BRAINWARE UNIVERSITY
SCHOOL OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Bachelor of Technology in Computer Science & Engineering - Artificial Intelligence & Machine Learning 2023

SEMESTER – V

Course Code	Course Name	Course Type	Hours per week			Credits	Total Marks
			L	T	P		
PCC-CSM501	Database Management Systems	PC	3	0	0	3	100
PCC-CSM502	Computer Networks	PC	3	0	0	3	100
PCC-CSM503	Artificial Intelligence for Real World Application	PC	3	0	0	3	100
PCC-CSM504	Compiler Design	PC	3	0	0	3	100
PEC-CSM501	Elective-I A. Image Processing B. Bioinformatics C. Cloud Computing	PE	3	0	0	3	100
PCC-CSM591	Database Management Systems Lab	PC	0	0	3	1.5	100
PCC-CSM592	Computer Networks Lab	PC	0	0	3	1.5	100
PCC-CSM593	Artificial Intelligence for Real World Application Lab	PC	0	0	3	1.5	100
PEC-CSM591	Elective-I A. Image Processing Lab B. Bioinformatics Lab C. Cloud Computing Lab	PE	0	0	3	1.5	100
Total						**21**	**900**

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Course Code: PCC-CSM501

Course Name: Database Management Systems

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

In the modern age data is most valuable part. To extract some information from a huge amount of data and store for near future to collect some knowledge also an important area of development. In this scenario data management plays a vital role. From this course learners can understand every point of data managements and also it can implement its day to day life.

Pre-requisite(s): Set theory concept of mathematics.

Course Outcome: After the completion of the course, students would be able to:

CO1: Define the various aspects of data definition, classify different data models and cite the example of entity relationship diagram.

CO2: Describe and compare the several relational query languages, query processing and query optimization using open source and commercial DBMS.

CO3: Define different storage structure like B-Tree, B+ Tree to analyze the storage policy.

CO4: Explain and Analyze the transaction process to interpret serializability of scheduling process and concurrency control policy.

CO5: State the security policy to evaluate the security policy of database along with the advancement of database design.

Module I: **[9H]**

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Module II: **[16H]**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms (1NF,2NF,3NF,BCNF,4NF,5NF,6NF), Dependency reservation, Lossless design. Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization.

Module III: **[12H]**

Storage strategies: Indices, B-trees, hashing. Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Database recovery.

Module IV: **[6H]**

Database Security: Authentication, Authorization and access control.

Module V: **[2H]**

Introduction to Data warehousing and data mining, SQL injection.

Text books:

1. “Database System Concepts”, Henry F. Korth and Silberschatz Abraham, Mc.Graw Hill, 7th edition.
2. “Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B. Navathe, Addison Wesley Publishing Edition.

Reference books:

1. “Principles of Database Systems”, Ullman JD., Galgottia Publication.2nd edition, 1993.
2. “Introduction to Database Management”, Date C. J., Pearson, 3rd edition.

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Course Code: PCC-CSM502

Course Name: Computer Networks

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

The objective of this course is to build an understanding of the fundamental concepts of computer networking, basic taxonomy and terminology of the computer networking area, layered approach that makes design, implementation and operation of extensive networks possible, 7-layer OSI network model (each layer and its responsibilities) and understand the TCP/IP suite of protocols and the networked applications supported by it.

Pre-requisite(s): Basic knowledge of binary number system.

Course Outcome: After the completion of the course, students would be able to:

CO1: Recall and explain Data Communications System and its components, topologies and utilization.

CO2: Apply and analyze the knowledge of flow control and error control mechanism in network.

CO3: Explain the different switching technique and protocols in Network Layer and also can identify the logical addresses Understand and building the skills of sub netting and routing mechanisms.

CO4: Discuss the functionality of transport layer and explain the improvement of Quality of services in computer network.

CO5: Appraise and categorize the functionalities of the different protocols of the application layer of OSI model.

Module I: **[10H]**

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs,

Connecting LAN and Virtual LAN Techniques for Bandwidth utilization: Multiplexing-Frequency division, Time division and Wave division, Concepts on spread spectrum.

Module II: **[12H]**

Data Link Layer and Medium Access Sub Layer: Multiple access protocols-Pure ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA Error Detection and Error Correction-Fundamentals, CRC; Flow Control and Error control protocols- Stop and Wait, Go back–ARQ, Selective Repeat ARQ, Sliding Window, Piggy backing, Random Access, Block coding, Hamming Distance.

