**M.D UNIVERSITY**

**SCHEME OF STUDIES AND EXAMINATION**

**M.TECH 1st YEAR (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

**SEMESTER 1st**

| Course No. | Subject | Teaching Schedule | | | | Examination Schedule (Marks) | | | | Duration on of Exam (Hours ) | No of hours/ week |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credit | Marks of Class works | Theory | Practical | Total | | |
| 21MT21C1 | C++ & Data Structures | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT21C2 | Introduction to Intelligent System | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT21C3 | Data Mining & Big Data Analytics | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT21C4 | Software Engineering | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT21C5 | Python Programming | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT21CL 1 | Software lab 1 based on 21MT21C1 | | 0 | 2 | 1 | 50 | | 50 | 100 | - | 2 |
| 21MT21CL 2 | Software lab 2 based on 21MT21C5 | | | 2 | 1 | 50 | | 50 | 150 | - | 2 |
| | **TOTAL** | | | | **22** | | | | | | |

**NOTE:**

Examiner will set nine questions in total. Question One will be compulsory and will comprise of all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

## 21MT21C1 C++ AND DATA STRUCTURES

**Marks credits**

| L T P | | | |
|---|---|---|---|
| 4 - - | **Exam:** | **100** | **4** |
| | **Sessional:** | **50** | |
| | **Total:** | **150** | **4** |

By the end of the course the students will be able to:
CO1: Understand concept of object oriented programming and its features.
CO2: Gain insights about C++ features and access specifies.
CO3: Able to understand importance of polymorphism and inheritance.
CO4: Learn to analyze algorithms on basis of their performance.
CO5: Ability to use stack, queue and linked list data structures.

**Note:** Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-I**

**Introduction to OOP**: Concept of OOP, Procedural vs. Object oriented programming, Characteristics of OOP: Objects, classes, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, and Message Passing.
**C++ Programming**: Data-types, Variables, Static Variables, Operators in C++, Arrays, Strings, Structure, Functions, Recursion, Control Statements.
**Access Specifies**: Private, Public and Protected, Member functions of the class, Constructor and Destructor, Parameterized Constructor, Copy Constructors.

**UNIT-II**

**Inheritance**: Reusability, Types of Inheritance: Single inheritance, Multiple, Multilevel, Hybrid Inheritance, Public, Private, and Protected Derivations.
Polymorphism: Function Overloading, Static Class Members, Static Member Functions, Friend Functions.
**Operator Overloading**: Unary and Binary Operator Overloading, Abstract class, Virtual function, pure virtual function, Overloading vs. Overriding.
**Memory management**: new, delete, object Creation at Run Time. Exception handling: Throwing, Catching, and Re-throwing an exception.

**UNIT-III**

**Design and Analysis of Algorithm**: Algorithm definition, comparison of algorithms. Top down and bottom up approaches to Algorithm design.
Introduction to Data Structures: Concept of Data Structure, Types of Data Structure: Primitive and non–primitive.
**Arrays:** Single and Multidimensional arrays. Address calculation using column and row major ordering. Various Operations on arrays. Applications of arrays.
Sorting: Selection sort, Insertion sort, Bubble sort, Quick sort, merge sort, Radix sort.

**Searching:** Sequential and binary search, Indexed search, Hashing Schemes. Comparison of time complexity.

**UNIT-IV**

**Stacks and Queues**: Representation of stacks and queues using arrays and linked-list. Applications of stacks: Conversion from infix to postfix and prefix expressions, Evaluation of postfix expression using stacks.
**Linked list**: Singly linked list; operations on list, Linked stacks and queues. Polynomial representation and manipulation using linked lists. Circular linked lists, Doubly linked lists.
**Applications of Stack, Queue and Linked List data structures**.

**Suggested Readings**:


1. Herbert Schildt: C++ - The Complete Reference, Tata McGraw Hill Publications
2. E. Balaguruswamy: C++, Tata McGraw Hill Publications.
3. E. Balaguruswamy: Object Oriented Programming and C++, TMH.
4. Shah & Thakker: Programming in C++, ISTE/EXCEL.
5. Johnston: C++ Programming Today, PHI.
6. Olshevsky: Revolutionary Guide to Object Oriented Programming Using C++, SPD/WROX.
7. R.Rajaram: Object Oriented Programming and C++, New Age International.
8. Samanta: Object Oriented Programming with C++ & JAVA, PHI.
9. Subburaj: Object-Oriented Programming with C++, VIKAS Publishing House.
10. Any other book(s) covering the contents of the paper in more depth.


Note: Latest and additional good books may be suggested and added from time to time.

# Introduction to Intelligent Systems

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam:** | **100** | **4** |
| **4 - -** | **Sessional:** | **50** | |
| | **Total:** | **150** | **4** |

**Course Outcomes**

CO1: Ability to Describe 'What is Intelligence', 'What are Intelligent Systems', 'How basic Intelligent Systems work', and "Different kinds of Intelligent Systems'
CO2: Ability to Explain basic Intelligent Systems Representation, Reasoning and Processing techniques
CO3: Ability to Explain various sub-fields of Intelligent Systems such as Computer Vision, Natural Language Processing, Robotics etc.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-I**

**Introduction to Intelligent Systems**: What is Intelligence, What are Intelligent Systems, Characteristics of Intelligent Systems, Applications of Intelligent Systems.

**Knowledge Representation**: Knowledge Representation techniques overview, Reasoning, Logic and Inferences - an overview

**UNIT-II**

**Prolog programming** – Basics of Prolog Programming
**Machine Learning**: Basic machine learning concepts, Machine learning applications
Natural Language processing - concepts and techniques, NLP applications

**UNIT-III**

**Computer vision** :Computer vision processing techniques, Computer vision applications
Robotics-Robotics basics, Robotic applications

**UNIT-IV**

Active and passive sensing - IoT and AI, Active and passive sensing - Intelligent IoT applications, Neuro-cognition Algorithms, Biological applications

Suggested Readings

1. S. Russel and P. Norvig, —Artificial Intelligence – A Modern Approach‖, Second Edition, Pearson Edu
2. Rich and Knight, —"Artificial Intelligence", Tata McGraw Hill, 1992
3. KM Fu, "Neural Networks in Computer Intelligence", McGraw Hill

# DATA MINING & BIG DATA ANALYTICS

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

Course Outcomes: By the end of the course the students will be able to:

CO1: Understand Data Mining Systems and Pattern Analysis.
CO2: Understand Classification and Clustering techniques.
CO3: Identify Big Data and relevance of Big Data Analytics.
CO4: Understand Map Reduce and its features.
CO5: Understand Hadoop and Hadoop Eco-System.

