-4. Student will be able to analyze pattern among various data sources through Data Analytics.</p>	
Max. Marks	Th. 25	Pr. 75
Internal Assessment Max Marks	Pr. 5	Th. 15
End Term Exam Max Marks	Pr. 20	Th. 60
Internal Min Pass Marks	Pr. 2	Th. 6
External Min Pass Marks	Pr. 8	Th. 24
Examination Time	Th. 1Hr 30 Min	Pr. 3 Hrs

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	<p>Overview of Python, Comments, Reserve Keywords, Identifiers, Variables, Constants, Standard Data types, Operators, Control Statements, Iterative Statements..</p> <p>Functions: Built in functions, Composition of functions, User defined Functions, Parameters, Function call, Return statement, Recursive function.</p> <p>Strings: Compound Data Type, Len function, Slices, Traversal, Escape Character, Formatting Operator, Formatting Functions.</p> <p>Lists: Values & Accessing Elements, Traversal, Deleting Element, Built-in Operators, Built-in Methods.</p>

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- II Tuples: Creating, Accessing Values in Tuples, Tuples Assignment, Tuples as Return Values, Variable length Argument Tuple, Basic Operations, Built-in-Tuple Function.
Dictionaries: Creating, Accessing Values, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary Keys, Operations in Dictionary, Built-in Dictionary Methods
Text Files and Exceptions: Text Files, Dictionaries, Exceptions, Exception with arguments, User defined exceptions.
Applications in Python: Managing Database using SQL: Database concept, Creating database & tables, Inserting data into tables, Retrieving data from table, Deleting data from table & deleting table.
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- III Introduction: Data analysis: Ideation, Retrieval, Preparation, Exploration, Modeling, Presentation, Reproduction.
Importing pandas. Panda series, Panda data frames, Loading data from files into a dataframe.
Representing Univariate data with the series: Configuring pandas, Creating a series, Size and shape of a series, Retrieving value in a series by label or position.
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- IV Manipulating data frame structure: Renaming columns, Adding new column with: [] and insert{}, through enlargement, concatenation, Replacing the content of column, Deleting column, Appending new rows, Concatenating rows.
Numerical and Statistical Method: Performing arithmetic on a data frame or series, Getting the count of values, Determining unique values, Finding minimum and maximum values, Locating n smallest and n largest values, Calculating the accumulated values
Calculating mean, Finding median, Determining the mode, Measuring variance, Finding the standard deviation, Calculating covariance and determining correlation. Executing random sampling of data.
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Part C-Learning Resources

Reference Books:

1. Sheetal Taneja, Naveen Kumar, *"Python Programming A Modular Approach"*, Pearson, 2017.
 2. Rao R. Nageswara , *"Core Python Programming"*, Dream Tech, New Delhi, 2018.
 3. Satyanarayana, Mani M. Radhika, Jagadesh B.N , *"Python Programming"*, India University Press, 2018.
 4. Cassell Laura, Gauld Alan , *"Python Projects"* , Wiley Publication, New Delhi, 2014
 5. Michael Heydt, *"Learning Pandas: High performance data manipulation and analysis using Python "*, Packt Publishing Limited, 2nd Edition.
 6. Fabio Nelli, *"Python Data Analytics"*, A Press, 1st Edition.
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Part A - Introduction	
Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	4 th
Name of the Course	Operating System
Course Code	24-BTPC-401
Course Type	Programme Core
Course Objectives	Students should be able to describe the services provided by and the design of an operating system. They should be able to understand the structure and organization of the file system, processes synchronization, process scheduling, system calls and different approaches to memory management.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Student will be able to understand the basic concepts of Operating System. CLO-2. Student will be able to understand structure and organization of Operating System and its Services.. CLO-3. Student will be able to work with process synchronization and scheduling. CLO-4. Student will be able to manage memory and disks. CLO-5 Student will be able to understand and manage security threats
Max. Marks	Th. 75 Pr. 25
Internal Assessment Max Marks	Th. 15 Pr. 5
End Term Exam Max Marks	Th. 60 Pr. 20
Internal Min Pass Marks	Th. 6 Pr. 2
External Min Pass Marks	Th. 24 Pr. 8
Examination Time	Th. 75 Pr. 25

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Computer system overview, concept of an operating system, batch system, multiprogramming, multiprocessing, multi user, time sharing, personal system, parallel system, real time system, simple monitors, general system architecture, System components, operating system services, system calls, system programs, system structure, Approaches to OS design and implementation: Microkernel, Layered, Kernel Approach