Module III: **[12H]**

Network Layer: Switching, Logical addressing–IPV4, IPV6; Address mapping–ARP, RARP, BOOTP and DHCP–Delivery, Study of distance vector and link state routing protocols- RIP, EIGRP, OSPF.

Module IV: **[5H]**

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Module V: **[6H]**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, SSH, SMS, Bluetooth, Firewalls, Basic concepts of cryptography.

Text books:

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw-Hill , 5thEdition, 2017.
2. Data and Computer Communication, William Stallings, Pearson, Prentice Hall India, 8thEdition, 2007.

Reference books:

1. Computer Networks, Andrew S. Tanenbaum, Pearson New International Edition, 5th Edition, 2011.
2. Internet working with TCP/IP, Douglas Comer, Prentice Hall of India, 6thEdition, 2013.

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Course Code: PCC-CSM503

Course Name: Artificial Intelligence for Real World Application

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

Artificial Intelligence for Real-World Application as a course will prepare students to gain the cutting edge knowledge. This course will help students understand Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), TensorFlow and Natural Language Processing (NLP).

Pre-requisite(s): Knowledge of Object-Oriented Programming Systems (OOPs), Basic knowledge of Sensors.

Course Outcome: After the completion of the course, students will be able to:

CO1: Define and list the basic concept of Artificial Intelligence (AI) tools along with its application.

CO2: Understand and compare the searching techniques and reasoning in AI.

CO3: Apply AI techniques to real-world problems to develop and demonstrate intelligent systems like Machine Learning and Deep Learning Models.

CO4: Select and analyze and test the Time Series in AI.

CO5: Evaluate the TensorFlow for implementing regression and clustering methods.

Module I: **[7H]**

Introduction to Artificial Intelligence (AI): History of AI, Tools to be used for AI programming and its overview, Cognitive science and problem of perception, Applications of AI.

Module II: **[6H]**

Search: Intelligent agents, uninformed search, Search Techniques 1 (search space and state space search), Search Techniques 2 (heuristic search and pattern-directed search), Planning, control strategies and

implementation, constraint satisfaction, Problem solving by heuristic search, A* algorithm, AO* algorithm, Adversarial search, game playing.

Module III: **[6H]**

Reasoning: Proposition and first-order logic, Rule-based systems, semantic net, conceptual graph, inference and deduction, Resolution refutation, answer extraction, Reasoning under uncertainty - probabilistic reasoning, belief networks.

Module IV: **[7H]**

Machine Learning: Basic concepts, Linear models, perceptrons, Introduction to supervised learning and k-nearest neighbors (KNN), decision trees, Advanced models - support vector machine (SVM), ensemble classifiers, Introduction to unsupervised learning and clustering methods.

Module V: **[7H]**

Deep Learning: Introduction to neural networks, Backpropagation, Training neural nets using keras, Regularization, batch normalization, dropout, Introduction to convolutional neural networks (CNN), Introduction to natural language processing (NLP) and toolkits.

Module VI: **[6H]**

Time Series Analysis: Introduction to time series, Stationary time series, Smoothing time series, Autocorrelation functions, Autoregressive integrated moving average (ARIMA) models, Signal transformations, Deep learning and time series analysis.

Module VII: **[6H]**

TensorFlow: Introduction to TensorFlow, Convolutional neural networks with TensorFlow, Using TensorFlow for implementing regression and clustering methods.

Text books:

1. Artificial Intelligence and Machine Learning by – Chandra S.S.V.

Reference books:

1. A First Course in Artificial Intelligence by Deepak Khemani.

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Course Name: Compiler Design

Course Code: PCC-CSM504

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

The aim of this course is to provide the knowledge and abilities to design and implement compilers.

Pre-requisite(s): Knowledge of automata theory, context free languages.

Course Outcome: After the completion of the course, students would be able to:

CO1: State the different types of translators used in programming.

CO2: Understanding the symbol table organization and compare the different roles of semantic analysis in Compiler Design.

CO3: Construction and implementation of intermediate representation considering the type systems.

CO4: Analyzing the optimization techniques for classification of the generated code.

CO5: Assessing the different compiler construction tools to develop and compare the simple compiler.