**Note:**
Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-I**

**Data Mining Concepts**: Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, Applications, Data Objects and Attribute types, Statistical description of data; Data Pre-processing – Cleaning, Integration, Reduction, Transformation and Discretization; Data Visualization, Data similarity and dissimilarity measures.

**Frequent Pattern Analysis**: Mining Frequent Patterns, Associations and Correlations; Mining Methods- Pattern Evaluation Method, Pattern Mining in Multilevel; Multi-Dimensional Space – Constraint Based Frequent Pattern Mining; Classification using Frequent Patterns.

**UNIT-II**

**Classification and Clustering**: Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection, Techniques to improve Classification Accuracy. Clustering Techniques: Cluster analysis, Partitioning Methods - Hierarchical Methods, Density Based Methods, Grid Based Methods; Evaluation of clustering, Clustering high dimensional data, Clustering with constraints, Outlier analysis-outlier detection methods.

**WEKA Tool**: Introduction to Datasets, WEKA sample Datasets, Data Mining Using WEKA tool.

**UNIT-III**

**Overview of Big Data and Hadoop**: Types of Digital Data, Overview of Big Data, Challenges of Big Data,Modern Data Analytic Tools, Big Data Analytics and Applications;Overview and History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Environment.

**HDFS**: Concepts of Hadoop Data File System, Design of HDFS, Command Line Interface, Hadoop file system interfaces, Data flow; Hadoop I/O: Compression and Serialization.

**UNIT - IV**

**Map Reduce**: Introduction, Map Reduce Features, How Map Reduce Works, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats.

**Hadoop Eco System**: Pig - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data

and User Defined Functions. Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction.

**Data Analytics with R**: Introduction of R and Big R, Collaborative Filtering, Big Data Analytics with Big R.

**Suggested Readings:**

1. Jiawei Han & Micheline Kamber: Data Mining - Concepts & Techniques, Harcourt India PVT Ltd. (Morgan Kaufmann Publishers).
2. I.H. Whiffen: Data Mining, Practical Machine Learning tools & techniques with Java (Morgan Kanffmen)
3. A.K. Pujari: Data Mining Techniques, University Press.
4. Pieter Adriaans Dolf Zant inge: Data Mining, Addition Wesley.
5. David Hand, Heikki Mannila, and Padhraic Smyth: Principles of Data Mining, PHI Publication.
6. Michael Berthold, David J. Hand: Intelligent Data Analysis, Springer.
7. Tom White: Hadoop- The Definitive Guide, Third Edition, O'reilly Media.
8. Seema Acharya, Subhasini Chellappan: Big Data Analytics, Wiley.
9. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos: Understanding BigData: Analytics for Enterprise Class Hadoop and Streaming Data, Mc Graw Hill publishing.
10. Anand Rajaraman and Jeffrey David Ullman: Mining of Massive Datasets, Cambridge University Press.
11. Bill Franks: Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streamswith Advanced Analytics, John Wiley &Sons.
12. Glenn J. Myatt: Making Sense of Data, John Wiley & Sons.
13. Pete Warden: Big Data Glossary, O'Reilly.
14. Zikopoulos, Paul, Chris Eaton: Understanding Big Data- Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications.

**Note**: Latest and additional good books may be suggested and added from time to time

## SOFTWARE ENGINEERING

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Understand basic concept of Software Engineering and the phases in a software project.
CO2: Comprehend fundamental concepts of requirements engineering and SRS document.
CO3: Know about software design process and design methodologies.
CO4: Learn various software testing level and software project management activities.
CO5: Learn software maintenance types and software configuration management activities.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV.

Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT – I**

**Introduction:** Software Crisis, Software Processes, Software life cycle models: Waterfall, Prototype, Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM.

**Software Metrics**: Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow
Metrics.

**UNIT – II**

**Software Project Planning:** Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

**Software Requirement Analysis and Specifications**: Problem Analysis, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping.

**UNIT – III**

**Software Design**: Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design.

**Software Reliability**: Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Calendar time Component, Reliability Allocation.

**UNIT – IV**

**Software Testing**: Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: Path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools & Standards.

**Software Maintenance**: Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Reengineering, Configuration Management, Documentation.

**Suggested Readings:**

[T1] R. S. Pressman, —Software Engineering – A practitioner‘s approach‖, 3rd ed., McGraw Hill Int. Ed., 1992.
[T2] K.K. Aggarwal & Yogesh Singh, —Software Engineering‖, New Age International, 2001
Suggested readings:
[R1] R. Fairley, —Software Engineering Concepts‖, Tata McGraw Hill, 1997.
[R2] P. Jalote, —An Integrated approach to Software Engineering‖, Narosa, 1991.
[R3] Stephen R. Schach, —Classical & Object Oriented Software Engineering‖, IRWIN, 1996.
[R4] James Peter, W Pedrycz, —Software Engineering‖, John Wiley & Sons
[R5] I. Sommerville, —Software Engineering‖, Addison Wesley, 1999

# Python Programming

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: To understand the python language

CO2: To understand the concept of python packages.

CO3: To understand the database with python.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-I**

**Introduction to Python**: History and Origin of Python Language, Features, Python, Two modes of using Python interpreter, variable and data types, operator and their precedence, Python string & slicing, Python lists, mutable and immutable types, Input from keyboard.. Loops and Iterations, Functions, Strings & Lists.

**UNIT-II**

**Modules and Packages**: Python Modules and Packages, Different ways to import Packages, File Input/output,The pickle module, Formatted Printing, Exception Handling.

**Arrays and Matrices**: The NumPy Module, Creating Arrays and Matrices, Copying,

**UNIT-III**

**Introduction to Pandas** : History of pandas, Advantages, Getting started with pandas, Data structures for manipulating data, Selecting data from pandas data frame, Slicing and dicing using pandas, Strings with pandas, Cleaning up messy data with pandas, Selecting entries and dropping entries.

