B.TECH. IN COMPUTER SCIENCE AND ENGINEERING
HONORS TRACK: HONORS IN ARTIFICIAL INTELLIGENCE

Sr.No	Semester	Course Code	Name of Subject	Nature of Evaluation	Credits
1	III	BCS42325	Introduction to Artificial Intelligence	ESE / MCQ	3
2	IV	BCS42425	Machine Learning Fundamentals	ESE / MCQ	3
3	V	BCS43525	Deep Learning	ESE / NPTEL	3
4	VI	BCS43625	Neural Networks	ESE / NPTEL	3
5	VII	BCS44725	Generative AI	ESE / NPTEL	3
6	VIII	BCS44825	Capstone Project in AI	ESE / NPTEL	3
Total Credits					**18**

B.TECH. IN COMPUTER SCIENCE AND ENGINEERING
MINORS TRACK: MINORS IN CSE

Sr.No	Semester	Course Code	Name of Subject	Nature of Evaluation	Credits
1	III	BCS42321	Data Structure	ESE / NPTEL	3
2	IV	BCS42421	Operating System	ESE / NPTEL	3
3	V	BCS43521	Database Management System	ESE / NPTEL	3
4	VI	BCS43621	Computer Network	ESE / NPTEL	3
5	VII	BCS44721	Introduction to Artificial Intelligence	ESE / NPTEL	3
6	VIII	BCS44821	Information Security	ESE / NPTEL	3
Total Credits					**18**

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Wardha Road, Nagpur-441108
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Second Year (Semester-IV) B.Tech. (CSE)

Course Name:- Operating System (BCS42421) Minor

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs 00Min.	

Course Objective:

1	To introduce the fundamental concepts and functions of Operating Systems.
2	To demonstrate the notion of processes, process management, and CPU scheduling algorithms.
3	To examine classical process synchronization problems and their solutions.
4	To analyze memory management techniques, including paging, virtual memory management, and page replacement algorithms.
5	To explore disk management and File System techniques

Course Contents

Unit I	Operating Systems – Definition, Types and Functions – Abstract View of OS – Booting Process and Bootstrap Program – System Calls and Types of System Calls – Virtual Machines – Cloud Operating Environment – Difference between Traditional OS, Virtual Machines and Containers.
Unit II	Process Concept – Process Definition – Operations on Processes – Process States – Process Control Block (PCB) – Context Switching – Process Scheduling – Scheduling Objectives – Types of Schedulers – CPU Scheduling Algorithms: FCFS, SJF, Priority and Round Robin Scheduling – Threads and Multithreading Concepts – Introduction to Multicore Processing and Multithreaded Applications.
Unit III	Synchronization – Critical Section Problem – Race Condition – Semaphores – Mutex Locks – Producer Consumer Problem – Reader Writer Problem – Synchronization in Multicore Systems and Concurrent Processing. Deadlocks – System Model – Deadlock Characterization – Deadlock Prevention – Deadlock Avoidance using Banker's Algorithm – Deadlock Detection and Recovery.
Unit IV	Memory Management: Basic concepts, logical and physical address mapping, Swapping Memory Allocation -Contiguous Memory Allocation - fixed partition and Variable partition, Fragmentation : Internal and External Fragmentation, Paging concept Virtual memory Management –Demand Paging-Page Replacement Algorithm : FIFO, LRU, Optimal
Unit V	Disk Management: Disk Structure, Disk Scheduling – FCFS, SSTF, SCAN File System: File concept, File attributes, File operations, File Types. File Access Method : Sequential Access, Direct access, Virtualization and Cloud Operating Environment Case Study: Windows OS, Linux File Systems and Android OS , Resource management in mobile OS

Text Books

T1	Operating System Concepts, A.Silberschatz,Peter B. Galvin,Grag Gagne, 8 th edition John Wiley & Sons, Inc. (Wiley).

Reference Books

1	Operating System A.Godbole, Atul Kahate 3rd Edition Tata McGrawHill
2	Operating Systems Concepts and Design Milan Milenkovic 7th Edition Tata McGrawHill.

Useful Links	
1	https://www.youtube.com/watch?v=lmlLdGMrdGU
2	https://nptel.ac.in/courses/106106144

BCS42421	Course Outcomes	CL	Class Session
BCS42421.1	Explain the fundamental concepts, structure, and functions of operating systems.	2	9
BCS42421.2	Describe process management concepts, threads, scheduling mechanisms, and inter-process communication in operating systems.	2	9
BCS42421.3	Apply CPU scheduling algorithms and synchronization techniques to solve process management problems.	3	9
BCS42421.4	Apply memory management techniques including paging, segmentation, and virtual memory concepts.	3	9
BCS42421.5	Apply disk management and file system concepts to manage storage resources effectively.	3	9

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Second Year (Semester-IV) B.Tech. (CSE)

Course Name:- Machine Learning Fundamentals (BCS42425) Honor

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs 00Min.	