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- II Concept of process, process states, process state transitions, process control block, operations on processes, threads, concurrent processes, mutual exclusion and synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, Inter process synchronization, Inter process communication, Linux, IPC Mechanism, Remote procedure calls, RPC exception handling, security issues
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- III Logical and physical address space, storage allocation and management techniques, swapping concepts of multi programming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithm, thrashing, File organization, record blocking, access method, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels
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- IV Types of Threats in OS, Basic OS Security Mechanisms, Understanding the Threats: Malware Taxonomy: Viruses, Worms, Rootkits, Defence: An Overview, Logging, Auditing, and Recovery, OS-level Memory Protection
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Part C-Learning Resources

Reference Books:

1. Galvin & Silberschatz, "*Operating System*", John Wiley, 2004.
 2. Dhamdhere , "*Operating System : A Concept Based Approach*", Tata McGraw Hill, 2006.
 3. Crowley , "*Operating System : A Design Based Approach*", Tata McGraw Hill, 2001.
 4. Cassell Laura, Gauld Alan , "*Python Projects*", , Wiley Publication, New Delhi, 2012
 5. Walia E., "*Operating System Concepts* ", Khanna Book Publishing, 2020
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Part A - Introduction		
Name of the Programme	B.Tech. (Computer Science – AI & ML)	
Semester	4 th	
Name of the Course	Computer Networks	
Course Code	24-BTPC-402	
Course Type	Programme Core	
Course Objectives	Students should be able to have an understanding of the fundamental concepts of computer networking and have a basic knowledge of the various network models and their uses. They should be able to analyse simple protocols and independently study literature concerning computer networks.	
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Student will be able to understand the basic concepts of Computer Networks. CLO-2. Student will be able to understand various models of Computer Networks. CLO-3. Student will be able to analyse network protocols.	
Max. Marks	Th. 75	Pr. 25
Internal Assessment Max Marks	Th. 15	Pr. 5
End Term Exam Max Marks	Th. 60	Pr. 20
Internal Min Pass Marks	Th. 6	Pr. 2
External Min Pass Marks	Th. 24	Pr. 8
Examination Time	Th. 75	Pr. 25

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Introduction to Computer Networks and its uses, Network categorization and Hardware: Broadcast and point-to-point networks, Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Internetworks, Topologies, Wireless networks, Network Software: Protocols, Services, network architecture, design issues, OSI Reference model, TCP/IP Reference model, Comparison of OSI and TCP/IP Models. Introduction to Example Networks: Internet, Connection-Oriented Networks – X.25, Frame Relay, ATM.

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- II Data Link Layer Design issues: Framing, error control, Flow Control, Error Detection and correction; Elementary Data Link Protocols, Sliding Window Protocols; Medium Access Control: Aloha, CSMA protocols, Collision free protocols, Limited Contention Protocols; Wavelength division Multiple access protocol, Wireless LAN Protocol: MACA; IEEE 802.3 Ethernet, IEEE 802.4 Token Bus; IEEE 802.5 Token ring, Binary Exponential Backoff algorithm, Digital Cellular, Radio: Global System for Mobile Communication (GSM), Code Division Multiple Access(CDMA), Fiber Distributed Data Interface, Distributed Queue Dual Bus (DQDB).
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- III Network Layer, Design issues , Virtual Circuit and Datagram Subnet, Routing Algorithms, Optimality principle, Shortest path Routing, Flooding , Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast and Multi Cast Routing, Routing for Mobile hosts, Routing in Adhoc Networks,, congestion Control Algorithms, General Principals Traffic Shaping, Leaky bucket token bucket, choke packets, Load Shedding.
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- IV Introduction and Transport-Layer Services; Multiplexing and Demultiplexing; Connectionless Transport: UDP; Principles of Reliable of Data Transfer; Connection-Oriented Transport: TCP; Principles of Congestion Control, TCP Congestion Control. Principles of Network Applications; The Web and HTTP; File Transfer: FTP;Electronic Mail in the Internet; DNS - The Internet's Directory Service; Peer-to-Peer applications; Socket Programming – Creating network applications.
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Part C-Learning Resources

Reference Books:

1. Andrew S. Tanenbaum, "*Computer Networks*", Pearson, 5th Edition.
 2. Behrouz A Forouzan, "*Introduction to Data communications and Networking*", Tata Mc-Graw Hill, 4th Edition.
 3. Prakash C. Gupta, "*Data Communications and Computer Networks*", PHI, 2006.
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Part A - Introduction	
Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	4 th
Name of the Course	Data Science
Course Code	24-BTPC-403
Course Type	Programme Core
Course Objectives	Students should be able to have an understanding of the fundamental concepts of computer networking and have a basic knowledge of the various network models and their uses. They should be able to analyse simple protocols and independently study literature concerning computer networks.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Student will be able to understand the basic concepts of Computer Networks. CLO-2. Student will be able to understand various models of Computer Networks. CLO-3. Student will be able to analyse network protocols.

