Centre for Artificial Intelligence

Islamic University of Science & Technology

BS-FYUGP through DYOD
Major in Artificial Intelligence

Curriculum

for

Undergraduate Programme
4 Years (FYUGP)
Semester IV
2025 Onwards

Foundations of Machine Learning

Semester IV

Course Code
CAIDYOD253C
4 Credits

L	T	P	S
3	1	0	0

Course Outcomes

- ✔ Explain fundamental statistical concepts including measures of central tendency, dispersion, and probability distributions.
- ✔ Distinguish between different types of machine learning paradigms and understand generative and discriminative approaches.
- ✔ Apply model selection techniques and evaluate models using bias-variance trade-off, cross-validation, and regularization methods.
- ✔ Implement supervised learning algorithms such as Linear Regression, Logistic Regression, and Support Vector Machines.
- ✔ Perform unsupervised learning tasks such as clustering using K-means and analyze model performance on real-world datasets.

Course Content

UNIT I

Measures of Central Tendency: Mean, Median, and Mode.
Measures of Dispersion: Range, Quartile, Mean Deviation, Standard Deviation, Coefficient of Variance, Skewness, Kurtosis.

(10 hours)

UNIT II

Probability Distribution, Sample Spaces and Events, Conditional Probability, Random Variables, Introduction to Machine Learning.
Types of Learning. Generative and Discriminative algorithms.

(8 hours)

UNIT III

Model selection and feature selection. Bias-variance trade-off, overfitting and underfitting.
Training, validation and test split. Cross-validation. Regularization.

(10 hours)

UNIT IV

Linear Regression, Logistic Regression, SoftMax Regression, Perceptron.
Decision Trees, Support Vector Machines. Clustering: K-means.

(8 hours)

Text Books

1. Machine Learning. Tom Mitchell. McGraw- Hill, 2010.
2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and TensorFlow, Oreilly, March 2017.

Reference Books

1. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press
3. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.

Web References

1. Coursera DeepLearning.AI
   Machine Learning Specialization
   By Andrew Ng, Geoff Ladwig, Aarti Bagul
2. Google for Developers
   Google Machine Learning Education
   By Google

OPERATING SYSTEM INTERNALS

Semester IV

Course Code
CAIDYOD251C
4 Credits

L	T	P	S
3	1	0	0

Course Outcomes

- ✔ Introduce fundamental concepts and functionalities of operating systems.
- ✔ Explain process management, scheduling, and synchronization mechanisms in modern OS.
- ✔ Describe techniques for memory management and deadlock handling.
- ✔ Discuss file system structure, implementation, and input/output management.
- ✔ Compare different operating systems such as UNIX and Windows in terms of design and performance.

Course Content

UNIT I

Introduction to the purpose and functions of operating systems. Types of operating systems including batch, time-sharing, distributed, and real-time systems. Structure and components of an operating system, system calls, operating system services, design and implementation aspects, and the system boot process.

(10 hours)

UNIT II

Concept of a process, process states, and process control block. Process creation, scheduling, and termination. Inter-process communication

Concept of concurrency, the critical section problem, race conditions, and mutual exclusion. Process synchronization mechanisms, Peterson's solution, semaphores, classical synchronization problems, monitors, and condition variables.

(10 hours)

UNIT III

CPU scheduling concepts and criteria. Scheduling algorithms including First Come First Serve, Shortest Job First, Shortest Remaining Time First, Longest Job First, Longest Remaining Time First, Round Robin, Priority Scheduling, Multilevel Queue Scheduling, and Multilevel Feedback Queue Scheduling.

System model and deadlock characterization. Necessary conditions for the occurrence of deadlock. Methods for handling deadlocks including prevention, avoidance, detection, and recovery.

(12 hours)

UNIT IV

Concepts of memory management including contiguous memory allocation, swapping, paging, multilevel paging, inverted paging, and segmentation. Virtual memory, demand paging, page replacement algorithms such as First In First Out, Least Recently Used, and Optimal. Allocation of frames, thrashing, and memory-mapped files.

File system structure and functions. Access methods, directory structure, and file-system mounting. File allocation methods including contiguous, linked, and indexed allocation.

(10 hours)

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th Edition, Wiley India Private Limited, New Delhi.

Reference Books

1. Stallings (2006), Operating Systems: Internals and Design Principles, 5th Edition, Pearson Education, India.
2. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd Edition, Prentice Hall of India, India.
3. Deitel & Deitel (2008), Operating Systems, 3rd Edition, Pearson Education, India.

DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

Semester IV

Course Code
CAIDYOD252C
4 Credits

L	T	P	S
3	1	0	0

Course Outcomes

- ✔ Convert number systems and perform binary arithmetic.
- ✔ Design combinational and sequential logic circuits using gates.
- ✔ Analyze CPU, registers, and I/O devices with instruction formats.
- ✔ Describe memory types and hierarchy (RAM, ROM, HDD, SSD, cache).
- ✔ Solve problems using digital design and computer organization principles..

Course Content

UNIT I

Number systems – decimal, binary, octal, and hexadecimal; number system conversions; 1's and 2's complements; addition and subtraction of binary numbers;
Basics of Boolean algebra; Logic gates – types, truth table, implementation of logic circuits using logic gates.

(10 hours)

UNIT II

Combinational logic circuits – design of various combinational circuits like half adder, full adder, half subtractor, full subtractor, binary adder, binary subtractor, multiplexer, decoder;
Introduction to basic sequential logic circuits – flip flops and registers.

(8 hours)

UNIT III

Computer structure; Central Processing Unit; Arithmetic Logic Shift Unit; CPU registers; Control unit; Input/output devices; Instruction formats.

(10 hours)

UNIT IV

Memory – memory hierarchy; Primary memory (RAM, ROM); Secondary memory (HDD, SSD); Cache memory.

(8 hours)

Text Books

1. Mano M. M., Ciletti M. D. Digital Design. 5th Ed., Pearson.
2. Mano M. M. Computer System Architecture. Revised 3rd Ed., Pearson.

PROBLEM SOLVING AND PROGRAMMING USING C AND C++

Semester IV

Course Code
CAIDYOD250C
4 Credits

L	T	P	S
3	1	0	0

Course Outcomes

- ✔ Understand basic programming concepts and problem-solving techniques.
- ✔ Write simple programs using C language.
- ✔ Use functions, arrays, and pointers in C programs.
- ✔ Understand the basics of Object-Oriented Programming (OOP) in C++.

Course Content

UNIT I

Problem-solving concepts; algorithms and flowcharts; Structure of a C program; constants, variables, and data types; Operators and expressions; input and output functions in C.

(10 hours)

UNIT II

Control statements – if, if-else, switch, for, while, do-while; Break and continue statements; Functions – declaration, definition, and calling; Function arguments and return values; recursion basics.

(8 hours)

UNIT III

Arrays – one-dimensional and two-dimensional; String handling and string library functions; Pointers – declaration and operations; Pointer to arrays; introduction to structures and unions.

(10 hours)

UNIT IV

Introduction to C++; Difference between C and C++; Basic structure of a C++ program;
Classes and objects; data members and member functions; Constructors, destructors, and function overloading.

(8 hours)

Text Books

1. E. Balagurusamy. Programming in ANSI C. McGraw Hill.
2. E. Balagurusamy. Object Oriented Programming with C++. McGraw Hill.

COMPUTER NETWORKS FOR INTELLIGENT SYSTEMS

Semester IV

Course Code
CAIDYOD254C
4 Credits

L	T	P	S
3	1	0	0

Course Outcomes

- ✔ Explain basic concepts, components, and topologies of computer networks.
- ✔ Describe network models, transmission media, and protocols.
- ✔ Understand IP addressing, routing, and error control mechanisms.
- ✔ Explain data link, network, transport, and application layer functions.
- ✔ Understand the role of networks in intelligent systems and IoT.

Course Content

UNIT I

Introduction to computer networks – need, advantages, and applications; Network types – LAN, MAN, WAN; network topologies; Network devices – hubs, switches, routers, gateways; Transmission media – guided and unguided; Network models – OSI and TCP/IP reference models.

(10 hours)

UNIT II

Framing, error detection and correction, flow control; MAC sublayer – channel allocation, Ethernet, CSMA/CD, switching concepts; Network layer – functions, logical addressing (IPv4), routing basics.

(8 hours)

UNIT III

TCP and UDP protocols, ports, congestion control; Application layer – HTTP, DNS, FTP, email protocols; Socket programming basics; Network security – firewalls, encryption, authentication.

(10 hours)

UNIT IV

Introduction to intelligent systems and IoT; Role of networks in intelligent systems; Cloud and edge computing basics; Communication protocols for IoT – MQTT, CoAP; Overview of sensor networks and data transmission in smart systems.

(8 hours)

Text Books

1. Andrew S. Tanenbaum, Computer Networks, 5th Edition, Pearson.
2. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill.

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