# SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

## V and VI Semester
## (Machine Learning and Computing)

**Effective for the students admitted in year 2019-20 and onwards.**

**Approved by 7th AC Meeting held on 1st Nov. 2021 (Agenda 7.5)**



Dean Academics
Bikaner Technical University
Bikaner

# B.Tech.: Machine Learning & Computing
## 3rd Year - V Semester

| S.No. | Category | Course Code | Course Title | Contact hrs/week L | T | P | Marks Exam Hrs | IA | ETE | Total | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | |
| 1 | ESC | 5ML3-01 | Statistical Machine Learning | 2 | 0 | 0 | 2 | 20 | 80 | 100 | **2** |
| 2 | PCC/ PEC | 5ML4-02 | Theory of Computation | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 3 | | 5ML4-03 | Operating Systems | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 4 | | 5ML4-04 | Artificial Neural Networks | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 5 | | 5ML4-05 | Analysis of Algorithms | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 6 | | Professional Elective 1: (anyone) | | 2 | 0 | 0 | 2 | 20 | 80 | 100 | **2** |
| | | 5ML5-11 | Microprocessor and Interfaces | | | | | | | | |
| | | 5ML5-12 | Learning in Human and Machine | | | | | | | | |
| | | 5ML5-13 | Bioinformatics | | | | | | | | |
| | | **Sub Total** | | **16** | **0** | **0** | | **160** | **640** | **800** | **16** |
| **PRACTICAL & SESSIONAL** | | | | | | | | | | | |
| 7 | PCC | 5ML4-21 | Neural Networks Lab | 0 | 0 | 2 | 2 | 30 | 20 | 50 | **1** |
| 8 | | 5ML4-22 | Analysis of Algorithms Lab | 0 | 0 | 2 | 2 | 30 | 20 | 50 | **1** |
| 9 | | 5ML4-23 | Advance Java Lab | 0 | 0 | 2 | 2 | 30 | 20 | 50 | **1** |
| 10 | | 5ML4-24 | Probability and Statistical Programming Using R | 0 | 0 | 2 | 2 | 30 | 20 | 50 | **1** |
| 11 | PSIT | 5ML7-30 | Industrial Training | 0 | 0 | 1 | | 75 | 50 | 125 | **2.5** |
| 12 | SODECA | 5ML8-00 | Social Outreach, Discipline & Extra-Curricular Activities | | | | | | 25 | 25 | **0.5** |
| | | **Sub- Total** | | **0** | **0** | **9** | | **195** | **155** | **350** | **7** |
| | | **TOTAL OF V SEMESTER** | | **16** | **0** | **9** | | **355** | **795** | **1150** | **23** |

**L**: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits
**ETE:** End Term Exam, **IA:** Internal Assessment

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# B.Tech.: Machine Learning & Computing
## 3rd Year - VI Semester

| S.No. | Category | Course | | Contact hrs./week | | | Marks | | | | Cr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Code | Title | L | T | P | Exam Hrs. | IA | ETE | Total | |
| **THEORY** | | | | | | | | | | | |
| 1 | ESC | 6ML3-01 | Digital Image Processing | 2 | 0 | 0 | 2 | 20 | 80 | 100 | **2** |
| 2 | PCC/ PEC | 6ML4-02 | Deep Learning | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 3 | | 6ML4-03 | Big Data Analytics | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 4 | | 6ML4-04 | Data Communication and Computer Networks | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 5 | | 6ML4-05 | Natural Language Processing | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| 6 | | Professional Elective 1 (anyone) | | 3 | 0 | 0 | 3 | 30 | 120 | 150 | **3** |
| | | 6ML5-11 | Information Retrieval | | | | | | | | |
| | | 6ML5-12 | Compiler Design | | | | | | | | |
| | | 6ML5-13 | Digital Signal Processing | | | | | | | | |
| | | **Sub-Total** | | **17** | **0** | **0** | | **170** | **680** | **850** | **17** |
| **PRACTICAL & SESSIONAL** | | | | | | | | | | | |
| 7 | PCC | 6ML4-21 | Digital Image Processing Lab | 0 | 0 | 3 | 2 | 45 | 30 | 75 | **1.5** |
| 8 | | 6ML4-22 | Deep Learning Lab | 0 | 0 | 3 | 2 | 45 | 30 | 75 | **1.5** |
| 9 | | 6ML4-23 | Natural Language Processing Lab | 0 | 0 | 3 | 2 | 45 | 30 | 75 | **1.5** |
| 10 | | 6ML4-24 | Mobile Application Development Lab | 0 | 0 | 3 | 2 | 45 | 30 | 75 | **1.5** |
| 11 | SODECA | 6ML8-00 | Social Outreach, Discipline & Extra-Curricular Activities | | | | | | 25 | 25 | **0.5** |
| | | **Sub- Total** | | **0** | **0** | **12** | | **180** | **145** | **325** | **6.5** |
| | | **TOTAL OF VI SEMESTER** | | **17** | **0** | **12** | | **350** | **825** | **1175** | **23.5** |