Module I: **[6H]**

Introduction: Phases of compilation and overview, cross-compiler, Analysis-Synthesis Model, cousins of the compiler.

Module II: **[7H]**

Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex).

Module III: **[13H]**

Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL (1) grammars and top-down parsing, operator grammars, LR(O), SLR (1), LR (1), LALR (1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR (1) parser generator (yacc, bison).

Module IV: **[11H]**

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.

Symbol Table: Structure, symbol attributes and management.

Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.

Intermediate Code Generation: Translation of different language features, different types of intermediate forms.

Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc.

Module V: **[8H]**

Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation

Advanced topics: Type systems, data abstraction, compilation of Object-Oriented features and non-imperative programming languages.

Text books:

1. Compilers- Principles, Techniques and Tools, By A.V. Aho, M.S. Lam, R Sethi and J.D. Ullman, Pearson Education.
2. Compiler Design, By Dr. O.G.Kakde, University Science Press.

Reference books:

1. lex & yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly.

2. Engineering a Compiler, by Cooper & Linda, Elsevier.
3. Compiler Construction, K.C. Louden, Thomson Brooks/Cole.
4. Compiler Design, Santanu Chattopadhyay, PHI Learning.

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Course Code: PEC-CSM501A

Course Name: Image Processing

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

The objective of this course is to get basic knowledge of Image Processing fundamentals, develop the ability about different types of Image Enhancement Techniques, image Restoration and Reconstruction, image Segmentation, different image Compression Techniques.

Pre-requisite(s): Linear Algebra, Differential Equations, Calculus, Signals and systems.

Course Outcome: After the completion of the course, students would be able to:

CO1: Defining the concepts of Image Processing through mathematical representation and illustration of different elements of sampling, quantization and transformation techniques.

CO2: Classify and analyze different types of Image Enhancement Techniques.

CO3: Applying Image Restoration methods and analyzing different kind of image filtering.

CO4: Estimating and Assessing Compression efficiency and compression and segmentation techniques.

Module I: Introduction to Digital Image [10H]

Background, Digital Image Representation-Gray scale and Color images, Fundamental steps in Image Processing, Basic Transformation-Translation, Scaling, Rotation; Elements of Digital Image Processing, Image sampling and quantization, Fourier Transformation.

Module II: Spatial Domain Image Enhancement [9H]

Basic gray level Transformations, Histogram Processing Techniques, Smoothing and Sharpening spatial filters.

Module III: Frequency Domain Image Enhancement [8H]

The basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain

filters, Homomorphic filtering.

Module IV: Image Restoration [8H]

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering.

Module V: Image Segmentation and Image Compression [10H]

Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.

Some Basic Compression Methods, compression efficiency.

Text books:

1. Digital Image Processing, R C Gonzalez and R E Woods, Pearson, 3rd, 2002.
2. Fundamentals of Digital Image Processing, Anil K. Jain, Prentice Hall of India, Eastern Economy Edition,2010.

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Course Code: PEC-CSM501B

Course Name: Bioinformatics

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

Bioinformatics is an interdisciplinary field of science for analyzing and interpreting vast biological data using computational techniques. This course aims to give a walkthrough of the major aspects of bioinformatics such as the development of databases, computationally derived hypothesis, algorithms, and computer-aided drug design. During the first section of the course, we will focus on DNA and protein sequence databases and analysis, secondary structures and 3D structural analysis. The second section will be devoted to applications such as prediction of protein structure, folding rates, stability upon mutation, and intermolecular interactions. Further, we will cover computer-aided drug design using docking and QSAR studies. This course is designed to nurture skills and knowledge required for aspiring students, young biologists and research scholars to develop algorithms and tools in bioinformatics.

Pre-requisite(s): Basic knowledge of Biology, Mathematics and any computer language would be helpful.

Course Outcome: After the completion of the course, students would be able to:

CO1: Recall and demonstrate the basic concept of biological science with computer application and some statistical approaches.

CO2: Identify and assess system biology with sequence similarity and alignment, classification and clustering concept.

CO3: Apply and evaluate rule mining for pairwise alignment, protein analysis and classify or clustering biological databases.

CO4: Analyze and construct various biological pathways with protein-protein interaction.

CO5: Evaluate and discuss various algorithms to classify and cluster biological data with statistical parameters.