**UNIT-IV**

**Files and Streams**: File modes and permissions, Reading & Writing data from a file, Redirecting output streams to files, Working with directories, CSV files and Data Files.

**Python and Databases**: ODBC and Python, Working with database in MySQL Arithmetic Operations, Cross product & Dot product , Saving and Restoring, Matrix Inversion, Vectorized Functions.

**Suggested readings:**

1. Fluent Python: Clear, Concise, and Effective Programming, by Luciano Ramalho
2. Learn Python 3 The Hard Way, by Zed A. Shaw
3. Head First Python: A Brain-Friendly Guide, by Paul Barry
4. Python Tricks by Dan Bader
5. Automating Boring Stuff with Python

**M.D UNIVERSITY**

**SCHEME OF STUDIES AND EXAMINATION**

**M.TECH 1st YEAR (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

**SEMESTER 2ND**

| Course No. | Subject | Teaching Schedule | | | | Examination Schedule (Marks) | | | | Duration on of Exam (Hours ) | No of hours/ week |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credit | Marks of Class works | Theory | Practical | Total | | |
| 21MT22C1 | Machine learning | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT22C2 | Natural Language Processing and Speech Recognition | 4 | 0 | 0 | 4 | 50 | 100 | | 150 | 3 | 4 |
| 21MT22C3 | Data Science | 4 | 0 | 0 | 4 | 50 | 100 | | 150 | 3 | 4 |
| 21MT22C5 | Human Computer Interaction | 4 | 0 | 0 | 4 | 50 | 100 | | 150 | 3 | 4 |
| 21MT22CL 1 | Software Lab 3 based on 21MT22C1 | | 0 | 2 | 1 | 50 | | 50 | 100 | - | 2 |
| 21MT22Cl 2 | Software Lab 4 based on 21MT22C2 | | | 2 | 1 | 50 | | 50 | 100 | - | 2 |
| | Foundation Elective | | | | 2 | | | | | | |
| | Open Elective | | | | 3 | | | | | | |
| | **TOTAL** | | | | **23** | | | | | | |

### Open Elective:

A candidate has to select this paper from the pool of Open Electives provided by the University.

### Foundation Elective:

A candidate has to select this paper from the pool of Foundation Electives provided by the University.

# MACHINE LEARNING

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Understand the basic concept of Machine learning.

CO2: Understand supervised, unsupervised and reinforcement learning.

CO3: To understand the concepts of modules, packages, 2D & 3D visualization, database and concepts relating machine learning using Python

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

## UNIT-I

**Introduction**: Basic concepts: Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

**Types of Learning**: Supervised learning and unsupervised learning. Overview of classification: setup, training, test, validation dataset, over fitting.

**Classification Families**: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor.

## UNIT-II

Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines: Optimal hyper plane, Kernels. Model selection and feature selection. Combining classifiers: Bagging, boosting (The Ada boost algorithm), Evaluating and debugging learning algorithms, Classification errors.

**UNIT-III**

**Unsupervised learning**: Clustering. K-means. EM Algorithm. Mixture of Gaussians.
Factor analysis. PCA (Principal components analysis), ICA (Independent components analysis), latent semantic, indexing. Spectral clustering, Markov models Hidden Markov models (HMMs).

**UNIT-IV**

**Reinforcement Learning and Control**: MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR). LQG. Q-learning. Value function approximation, Policy search. Reinforce. POMDPs.

**Suggested readings:**

[T1] Tom M Mitchell, Machine Learning, McGraw Hill Education
[T2] Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
[T3] Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: WileyInterscience, 2000. ISBN: 9780471056690.
[T4] Tom M. Mitchell, Machine Learning .ISBN – 9781259096952, McGraw-Hill Series, Edition – First
[R1] Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
[R2] Introduction to Machine Learning - Ethem Alpaydin, MIT Press, Prentice hall of India.

## NATURAL LANGUAGE PROCESSING & SPEECH RECOGNITION

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Understand Natural Language Processing, Probabilistic model of defining language and techniques.

CO2: Applying Hidden Markov model and Speech Recognition.

CO3: Application of context free grammar and language parsing.

CO4: Implement probabilistic and language parsing.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

### UNIT – I

**Introduction to Natural Language Processing**: NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity.

**Regular Expressions**: Regular Expressions, Automata, Similarity Computation: Regular Expressions, patterns, FA, Formal Language, NFSA, Regular Language and FSAs, Raw Text Extraction and Tokenization, Extracting Terms from Tokens, Vector Space Representation and Normalization, Similarity Computation in Text.

**Morphology and Finite-State Transducers**: Inflection, Derivational Morphology, FiniteState Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing.

### UNIT - II

**Matrix Factorization and Topic Modeling**: Introduction, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation Computational

**Phonology and Text-to-Speech**: Speech Sounds and Phonetic Transcription, The Phoneme and Phonological Rules, Phonological Rules and Transducers, Advanced Issues in Computational Phonology, Machine Learning of Phonological Rules, Mapping Text to Phones for TTS, Prosody in TTS .

**Probabilistic Models of Pronunciation and Spelling**: Dealing with Spelling Errors, Spelling Error Patterns, Detecting NonWord Errors, Probabilistic Models, Applying the Bayesian method to spelling, Minimum Edit Distance, English Pronunciation Variation, The Bayesian method, Pronunciation in Humans.

**N-gram Language Models**: The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Smoothing, Backoff, Deleted Interpolation, N-grams for Spelling and Pronunciation, Entropy.

**UNIT - III**

**HMMs and Speech Recognition**: Speech Recognition Architecture, Overview of Hidden Markov Models, The Viterbi Algorithm Revisited, Advanced Methods for Decoding, Acoustic Processing of Speech, Computing Acoustic Probabilities, Training a Speech Recognizer, Waveform Generation for Speech Synthesis, Human Speech Recognition. Word Classes and Part-of-Speech Tagging: Tagsets for English, Part of Speech Tagging, Rule-based Part-of-speech Tagging, Stochastic Part-of-speech Tagging, Transformation Based Taggin.