Max. Marks	Th. 75	Pr. 25
Internal Assessment Max Marks	Th. 15	Pr. 5
End Term Exam Max Marks	Th. 60	Pr. 20
Internal Min Pass Marks	Th. 6	Pr. 2
External Min Pass Marks	Th. 24	Pr. 8
Examination Time	Th. 75	Pr. 25

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Data acquisition, cleaning, and aggregation, Exploratory data analysis and visualization, Feature engineering, Model creation and validation Numerical Data, Summary Statistics, From Population to Sampled Data, Different Types of Biases, Random Number Generation and their applications.
II	Probability, Expectation and Probability Distribution. Introduction to Statistical Inference., Association and Dependence, Association and Causation, Conditional Probability and Bayes Rule, Simpsons Paradox, Confounding, Introduction to Linear Regression, Special Regression Models,
III	Bayesian inference: combining models and data in a forecasting problem, Bayesian hierarchical modeling for studying public opinion, Bayesian modeling for Big Data Goals of statistical graphics and data visualization, Graphs of Data, Graphs of Fitted Models, Graphs to Check Fitted Models, What makes a good graph?, Principles of graphics

IV Introduction, Classification, Linear Classification, Ensemble Classifiers, Model Selection, Cross Validation, Holdout, Probabilistic modelling, Topic modelling, Probabilistic Inference, Application: prediction of preterm birth, Data description and preparation, Relationship between machine learning and statistics

Part C-Learning Resources

Reference Books:

1. Jain V K, "*Data Science and Analytics*", Khanna Book Publishing House, 2021.
 2. Bruce P. & Bruce A., "*Practical Statistics for Data Scientists*", O'Reilly, 2017
 3. Tamhane, C.Ajit & Dorothy D, "*Statistics and Data Analysis: From Elementary to Intermediate*", PHI, 1999
 4. Dirk P. Kroese "*Data Science and Machine Learning*", CRC, 2019
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Part A - Introduction		
Name of the Programme	B.Tech. (Computer Science – AI & ML)	
Semester	4 th	
Name of the Course	Data Base Management System	
Course Code	24-BTPC-404	
Course Type	Programme Core	
Course Objectives	Students should be able to understand the basics of database and database management system, provide the detail of various data models. To understand the relational calculus, effects of transaction processing methods and to gain knowledge about the latest industrial applications of database.	
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Student will be able to understand the basic concepts of Data Base Management System. CLO-2. Student will be able to understand various models of Computer Networks. CLO-3. Student will be able to analyse network protocols.	
Max. Marks	Th. 75	Pr. 25
Internal Assessment Max Marks	Th. 15	Pr. 5
End Term Exam Max Marks	Th. 60	Pr. 20
Internal Min Pass Marks	Th. 6	Pr. 2
External Min Pass Marks	Th. 24	Pr. 8
Examination Time	Th. 75	Pr. 25

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics
I	Database System: Definition, Characteristics, Relational data models, Schemas, Instances, Three schema architecture and data independence. Data modeling : Entity, Entity type, Entity set, Attributes, Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak entity type, Naming convention for ER diagram, Design issues, Subclass, Super class, Inheritance, Specialization & Generalization.
II	Relational Algebra: Select, Project, Join, Division, Union, Intersection, Minus, Cartesian product. Relational Calculus: Tuple variable, Range relations, Expressions, Formulas, Existential & Universal Quantifiers & there transformation, Using the Universal Quantifier, Safe expression, Domain relational calculus.

III Transaction Processing: Introduction, Single User, Multiuser, Read and Write Operation, Lost update problem, Temporary update, Incorrect summary problem, Traction states, System log, Commit point of a transaction, Desirable properties, Serial, Non serial & Conflict Serializable schedule, Testing of Conflict Serializability of a schedule, View equivalence & View serializability.

IV Emerging Database Technologies and Applications: Geographical Information System: Components of GIS Systems, Characteristics of Data in GIS, Conceptual Data Models for GIS, GIS standards and Operations, GIS Applications and Future Works.

Genome Data Management: Characteristics of Biological Data, The Human Genome projects and existing biological database.