Module I: Cell Biology [6H]

System Biology, Central Dogma, Biological Database: Sequence data, Gene expression data, Micro-array experiment, NCBI database, Challenges faced in the integration of biological data, Data management and data integration in bio-informatics, Issues related to the designing of a biological information system. DNA sequence analysis, DNA Databases, Protein structure and function, protein sequence databases.

Module II: Sequence similarity, homology, and alignment. Pair wise alignment [10H]

Scoring model, dynamic Programming algorithms, heuristic alignment, and pair wise alignment using Hidden Markov models (HMM), Multiple alignment**:** scoring model, local alignment gapped and ungapped global alignment. Motif finding: motif models, finding occurrence of known sites, discovering new sites, Amino Acid, Protein, Phylogenetic tree construction: Neighbor Joining Algorithm. sequence alignment, PAM matrix, Global and local alignment, BLAST: features and scores.

Module III: Biological Pathways [4H]

Gene regulatory network, Transcription factors, Signal Transduction, Protein-Protein interaction, Boolean Network, Stochastic gene networks, Network connectivity.

Module IV: Clustering, Classification & Rule mining [8H]

Clustering algorithms: k-means, k-medoid, Isodata, AGNES, DIANA, BIRCH, DBSCAN, CHAMELON, Grid based methods, Model based methods Classifier: Bayes theorem, Naïve Bayes classifier, Baysian belief network, Cluster validity indices: DB-Index, Dunn Index, Xie-Beni Index etc. Association rule Mining: Apriori, FP-Growth.

Module V: Protein Analysis [10H]

Protein sequence analysis, hydrophobicity profiles, non-redundant datasets. Protein tertiary structure, Protein Data Bank, visualization tools, structural classification, Protein structural analysis, protein structure prediction, Protein stability, energetic contributions, database, stabilizing residues, Protein folding rates, proteins interactions, binding site residues, Computer aided drug design, docking, screening, QSAR.

Module VI: Statistical approach [7H]

Information theory (Entropy), Prediction using linear regression, multiple regression, predicting reading frames, maximal dependence decomposition, Expectation-maximization, Bayesian model, Gaussian Mixture Model (GMM), P-value statistics (GO), z-score, t-test, F-test, Validation parameters: True positive, Sensitivity, Specificity, FDR, Accuracy.

Text books:

1. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, New York: Garland Science, 4th Edition, 2002.
2. Bioinformatics: Sequence and Genome Analysis, David W. Mount, Cold Spring Harbor Laboratory Press, 2nd Edition, 2005.
3. Bioinformatics And Functional Genomics: A Short Course, Jonathan Pevsner, Wiley-Liss, 3rd Edition, 2015.
4. Data Mining Concepts and techniques, Han & Kamber, Elsevier, 3rd Edition, 2011.
5. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, 4th Edition, 2014.
6. Developing Bioinformatics Computer Skills, Cynthia Gibas and Per Jambeck, O'Reilly, 1st Edition, 2001.

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Course Code: PEC-CSM501C

Course Name: Cloud Computing

Contact: 3L

Credit: 3

Allotted Hour: 45L

Course Objective:

Understanding the concepts, characteristics, delivery models, key security, compliance challenges and benefits of cloud computing. Comparative study of different services.

Pre-requisite(s): Basics knowledge of networking and computer fundamentals.

Course Outcome: After the completion of the course, students will be able to:

CO1: Recall and demonstrate the basic concept of cloud computing.

CO2: Explain and identify different mechanisms of cloud computing.

CO3: Demonstrate and analyze cloud security services and architecture.

CO4: Examine and compare different cloud services available as a case study.

Module I: **[10H]**

Introduction: Vision of Cloud Computing, Characteristics of cloud computing as per NIST, Cloud computing reference model, Cloud computing environments, Cloud services requirements, Cloud and dynamic infrastructure, Cloud Adoption and rudiments. Overview of cloud applications: ECG Analysis in the cloud, Protein structure prediction, Gene Expression Data Analysis, Satellite Image Processing, CRM and ERP, Social networking .

Module II: **[10H]**

Cloud Computing Architecture: Cloud Reference Model, Types of Clouds, Cloud Interoperability & Standards, Scalability and Fault Tolerance, Cloud Solutions: Cloud Ecosystem, Cloud Business Process Management,

Cloud Service Management. Cloud Offerings: Cloud Analytics, Testing Under Control, Virtual Desktop Infrastructure.