**Context-Free Grammars for English**: Context-Free Rules and Trees, Sentence-Level Constructions, The Noun Phrase, Coordination, Agreement and The Verb Phrase and Sub- categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence & Normal Form, Finite State & Context-Free Grammars, Grammars & Human Processing.

**UNIT - IV**

**Parsing with Context-Free Grammars and Features and Unification**: Parsing as Search, A Basic Top-down Parser, The Earley Algorithm, Finite-State Parsing Methods, Feature Structures, Unification of Feature Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints, Types and Inheritance

**Lexicalized and Probabilistic Parsing**: Probabilistic Context-Free Grammars, Problems with PCFGs, Probabilistic Lexicalized CFGs, Dependency Grammars, Human Parsing, The Chomsky Hierarchy, How to tell if a language isn't regular, Natural Language Context-Free or not, Complexity and Human Processing.

**Representing Meaning and Semantic Analysis**: Computational Desiderata for Representations, Meaning Structure of Language, First Order Predicate Calculus, Some Linguistically Relevant Concepts, Alternative Approaches to Meaning, Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Earley Parser, Idioms and Compositionality, Robust Semantic Analysis

**Text Sequence Modeling and Deep Learning**: Statistical Language Models, Kernel Methods, Word-Context Matrix Factorization Models, Neural Language Models, Recurrent Neural Networks.

**Suggested Readings**:

1. Daniel Jurafsky and James H.Martin: Speech and Language Processing(2nd Edition),Prentice Hall:2 edition,2008.
2. Charu C.Aggarwal: Machine Learning for Text Springer,2018 edition
3. Christopher D.Manning and Hinrich Schuetze: Foundations of Statistical Natural Language Processing MIT press.
4. Steven Bird,Ewan Klein and Edward Loper: Natural Language Processing with Python,O'Reilly Media.
5. Roland R.Hausser: Foundations of Computational Linguistics:HumanComputer Communication in Natural Language,Paperback,MIT press..
6. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

# Data Science

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**CO1:** Students will be able to perform exploratory analysis of multivariate data and scientific data Visualization.

**CO2:** Student will be able to conduct statistical hypothesis testing

**CO3:** Student will be able to use regression techniques for predictive data analytics and time series modeling.

**CO4:** Students will build capability of real life problem solving and dealing with large data.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

## UNIT-I

Random variable, distribution, Maximum Likelihood Estimation usingmaxLik, basic multivariate stats - matrix summarisation, Simpson's paradox, variance- covariance, correlation, canonical correlation; Data preprocessing, exploratory data analysis and high quality visualisation. Advanced scientific plots - stacked histograms for multivariate data, bi-variate scatter plots, parallel coordinate plot, table plot, mosaic plot etc**.**

## UNIT-II

Goodness of fit - likelihood ratio test, Lagrange multiplier test, Q-Q plot, performing varity of hypothesis testings. Dimension reduction using PCA, SVD, tSNE. Generalised linear models (GLM) with various link functions (eg logit). Specific focus on gamma regression

## UNIT-III

Time series modeling using autoregressive errors (AR), moving average (MA), ARIMA - stationary and non-stationary time series data, mean stationarity, trend stationarity, statistical test for stationarity. Survival Analysis using survfit - Kaplan Meier survival density estimation, Cox proportional hazards model, Gaussian mixture model and Naive Bayes, assessment of model performance

**UNIT-IV**

Bootstrapping and Monte Carlo methods, randomisation test. Introduction to handling large data - locality sensitive hashing, sizing sketches, corset, Applications - gene expression, EHR data, demand forecasting, price optimisation in retal, probability of default in banking

**Suggested Readings**

[1] Han, Jiawei, Jian Pei, and Micheline Kamber. Data mining: concepts and techniques. Elsevier, 2011.
[2] Tan, Pang-Ning. Introduction to data mining. Pearson Education India, 2007.
[3] Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning. Vol. 1. No. 10. New York, NY, USA:: Springer series in statistics, 2001.
[4] Shalev-Shwartz, Shai, and Shai Ben-David. Understanding machine learning: From theory to algorithms. Cambridge university press, 2014.
[5] R for Data Science, by Garrett Grolemund and Hadley Wickham (2016)
[6] Exploratory Data Analysis with R, by Roger D. Peng (2016)
[7] An Introduction to Statistical Learning with Application in R, First Edition, by Gareth James et al. (2013)
[8] Introduction to linear algebra, by Gilbert Strang

# HUMAN COMPUTER INTERACTION

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: To understand the process of interaction between human and computer.

CO2: To understand the rapid prototyping, techniques for gathering data.

CO3. To access usefulness and usability of interaction designs.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT I**

**Introduction**: The Human, The Computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles and Theories.

**Design Process**: Interaction design basics, HCI in the software process, Design rules, Implementation support,

Evaluation techniques, Universal design, User Support.

**UNIT II**

**Models and Theories**: Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modelling rich interaction.

**UNIT III**

**Interaction Styles**: Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation.

**UNIT IV**

**Design Issues**: Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization.
**Outside the Box**: Group ware, Ubiquitous computing and augmented realities, Hypertext, Multimedia and the World Wide Web.

**Suggested Reading:**
[T1] Alan Dix, Janet Finlay, —Human Computer Interaction‖, ISBN: 9788131717035 Pearson Education, 2004.
[T2] Ben Shneiderman, —Designing the User Interface-Strategies for Effective Human Computer Interaction‖,
ISBN:9788131732557, Pearson Education , 2010
Suggested readings:
[R1] Usability Engineering: Scenario-Based Development of Human-Computer Interaction, by Rosson, M. and Carroll, J. (2002)
[R2] The Essentials of Interaction Design, by Cooper, et al. , Wiley Publishing(2007)
[R3] Usability Engineering, by Nielsen, J. Morgan Kaufmann, San Francisco, 1993. ISBN 0-12-518406-9
[R4] The Resonant Interface: HCI Foundations for Interaction Design , by Heim, S. , Addison-Wesley. (2007)
[R5] Usability engineering: scenario-based development of human-computer interaction, By Rosson, M.B & Carroll, J.M. , Morgan Kaufman.(2002)