Course Objective:

1	To understand the basic concepts of machine learning.
2	To learn various machine learning types and use it for the various machine learning tasks.
3	To optimize the machine learning model and generalize it.
4	To develop mathematical concepts required for Machine learning algorithms.
5	To explore supervised and unsupervised learning paradigms of machine learning

Course Contents	
Unit I	**Introduction to Machine Learning: -** Overview of Human Learning and Machine Learning, Comparison of Machine learning with traditional programming, ML vs AI vs Data Science. Types of Machine Learning: Supervised, Unsupervised, Reinforcement learning Basic/Key concepts: Generalization, Overfitting, Underfitting Statistics & Linear Algebra: Probability, Bayes' theorem, Distributions, Variance, CoVariance, Matrices, Vectors, Eigenvalues, Gradient Descent Data and Dimensionality: Feature Sets, Feature Extraction and Subset Selection, Feature Transformation. Dimensionality reduction techniques- PCA and LDA
Unit II	**Supervised Learning: Classification:-** Types of Supervised learning: Regression and Classification, Difference between Classification and Regression Model Evaluation and Validation: Confusion Matrix, Accuracy, Precision, Recall, ROC Curve, F1- score, Cross-validation techniques (k-fold, stratified k-fold), Sub Sampling Classification Algorithms: Bayesian Learning - Naive Bayes Classifier, Bayesian Network, Applications of Bayesian Network, k-Nearest Neighbors (k-NN) Decision Trees - Introduction, Learning Decision Tree Using ID3 and Gini Index, CART, Overfitting, Ensemble Methods- Bagging (Random Forest).
Unit III	**Supervised Learning: Regression: -**Foundational Concepts: Different types of regression models, distributions, hypothesis testing, and confidence intervals. Univariate Regression – Model Representation, Least-Square Method for finding values of the regression coefficients. Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimizing Simple Linear Regression with Gradient Descent Algorithm. Multivariate Regression –Model Representation, Polynomial Regression. Performance enhancement with Regularization techniques. Generalization Issues- Overfitting Vs. Underfitting, Bias Vs. Variance, Maximum Likelihood Function Logistic Regression – Model, Cost Function
Unit IV	**Unsupervised Learning:-** Introduction of Unsupervised Learning, Application of unsupervised learning, Types of Unsupervised learning: Clustering algorithms - Partitioning Methods - k-means and k-Medoids, Hierarchical Methods - Agglomerative, Divisive, Density-based methods – DBSCAN, Apriori algorithm for association rule learning

Unit V	**Advance topics in Machine Learning:-** Overview of Reinforcement Learning, Components of Reinforcement Learning Introduction to ML Frameworks: Definition and Importance of ML Frameworks – Types of ML Frameworks – Tensorflow – PyTorch – Scikit-learn – Keras – Challenges in ML Frameworks Case-study of ML applications: Image recognition, speech recognition, Email spam filtering, Online fraud detection, Market basket analysis, Healthcare applications
Text Books	
T1	Tom M. Mitchell, ―Machine Learning‖, McGraw Hill
T2	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014. 3. Mehryar Moh
T3	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar " Foundations of Machine Learning", MIT Press,2012.
Reference Books	
1	Kevin P. Murphy, ―Machine Learning ― A Probabilistic Perspective‖, MIT Press
2	Stephen Marsland, ―Machine Learning an Algorithmic Perspective‖, CRC Press
Useful Links	
1	https://nptel.ac.in/courses/106106139
2	https://onlinecourses.nptel.ac.in/noc25_cs50/preview

BCS42425	Course Outcomes	CL	Class Session
BCS42425.1	**Describe** the fundamental concepts of Machine Learning, learning paradigms, statistical foundations, feature engineering, and dimensionality reduction techniques.	2	9
BCS42425.2	**Implement** classification algorithms and model evaluation techniques for supervised learning applications.	3	9
BCS42425.3	**Develop** regression models using appropriate optimization and regularization techniques for predictive analysis.	3	9
BCS42425.4	**Utilize** clustering and association rule mining algorithms to discover patterns from unlabeled datasets.	3	9
BCS42425.5	**Demonstrate** reinforcement learning concepts and machine learning frameworks for solving real-world problems.	3	9

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