Module III **[10H]**

Cloud Management & Virtualization Technology: Resiliency, Provisioning, Asset management, Concepts of Map reduce, Cloud Governance, High Availability and Disaster Recovery. Virtualization: Fundamental concepts of compute, storage, networking, desktop and application virtualization. Virtualization benefits, server virtualization, Block and file level storage virtualization Hypervisor management software, Infrastructure Requirements, Virtual LAN(VLAN) and Virtual SAN(VSAN) and their benefits.

Module IV: **[8H]**

Cloud Security: Cloud Information security fundamentals, Cloud security services, Design principles, Secure Cloud Software Requirements, Policy Implementation, Cloud Computing Security Challenges, Virtualization security Management, Cloud Computing Security Architecture.

Module V: **[7H]**

Market Based Management of Clouds, Federated Clouds/Inter Cloud: Characterization & Definition, Cloud Federation Stack, Third Party Cloud Services. Case study: Google App Engine, Microsoft Azure, Hadoop, Amazon, Aneka

Text books:

1. Mastering Cloud Computing, Buyya, Selvi, TMH Publication.
2. Cloud Computing, Kumar Saurabh, Wiley Publication.

Reference Books:

1. Cloud Computing- A Practical Approach, Velte, TMH Publication.

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Course Code: PCC-CSM591

Course Name: Database Management Systems Lab

Contact: 3P

Credit: 1.5

Allotted Hour: 45L

Course Objective:

The objective of this course is to design database schema for a given application and apply normalization, acquire skills in using SQL commands for data definition and data manipulation. It also help to develop solutions for database applications using procedures, cursors and triggers.

Pre-requisite(s): Nil.

Course Outcome: After the completion of the course, students would be able to:

CO1: Apply and analyze the basic concepts of Database Systems and Applications.

CO2: Prepare and Demonstrate the basics of SQL and construct queries using SQL in database creation and interaction.

CO3: Choose the relevant models and algorithms to turn available data into valuable and useful Information.

CO4: Appraise and develop a commercial relational database system (Oracle, MySQL) by writing SQL using the system.

Module I: **[3H]**

Converting table from ER diagram.

Module II **[6H]**

Creating Database Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indices.

Module III: **[3H]**

Table and Record Handling INSERT statement.

Module IV: **[6H]**

Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements.

Module V: **[6H]**

Retrieving Data from a Database The SELECT statement Using the WHERE clause Using Logical Operators in the WHERE clause Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause.

Module VI: **[6H]**

Aggregate Functions, Combining Tables Using JOINS Subqueries.

Module VII: **[3H]**

Correlated nested query.

Module VIII: **[3H]**

Creating view and operations on view.

Module IX: **[6H]**

PL SQL, stored procedure, function, cursor, trigger.

Module X: **[3H]**

Concept of MongoDB and NoSQL.

Text books:

1. SQL, PL/SQL the Programming Language of Oracle", Ivan Bayross, BPB publication, 4th Edition.

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Course Code: PCC-CSM592

Course Name: Computer Networks Lab

Contact: 3P

Credit: 1.5

Allotted Hour: 45L

Course Objective:

The objective of this course is to utilize different network devices to configure network, commands to communicate in the network. It also develops programs to implement classful addressing scheme, simulation using Cisco Packet Tracer to design a LAN using hub, switch, MAN, WAN router, WLAN. It also helps to simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion, develop the program for connection oriented and connection less socket programming and error detecting using cyclic redundancy check (CRC).

Pre-requisite(s): Java programming

Course Outcome: After the completion of the course, students would be able to:

CO1: Find and explain Data Communications System and its components, topologies and utilization.

CO2: Apply and analyze the knowledge of flow control and error control mechanism in network.

CO3: Explain and identify the different switching technique and protocols in Network Layer and also can identify the logical addresses Understand and building the skills of sub netting and routing mechanisms.

CO4: Familiarize with the functionality of transport layer and explain the improvement of Quality of services in computer network.

CO5: Appraise and develop the functionalities of the different protocols of the application layer of OSI model.

Module I: **[3H]**

Network Devices: Repeater, hub, switch, router, gateway, Commands for communication: ping, tracert, nslookup, arp, Learn about RJ45connector, different cable and climping tool.