**M.D UNIVERSITY**

**SCHEME OF STUDIES AND EXAMINATION**

**M.TECH 2ND YEAR (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

**SEMESTER 3RD**

| Course No. | Subject | Teaching Schedule | | | | Examination Schedule (Marks) | | | | Duration on of Exam (Hours ) | No of hours/ week |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total Credit | Marks of Class works | Theory | Practical | Total | | |
| 21MT23C1 | Cyber Security & Block Chain Technology | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT23C2 | Neural Network and Deep Learning | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT23C3 | Elective I<br>i)Network Programming<br>ii)Cloud Computing<br>iii)Network security | 4 | 0 | - | 2 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT23C4 | Elective II<br>i)Mixed reality & wearable computing<br>ii)Web development using PHP<br>iii)High speed network | 4 | 0 | - | 2 | 50 | 100 | - | 150 | 3 | 4 |
| 21MT23CL1 | Software lab 5 based on 21MT23C2 | | 0 | 2 | 2 | 50 | | 50 | 100 | | 2 |
| 21MT23CL2 | Software lab 6 based on Elective I and/ or Elective II | | 0 | 2 | 2 | 50 | | 50 | 100 | - | 2 |
| 21MT23CL3 | Seminar | 2 | 0 | 0 | 2 | 50 | | | 50 | - | 2 |
| 21MT23CL4 | Dissertation-I | 2 | 0 | 0 | 0 | 50 | | | 50 | | 2 |
| | **TOTAL** | | | | **18** | | | | | | |

# CYBER SECURITY & BLOCKCHAIN TECHNOLOGY

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Become familiar with the concepts of cyber threats, cyber crime, cyber security and understand the vulnerability scanning.

CO2: Understand network defence tools and web application tools.

CO3: To learn about cyber crime, hacking attacks and cyber laws.

CO4: Understand the concepts of blockchain technology & its need and cryptocurrency.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT - I**

**Introduction to Cyber Security:** Overview of Cyber Security, Internet Governance – Challenges and Constraints; Cyber Threats: Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage; Need for a Comprehensive Cyber Security Policy.

Introduction to Vulnerability Scanning: Overview of vulnerability scanning, Open Port/Service Identification, Banner/Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit.

**Network Vulnerability Scanning**: Netcat, Socat; understanding Port and Services tools - Datapipe, Fpipe, WinRelay; Network Reconnaissance – Nmap, THC-Amap and System tools, Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping, Kismet.

**UNIT - II**

**Network Defense Tools**: Firewalls and Packet Filters - Firewall Basics, Packet Filter Vs Firewall; Network Address Translation (NAT) and Port Forwarding; Basics of Virtual Private Networks, Linux Firewall, Windows Firewall.

**Web Application Tools**: Scanning for web vulnerabilities tools- Nikto, W3af; HTTP utilities - Curl, OpenSSL; and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap.

DVWA, Webgoat; Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTCHydra.

**UNIT - III**

**Cyber Crimes and Law**: Introduction to Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Digital Forensics, Realms of the Cyber world, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.

**Cyber Crime Investigation**: Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

**UNIT - IV**

**Blockchain Technology**: Cryptography - Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof; Blockchain Overview: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

**Blockchain Applications**: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

**Suggested Readings**:

1. Mike Shema: Anti-Hacker Tool Kit, McGraw Hill
2. Nina Godbole and Sunit Belpure: Cyber Security Understanding Cyber Crimes, ComputerForensics and Legal Perspectives, Wiley.
3. Achyut S.Godbole: Data Communication and Networking, McGraw –Hill Education New Delhi.
4. Forouzan: Data Communication and Networking (Global Edition) 5/e, McGraw Hill Education India.
5. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder: Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press.
6. Wattenhofer: The Science of the Blockchain.
7. Antonopoulos: Mastering Bitcoin - Unlocking Digital Cryptocurrencies.
8. Satoshi Nakamoto: Bitcoin: A Peer-to-Peer Electronic Cash System
9. Forouzan, B.A.: Cryptography & Network Security. Tata McGraw-Hill Education.
10. Kahate, A. Cryptography and Network Security. McGraw-Hill Higher Ed.
11. Peter Szor , The Art of Computer Virus Research and Defense, Symantec Press.
12. Markus Jakobsson and Zulfikar Ramzan, Crimeware, Understanding New Attacks

and Defenses, Symantec Press, 2008, ISBN: 978-0-321-50195-0.
13. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
14. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', CSI Publishing Platform, 2017.
15. Any other book(s) covering the contents of the paper in more depth.
**Note:** Latest and additional good books may be suggested and added from time to time

## NEURAL NETWORKS & DEEP LEARNING

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**
By the end of the course the students will be able to:
CO1: To cover the fundamentals of neural networks and deep learning.
CO2: To cover advanced topics such as recurrent neural networks, long short term memory cells.
CO3: To understand Recurrent neural network, convolutional neural network and theorem for Generative models.
CO4: To implement programming assignments related to neural network's topics.
CO5: To understand the concept of Deep reinforcement learning.

**Note:**
Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-1**

**Introduction**: Biological neuron, Idea of Computational units, McCulloch-Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning algorithm, Linear separability; Convergence theorem for Perceptron Learning algorithm.

**Feedforward Networks**: Empirical Risk Minimization, Regularizing a deep network, model exploration and hyper parameter tuning.
**Deep Learning**: Historical context and motivation for deep learning, Basic Supervised classification task, Optimizing logistic classifier using gradient descent, Stochastic gradient descent, Momentum, and adaptive sub-gradient method.

**UNIT-II**

**Deep Neural Networks**: Difficulty of training deep neural networks, Greedy layerwise training.
**Better Training of Neural Networks**: Newer optimization methods for neural networks (Adagrad, Adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in Neural network, Regularization methods.
**Recurrent Neural Network**: Bidirectional RNNs, Encoder-Decoder sequence to sequence architecture, Backpropagation through time, Long Short Term Memory (LSTM), Gated Recurrent Units, Bidirectional LSTMs, Deep Recurrent networks.

**UNIT-III**

**Convolutional Neural Networks**: Basics of convolutional neural networks, stacking, striding and pooling, Applications such as image and text classification, LeNet, AlexNet.