Unstructured text, Information retrieval systems, document retrieval and ranking

Part C-Learning Resources

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, "*Fundamentals of Database Systems*", Pearson, 6th edition, 2010.
 2. Silberschatz Abraham , "*Database System Concept*", Tata Mc Graw Hill, 7th edition, 2019.
 3. C. J Date , "*Introduction to Database Systems*", Pearson Education, 8th edition, 2004.
 4. Krishnan Ram and Gehrke , "*Database Management System*", , Tata Mc Graw Hill, 2003.
 5. Byross Ivan , "*Oracle 10 G The Database with HTML Database*", BPB publication,2006.
 6. Erik T. Ray, "*Learning XML*", O'Reilly, 2nd Edition
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Part A - Introduction	
Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	4 th
Name of the Course	Advanced Machine Learning
Course Code	24-BTPC-405
Course Type	Programme Core
Course Objectives	To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1 Student will be able to understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. CLO-2 Students will be able to apply various machine learning algorithms in a range of real-world applications CLO-3 Student will be able to Integrate and apply their expertise to produce solutions for real-world problems. CLO-4 Student will be able to Integrate and apply their expertise to produce solutions for real-world problems.
Max. Marks	Th. 75 Pr. 25
Internal Assessment Max Marks	Th. 15 Pr. 5
End Term Exam Max Marks	Th. 60 Pr. 20
Internal Min Pass Marks	Th. 6 Pr. 2
External Min Pass Marks	Th. 24 Pr. 8
Examination Time	Th. 75 Pr. 25
Part B- Contents of the Course	
<u>Instructions for Paper- Setter:</u> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.	
Unit	Topics
I	Introduction to ANN, Perceptron, Cost Function, Gradient Checking, multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, Random Initialization.
II	Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.
III	Reinforcement learning through feedback network, function approximation.
IV	Bagging, boosting, stacking and learning with ensembles. Random Forest.

Part C-Learning Resources

Reference Books:

1. Mitchell T., "*Machine Learning*", McGrawHill 1997.
 2. Chopra R. , "*Machine Learning*", Khanna Book Publishing, 2021.
 3. Murphy K.P., "*Machine Learning : A Probabilistic Perspective*", MIT Press, 2012.
 4. Apaydin E., "*Introduction to Machine Learning*", MIT Press, 2010.
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Part A - Introduction	
Name of the Programme	B.Tech. (Computer Science – AI & ML)
Semester	4 th
Name of the Course	Environmental Science
Course Code	24-BTPC-405
Course Type	Audit Course
Course Objectives	<p>People working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.</p> <p>Solve various engineering problems applying ecosystem to produce eco – friendly products.</p> <ul style="list-style-type: none"> • Use relevant air and noise control method to solve domestic and industrial problems. • Use relevant water and soil control method to solve domestic and industrial problems. • To recognize relevant energy sources required for domestic and industrial applications. • Solve local solid and e-waste problems.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	<p>At the end of the course student will be able to</p> <p>CLO - 1. Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.</p> <p>CLO - 2. Understand the suitable air, extent of noise pollution, and control measures and acts.</p> <p>CLO - 3. Understand the water and soil pollution, and control measures and acts.</p> <p>CLO - 4. Understand different renewable energy resources and efficient process of harvesting.</p> <p>CLO - 5. Understand solid Waste Management, ISO 14000 & Environmental Management.</p>
Max. Marks	Th. 75
Internal Assessment Max Marks	Th. 15
End Term Exam Max Marks	Th. 60
Internal Min Pass Marks	Th. 6
External Min Pass Marks	Th. 24
Examination Time	Th. 75
Part B- Contents of the Course	
<p>Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.</p>	
Unit	Topics

I Structure of ecosystem, Biotic & Abiotic components, Food chain and food web, Aquatic (Lentic and Lotic) and terrestrial ecosystem, Carbon, Nitrogen, Sulphur, Phosphorus cycle, Global warming -Causes, effects, process, Green House Effect, Ozone depletion.

Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler), Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator).

Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler.

Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

II Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation.

Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).

Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

III Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.

Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.

Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.

New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.

IV Solid waste generation- Sources and characteristics of: Municipal solid waste, E-waste, biomedical waste.

Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.

Air quality act 2004, air pollution control act 1981 and water pollution and control act 1996. Structure and role of Central and state pollution control board.

Concept of Carbon Credit, Carbon Footprint.

Environmental management in fabrication industry.

ISO14000: Implementation in industries, Benefits.

Reference Books:

1. Rao C.S., "*Environmental Pollution Control and Engineering*", New Age International 2007.
 2. Sharma S.C. & Poonia M.P., "*Environmental Studies*", Khanna Book Publishing, 2021.
 3. Rao M.N., Rao H.V.N., "*Air Pollution :*", Tata McGraw Hill, 1988.
 4. Vieira A, Rosa D., "*Fundamentals of Renewable Source Energy*", Academic Press, Oxford, 2013.
 5. Patvardhan A.D., "*Industrial Solid Waste*", Teri Press, 2013.
 6. Gupta O.P., "*Elements of Environmental Pollution Control*", Khanna Book Publishing, 2023.
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