Module II: **[9H]**

Simulation with Cisco Packet Tracer: implement different topology and configure LAN, MAN, WAN.

Module III: **[12H]**

Implementing distance vector and link state routing protocols using Cisco packet tracer.

Module IV: **[12H]**

Examining NAT and DHCP protocol, configuration of access control lists in router, basic switch configuration, telnet operation.

Module V: **[9H]**

Socket programming, implementation of TCP and UDP protocol.

Text books :

1. Computer Networks, Andrew S. Tanenbaum, Pearson New International Edition, 5th Edition, 2011.
2. Internetworking with TCP/IP, Douglas Comer, Prentice Hall of India, 6thEdition, 2013.

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Course Code: PCC-CSM593

Course Name: Artificial Intelligence for Real World Application Lab

Contact: 3P

Credit: 1.5

Allotted Hour: 45L

Course Objective:

Students will gain an understanding of TensorFlow, Natural Language Processing, Deep Learning, Machine Learning, and Artificial Intelligence (AI) in this course. The AI/ML principles and algorithms will be implemented using Python 3.x and its related packages.

Pre-requisite(s): Knowledge of Object-Oriented Programming Systems (OOPs), Basic knowledge of Sensors.

Course Outcome: After the completion of the course, students will be able to:

CO1: State and define the various technical terms, pre-processing techniques on different datasets.

CO2: Understand and Construct Machine learning programs for Supervised, Unsupervised and Semi supervised learning models.

CO3: Apply and develop the deep learning programs for Supervised & Unsupervised learning models.

CO4: Identify and analyze Artificial Intelligence concepts to solve real world problems.

Module I: **[6H]**

Different Tools used for AI programming.

Module II: **[6H]**

Different Search Techniques.

Module III: **[6H]**

Rule-based systems, semantic net, conceptual graph, inference and deduction, Resolution refutation, answer extraction, probabilistic reasoning, belief networks.

Module IV: **[6H]**

Machine Learning Models.

Module V: **[6H]**

Deep Learning Models.

Module VI: **[6H]**

Time Series Analysis.

Module VII: **[9H]**

Using TensorFlow.

Text books:

1. Artificial Intelligence and Machine Learning by – Chandra S.S.V.

Reference books:

1. A First Course in Artificial Intelligence by Deepak Khemani

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Course Code: PEC-CSM591A

Course Name: Image Processing Lab

Contact:3P

Credit: 1.5

Allotted Hour: 45L

Course Objective:

Give the students a taste of the applications of the theories taught in the subject. This will be achieved through some lab sessions. Give the students a useful skill base that would allow them to carry out further study in this domain in future.

Pre-requisite(s): Nil

Course Outcome: After the completion of the course, students would be able to:

CO1: Recall and illustrate image fundamentals and mathematical image transforms and illustrating MATLAB tools.

CO2: Understand basic image processing algorithms in Spatial and frequency domain. and applying histogram mapping and transformation.

CO3: Apply and justify various techniques of image enhancement, reconstruction.

CO4: Analyze and estimate different Image compression and segmentation method.

Module I: **[9H]**

Introduction to MATLAB. Simulation and display different attributes of an Image, Negative of an Image (Binary & Gray Scale), Implementation of Relationships between Pixels and transformations of an Image.

Module II: **[9H]**

Contrast stretching of low contrast image**,** Histogram Mapping and Equalization, Image Smoothening and Sharpening.

Module III: **[9H]**

Display of bit planes of an Image, Fast Fourier Transform (1-D & 2-D) of an image.

Module IV: **[9H]**

Degradation Model, Algebraic Restoration Approach; Constrained Least Square Restoration, Restoration by Homomorphic Filtering.

Module V: **[9H]**

Segmentation using watershed transform, Image Compression by HUFFMAN coding.

Text book:

1. Digital Image Processing, Rafael.C, Gonzalez, Richard E Woods, Pearson India, 3rd Edition, 2013.
2. Digital Image Processing, William K. Pratt, John Wiley, 4th, 2007.

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Course Code: PEC-CSM591B

Course Name: Bioinformatics Lab

Contact: 3P

Credit: 1.5

Allotted Hour: 45L

Course Objective:

To use and develop bioinformatics programs for comparing & analyzing biological sequence data to identify probable function.