**Generative Models**: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, Gradient computations in RBMs, Deep Boltzmann Machines.

**Recent Trends**: Varitional Autoencoders (Undercomplete autoencoders, regularized autoencoders, sparse autoencoders, denoising autoencoders), Representational power, layer, size and depth of autoencoders, Stochastic encoders and decoders, Generative Adversarial Networks, Multi-Task Deep Learning, Multi-view Deep learning.

**UNIT-IV**

**Deep Reinforcement Learning**: Basic concepts of Deep Reinforcement Learning (DRL), DRL process and RL approaches, Algorithms of DRL (Value Learning, Policy Learning), QLearning algorithm and its implementation, Digging deeper into Q function, Deep QLearning algorithm and its implementation with Tensorflow, Deep Q-Network, DRL Applications. Policy optimization: Introduction to policy-based methods, Policy Gradient, Model based RL, Recent Advances and Applications.

**Suggested Readings:**

1. Ian Goodfellow: Deep Learning, MIT Press.
2. Jeff Heaton: Deep Learning and Neural Networks, Heaton Research Inc.
3. Mindy L Hall: Deep Learning, VDM Verlag.
4. Li Deng, Dong Yu: Deep Learning: Methods and Applications (Foundations and Trends

in Signal Processing), Now Publishers Inc.
5. Richard S. Sutton and Andrew G. Barto: Reinforcement Learning: An Introduction, Second Edition, MIT Press.
6. Wiering, Marco, and Martijn Van Otterlo: Reinforcement learning - Adaptation, Learning, and Optimization.
7. Russell, Stuart J., and Peter Norvig: Artificial Intelligence: AModern Approach, Pearson Education Limited.
8. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville: Deep learning, MIT Press.
9. Any other book(s) covering the contents of the paper in more depth.
Note: Latest and additional good books may be suggested and added from time to time

## NETWORK PROGRAMMING

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**

By the end of the course the students will be able to:
CO1: Understand TCP/IP and Network Architecture.
CO2: Creating sockets and socket implementation.
CO3: Windows Socket API and their programming.
CO4: Web programming and implementing security.
CO5: Performing client side programming and server side programming.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT- I**

**Introduction**: Overview of UNIX OS, Environment of a UNIX process, Process control, Process relationships Signals, Interprocess Communication, Overview of TCP/IP, Network architecture, UUCP, XNS, IPX/SPX for LANs, TCP & IP headers, IPv4 & v6 address structures.

**Socket Programming**: Creating sockets, Posix data type, Socket addresses, Assigning address to a socket, Java socket programming, Thread programming, Berkeley Sockets: Overview, socket address structures, byte manipulation & address conversion functions, elementary socket system calls – socket, connect, bind, listen, accept, fork, exec, close, TCP ports (ephemeral, reserved), Berkeley Sockets: I/O asynchronous & multiplexing models, select & poll functions, signal & fcntl functions, socket implementation (client & server programs), UNIX domain protocols.

**UNIT- II**

**APIs & Winsock Programming**: Windows socket API, window socket & blocking I/O model, blocking sockets, blocking functions, timeouts for blocking I/O, API overview, Different APIs & their programming technique, DLL & new API's, DLL issues, Java Beans.

**UNIT- III**

**Web Programming & Security**: Java network programming, packages, RMI, Overview of Javascript, WAP architecture & WAP services, Web databases, Component technology, CORBA concept, CORBA architecture, CGI programming, Firewall & security technique, Cryptography, Digital Signature.

**UNIT- IV**

**Client Server Programming**: Client side programming:- Creating sockets, implementing generic network client, Parsing data using string Tokenizer, Retrieving file from an HTTP server, Retrieving web documents by using the URL class. Server side programming:- Steps for creating server, Accepting connection from browsers, creating an HTTP server, Adding multithreading to an HTTP server.

**Suggested Readings**:

1. W.Richard Stevens: Advanced Programming in the UNIX Environment, Addison Wesley.
2. W. Stevens, Bill Fenner, Andrew Rudoff: UNIX Network Programming -Volume 1 (The Sockets Networking API), Pearson Education/Prentice-Hall International.
3. Meeta Gandhi,Tilak Shetty and Rajiv Shah: The 'C' Odyssey Unix –The open Boundless C, BPB Publications.
4. Steven.W.R: UNIX Network Programming (Volume I& II), PHI.
5. Bobb Quinn and Dave Schutes: Window Socket Programming by
6. Davis.R.: Windows Network Programming, Addison Wesley.
7. Baner .P.: Network Programming With Windows Socket, Prentice Hall. 8. Any other book(s) covering the contents of the paper in more depth.

**Note:** Latest and additional good books may be suggested and added from time to time.

# CLOUD COMPUTING

| | | Marks | credits |
|---|---|---|---|
| **L T P** | **Exam :** | **100** | **4** |
| **4 - -** | **Sessional :** | **50** | |
| | **Total :** | **150** | **4** |

**Course Outcomes:**

By the end of the course the students will be able to:

**CO1:**Students will be able to understand cloud computing architecture.

**CO2:**Student will be able to understand models and layers.

**CO3:**Student will be able to use cloud simulator.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

## Unit I

**Cloud Computing Overview** Origins of Cloud computing – Cloud components - Essential characteristics – On-demand selfservice, Broad network access, Location independent resource pooling ,Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

## Unit II

**Cloud Insights-** Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

## Unit III

**Cloud Architecture**- Layers and Models Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service ( PaaS ), features of PaaS and benefits, Infrastructure

as a Service ( IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption.

**Cloud deployment model:** Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

**Unit IV**

**Cloud Simulators**- CloudSim and GreenCloud Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud

## Network Security

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**

By the end of the course the students will be able to:

**CO1:** Develop Concept of Security needed in Communication of data through computers and networks along with Various Possible Attacks

**CO2:** Understand Various Encryption mechanisms for secure transmission of data and management of key required for required for encryption

**CO3:**. Understand authentication requirements and study various authentication mechanisms

CO4: Understand network security concepts and study different Web security mechanisms.

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more

questions selecting one quest ion from each Unit.

**Unit I**

**Introduction**: Need for Security, Security Attacks , Services and Mechanisms, Network Security, Model

**Unit II**

**Ciphers:** Symmetric Ciphers, Substitution &Transposition Techniques , Block Cipher, DES, Triple DES, Stream Ciphers, RC4

**Unit III**

**Public Key Cryptography**: Need and Principles of Public Key Cryptosystems, RSA Algorithm, Key Distribution and Management, Diffie-Hellman Key Exchange, Digital Signatures

**Unit IV**

**Authentication**: Authentication Requirements, Message Authentication Codes, Hashes, MD5 & SHA, User Authentication: Password, Certificate based & Biometric Authentication, Kerberos

**Network Security**: Firewalls, IP Security, VPN, Intrusion Detection, Web Security, SSL,TLS

**Suggested readings:**


1. “Cryptography & Network Security”, PHI William Stalling
2. “Cryptography & Network Security”, Mc Graw Hill Atul Kahate
3. “Cryptography & Network Security”, PHI Forouzan
4. "Modern Cryptography, Theory & Practice", Pearson Education. Wenbo Mao
5. "An Introduction to Mathematical Cryptography", Springer. Hoffstein, Pipher, Silvermman.
6. "The Design of Rijndael", Springer. J. Daemen, V. Rijmen.
7. "Algorithmic Cryptanalysis", CRC Press. A. Joux
8. "Number Theory", Tata Mc Graw Hill. S. G. Telang
9. "Protocols for Authentication and Key Establishment", Springer. C. Boyd, A. Mathuria.
10. "Computer Security", Pearson Education. Matt Bishop
11. “Understanding Cryptography”, Springer-Verlag Berlin Heidelberg Christof Paar, Jan Pelzl


## MIXED REALITY & WEARABLE COMPUTING

Marks credits

| L T P | Exam : | 100 | 4 |
|---|---|---|---|
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Knowledge of wearable computing

CO2: Understanding of various devices used in wearable computing

CO3: Understand the hardware and software requirements of wearable computing

CO4: Understand the cybernetics and humanistic intelligence

CO5: Knowledge of Internet of Everything

**Note:**

Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-I**

**Introduction**: History, Creative Coding Platforms, Open Source Platforms, PIC, Arduino, Sketch, Raspberry Pi, Iterative coding methodology. Python Programming - Mobile phones and similar devices, Arm Devices, Basic Electronics (circuit theory, measurements, parts identification)

**Sensors and Software**: Understanding Processing Code Structure, variables and flow control, Interfacing to the Real World.

**UNIT-II**

**Software &Hardware Frameworks**: Software-Open Frameworks as our IDE (C/C++) - Arduino Language (C/C++), Hardware- Desktop / Laptop / Raspberry Pi - How to approach a programming problem? Representing “reality” with computers. Digital vs. Analog circuits, audio, communication, etc. Analog to Digital Conversion (ADC) - Digital to Analog Conversion (DAC)– Microcontrollers - Communication – Serial & Parallel - Hardware to Hardware Communication - I2C/IIC (Inter-Integrated Circuit) - SPI (Serial Peripheral Interface) – Serial UART Communication.

**UNIT-III**

**Cybernetics and Humanistic Intelligence Wearables**: Augmented Reality – Mixed Reality. AR versus VR - IoT and Wearables: Smart Cites and Wearable Computing as a form of urban design - Advanced I/O – open Frameworks: Live Network feeds (push and pull) - Data persistence (saving data and preferences) - Database interface (MySQL, SQLite, XML, PHP/Web) - Arduino: Wired/Wireless Networking (hardware vs. USB proxy) - Software serial (RS-232).

**UNIT-IV**

**Internet of Everything**: Humanistic Intelligence; Wearable Computing and IoT (Internet of Things), Overview of Mobile and Wearable Computing, Augmented Reality, and Internet of Things. The fundamental axes of the Wearables + IoT + AR space - Free-roaming AR: Wearable Computing, Wireless, Sensing, and Meta sensing with light bulbs Phenomenal Augmented Reality: Real world physical phenomena as the fundamental basis of mobile and wearable AR.

**Suggested Readings** :

1. Woodrow Barfield : Fundamentals of Wearable Computers and Augmented Reality, Second Edition.
2. Omesh Tickoo, Ravi Iyer : Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design.
3. Josha Noble : Programming Interactivity, Second Edition.
4. Raspberry Pi: Getting Started with Python, second edition, 2016
5. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and good books may be added from time to time

## WEB DEVELOPMENT USING PHP

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Understand regular expressions including modifiers, operators, and meta characters.

CO2: Create PHP programs that use various PHP library functions, and that manipulate files and directories.
CO3: Analyze and solve various database tasks using the PHP language.
CO4: Analyze and solve common Web application tasks by writing PHP programs.
CO5: Formulate, design and create PHP control structures, including selection and iterative structures

**Note:**
Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT-I**

**Introduction to PHP**: Evolution of PHP & its comparison with other web programming languages, Interfaces to External systems, Hardware and Software requirements.
**Basic PHP Development**: PHP Scripting, Working of PHP scripts, Basic PHP syntax, PHP data types, Operators, Variable manipulation, Dynamic variables, Variable scope, and Accessing variable with the global statement Static vs. Dynamic Optimization, Google Caffeine.
**Control Statements**: if( ) and else if( ) condition Statement, The switch statement, Using while ( ) Loop, The do while statement, Using the for ( ) Loop, Breaking out of loops, Nesting loops.

**UNIT-II**

**String & Arrays**: Formatting String for Presentation, Formatting String for Storage, Joining and Splitting String, Comparing String, Matching and replace Substring. Arrays: Anatomy of an Array, Creating index based and Associative array, Accessing array Elements, Looping with Index based array, Looping with associative array using each( ) and foreach( ) loops, Library functions.
**Functions**: Function definition, Creation, Returning values, User-defined functions, Dynamic function, Function calls with the static statement, default arguments, passing arguments to a function by value.

**UNIT-III**

**Forms**: Working with Forms, Super global variables, Super global array, Importing user input, Accessing user input, Handling Html Form With PHP, Using hidden fields, Redirecting the user.
**Working with File and Directories**: Understanding file & directory, Opening and closing a file, Copying ; renaming and deleting a file, Working with directories, Building a text editor,

File Uploading & Downloading.