Pre-requisite(s): Basic knowledge of Biology, Mathematics and any computer language would be helpful.

Course Outcome: After the completion of the course, students would be able to:

CO1: Understanding and relate the methodologies used for database searching, and determining the accuracies of database search.

CO2: Decide and construction of probabilistic model to determine important patterns.

CO3: Formulate and evaluate the structure from sequence and subsequently testing the accuracy of predicted structures.

CO4: Determine and model the protein function from sequence through analysis of data.

CO5.Analyze and development of models for better interpretation of biological data to extract knowledge.

Module I: **[9H]**

Overview of the practical implementation of "Structural Biology" on RCSB, Visualization software's, and tools related to secondary and tertiary structure predictions. Different sequence formats such as FASTA, PIR, EMBL, PDB, etc. Different sequence databases, retrieval of sequences from those databases and different ways to store the sequences. Calculation of the score of a pairwise alignment by using a scoring pattern.

Module II: **[9H]**

Select a protein family for your mini-project and find out its superfamily. Also select another protein family which belongs to above superfamily and closer to your protein family. Find out structural and functional information about above protein families and superfamily.

Module III: **[9H]**

Implementation of Needleman-Wunsch algorithm to align between two sequences. Use EBI (European Bioinformatics Institute) Needle sequence alignment tool to align above two sequences and compare your result with that of Needle tool.

Module IV: **[6H]**

Use of BLAST on line server to retrieve sequences from a database Develop a program based on BLAST algorithm to carry out database search. Use Clustaw software or on line server to align sequences from a family.

Module V: **[6H]**

Develop a Multiple Sequence Alignment (MSA) program based on ClustalW algorithm Develop a program to identify motif from a set of sequences. Use on-line motif identification tools to predict motif in a set of sequences.

Module VI: **[6H]**

Use of Phylip package to infer phylogenetic tree in distance, maximum parsimony (MP) and maximum likelihood (ML) methods. Use of phylip package to determine robustness of inferred tree determined by each method.

Text books:

1. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, New York: Garland Science, 4th Edition, 2002.
2. Bioinformatics: Sequence and Genome Analysis, David W. Mount, Cold Spring Harbor Laboratory Press, 2nd Edition, 2005.
3. Bioinformatics and Functional Genomics: A Short Course, Jonathan Pevsner, Wiley-Liss, 3rd Edition, 2015.

4. Data Mining Concepts and techniques, Han & Kamber, Elsevier, 3rd Edition, 2011.
5. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, 4th Edition, 2014.
6. Developing Bioinformatics Computer Skills, Cynthia Gibas and Per Jambeck, O'Reilly, 1st Edition, 2001 .

BRAINWARE UNIVERSITY
SCHOOL OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Bachelor of Technology in Computer Science & Engineering - Artificial Intelligence & Machine Learning 2023

Course Code: PEC-CSM591C

Course Name: Cloud Computing Lab

Contact: 3P

Credit: 1.5

Allotted Hour: 45L

Course Objective:

The core objective of cloud computing lab is to configure various virtualization tools such as Virtual Box, VMware workstation, design and deploy a web application in a PaaS environment, simulate a cloud environment to implement new schedulers. It helps to Install and uses a generic cloud environment that can be used as a private cloud and design manipulate large data sets in a parallel environment.

Pre-requisite(s): Computer fundamental, programming basics and computer network.

Course Outcome: After the completion of the course, students will be able to:

CO1: Find and relate the basic concepts of cloud computing.

CO2: Demonstrate and identify different techniques of cloud computing.

CO3: Interpret and apply the installation of cloud platforms.

CO4: Build and assess a cloud scenario.

Module I: **[9H]**

Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows 7 or 8. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.

Module II: **[9H]**

Install Google App Engine. Create hello world app and other simple web applications using python/java. Use GAE launcher to launch the web applications.

Module III: **[9H]**

Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Module IV: **[9H]**

Find a procedure to transfer the files from one virtual machine to another virtual machine.

Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version).

Module V: **[9H]**

Install Hadoop single node cluster and run simple applications like wordcount.

Text books:

1. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Prentice Hall, 2013.
2. Architecting the Cloud: Design Decisions for Cloud Computing Service Models, Michael J. Kavis, Wiley, 2014.