**Generating Images with PHP**: Basics computer Graphics, Creating Image , Manipulating Image , Using text in Image. Object Oriented concept using PHP: Classes, Objects, Polymorphism, Inheritance, Interface, Abstraction, Constructor, Destructor.

**UNIT-IV**

**PHP with MySQL**: Creating Connection, Selecting Database, Perform Database (query), Use returned data, close connections, file handling in PHP – reading and writing from and to FILE.

**Advance PHP Techniques:** Introduction about FTP/SMTP server, Math functions, File upload, File Download, E-mail with PHP, PHP configuration file, Error tackling and debugging.

**PHP Project Development**: Exposure of Requirements analysis of a Project and its development.

**Suggested Readings:**


1. Matt Doyle: Beginning PHP 5.3, Willey Publishing.
2. Steve Suehring, JavaScript Step by Step, Microsoft Press, PHI.
3. Harwani: Developing Web Applications in PHP and AJAX, McGraw Hill
4. P.J. Deitel & H.M. Deitel: Internet and World Wide Web- How to Program, Pearson.
5. Web Technologies, Black Book, Dreamtech Press.
6. Steven Holzner: PHP- The Complete Reference, Tata McGraw Hill.
7. Kevin Tetroi: Programming PHP, O' Reilly
8. Any other book(s) covering the contents of the paper in more depth.


**Note:** Latest and additional good books may be suggested and added from time to time.

## HIGH SPEED NETWORKS

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 100 | 4 |
| 4 - - | Sessional : | 50 | |
| | Total : | 150 | 4 |

**Course Outcomes:**

By the end of the course the students will be able to:

CO1: Understand high-speed networks and their relevance.

CO2: Learn about network performance evaluation and their analysis.

CO3: Understand ATM traffic management and integrated services.
CO4: Learn about protocols for QoS.
CO5: Understand Internet routing and analysis.

**Note:**
Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 20 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 20 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one quest ion from each Unit.

**UNIT - I**

**Frame Relay Network**: Introduction, Packet-Switching Networks, Frame Relay Networks; **Asynchronous Transfer Mode**: ATM Protocol Architecture and Logical Connection, ATM Cells, ATM Service Categories, ATM Adaption Layer; **High Speed LANs**: Fast Ethernet LAN, Gigabit Ethernet, ATM LAN, Network Attached Storage (NAS), Wireless LAN and Wi-Fi, LAN Interoperability.

**UNIT - II**

**Network Performance Evaluation Models**: Introduction, Overview of Probability and Stochastic Processes, Queuing Analysis, Self-Similarity Network Traffic.
**Congestion Management**: Congestion – An Overview, Effects of Congestion, Congestion Control, Traffic Management, Frame Relay Congestion Control, Flow Control Techniques, Error Control Techniques; TCP Traffic and Congestion Control: TCP Flow control, TCP Congestion Control, Performance of TCP over ATM.

**UNIT - III**

**ATM Traffic and Congestion Control**: ATM Traffic and Congestion Control, Traffic Management Framework, ABR Traffic Management, GFR Traffic Management**; Integrated Services**: Integrated Service (IntServ) Model, Flow and Service Description, Queuing Discipline, Integrated Services in IP-ATM Networks;
**Differentiated Services**: Differentiated Service Architecture, Scalability of DiffServ, DiffServ Functional Elements, Per-Hop Behavior (PHB), Models of DiffServ.

**UNIT - IV**

**Protocols for Quality of Service (QoS) Support**: Multicasting, Multicast Transport Protocol (MTP), Resource Reservation Protocol (RSVP), Real-Time Transport Protocol (RTP), Multiprotocol Label Switching (MPLS), Subnet Bandwidth Management (SBM), QoS Architectures, QoS Support for Multicast.

**Internet Routing Basics and Design**: Basicsof Graph Theory, Internet Routing Principles, Analysis of Shortest Route, Intra-DomainRouting Protocol, Border Gateway Protocol, Inter-Domain Routing Protocol (IDRP).

**Suggested Readings**:


1. Kaven Pahlavan and Prashant Krishnamoorthy: Principles of Wireless Network, Prentice Hall of India.
2. Adrian Farrel: The Internet And Its Protocols, Elsevier Publications.
3. Larry L. Peterson and Bruce S.Davie: Computer Networks, Elsevier Publications.
4. William Stallings: High-Speed Networks and Internets, Performance and Quality of Service, Pearson Publications.
5. Behrouz A. Forouzan: Data Communications and Networking, Fourth Edition, McGraw Hill.
6. B Muthukumaran: Introduction to High Performance Networks, Mcgraw-Hill
7. Douglas E. Comer: Internetworking with TCP/IP Volume – I, Principles, Protocols, and Architectures, Fourth Edition, Pearson Education.
8. Mahbub Hassan, Raj Jain: High Performance TCP/IP Networking, Concepts, Issues, and Solutions, Pearson Education.
9. Andrew S. Tanenbaum: Computer Networks, PHI.
10. James F. Kurose, Keith W. Ross: Computer Networking, A Top-Down Approach Featuring the Internet, Pearson Education.
11. Any other book(s)covering the contents of the paper in more depth.


**Note:** Latest and additional good books may be suggested and added from time to time.

**21MT23CL3** **SEMINAR**

| | | Marks | credits |
|---|---|---|---|
| L T P | Exam : | 50 | 2 |
| 2 - | Total : | 50 | 2 |

A candidate has to present a seminar on a recent topic/ technology/ research advancement and has to submit a seminar report. The marks will be given on the basis of seminar report, contents of the presentation, communication and presentation skills.

**M.D UNIVERSITY**

**SCHEME OF STUDIES AND EXAMINATION**

**M.TECH 2ND YEAR (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

**SEMESTER 4TH**

| COURSE NO. | SUBJECT | EXTERNAL MARKS | INTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|
| 21MT24C1 | Dissertation and viva (Dissertation Stage 2) | 500 | 250 | 750 | 20 |

NOTE: 1. Students have to publish a research paper in a journal / conference of the research work done in the semester.