L: Lecture, T: Tutorial, P: Practical, Cr: Credits
ETE: End Term Exam, IA: Internal Assessment

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# SYLLABUS OF UNDERGRADUATE DEGREE COURSE

## V and VI Semester
## (Machine Learning and Computing)

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# 5ML3-01: Statistical Machine Learning

| Credit: 2 | Max Marks: 100 (IA :20, ETE:80) |
|---|---|
| 2L+ 0T+ 0P | End Term Exams: 2hr |

| S. No. | Contents | Hour |
|---|---|---|
| 1 | **Statistical Theory:** Maximum likelihood, Bayes, minimax, parametric versus nonparametric methods, Bayesian versus Non-Bayesian approaches, classification, regression, density estimation. Convexity and Optimization: Convexity, conjugate functions, unconstrained and constrained optimization, KKT conditions. | 8 |
| 2 | **Introductory supervised learning,** Concentration inequalities and generalization bounds, plugin classifiers, the perceptron algorithm, and single-layer neural networks. Feature maps and the "kernel trick", Theory of generalization, Vapnik-Chervonenkis (VC) dimension, VC generalization bounds, least-squares, regularization. | 8 |
| 3 | **Sparsity:** High dimensional data and the role of sparsity, basis pursuit and the lasso revisited, sparsistency, consistency, persistency, greedy algorithms for sparse linear regression, sparsity in nonparametric regression. Sparsity in graphical models compressed sensing.<br>**Nonparametric Methods:** Nonparametric regression and density estimation, nonparametric classification, clustering and dimension reduction, manifold methods, spectral methods, the bootstrap and subsampling, nonparametric Bayes. | 8 |
| 4 | **Advanced Theory:** Concentration of measure, covering numbers, learning theory, risk minimization, Tsybakov noise conditions, minimax rates for classification and regression, surrogate loss functions. Computation: The EM Algorithm, simulation, variational methods, regularization path algorithms, graph algorithms. | 7 |
| **Total** | | **31** |

**Suggested Books**


- Hastie, T., Tibshirani, R. and Friedman J., The elements of statistical learning: data mining, inference, an prediction (2 ed.), Springer Science & Business Media, 2017. ISBN 978-0387848570.
- Murphy, K., Machine Learning: A Probabilistic Perspective (1 ed.), MIT Press, 2012. ISBN 978-026201802
- Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, An introduction to statistical learning with applications in R (1 ed.), Springer, 2013. ISBN 978-1461471370.
- Masashi Sugiyama, Introduction to Statistical Machine Learning (1 ed.), Morgan Kaufmann, 2017. ISBN 978 0128021217.

# 5ML4-02: Theory of Computation

| Credit: 3 | | Max Marks: 150 (IA :30, ETE:120) |
|---|---|---|
| 3L+ 0T+ 0P | | End Term Exams: 3hr |
| **S No** | **Contents** | **Hours** |
| 1 | Finite Automata & Regular Expression: Basic machine, Finite state machine, Transition graph, Transition matrix, Deterministic and non-deterministic finite automata, Equivalence of DFA and NDFA, Decision properties, minimization of finite automata, Mealy & Moore machines.<br>Alphabet, words, Operations, Regular sets, relationship and conversion between Finite automata and a regular expression and vice versa, designing regular expressions, closure properties of regular sets, Pumping lemma and regular sets, Myhill- Nerode theorem, Application of pumping lemma, Power of the languages. | 8 |
| 2 | Context-Free Grammars (CFG), Derivations and Languages, Relationship between derivation and derivation trees, leftmost and rightmost derivation, sentential forms, parsing and ambiguity, simplification of CFG, normal forms, Greibach and Chomsky Normal form, Problems related to CNF and GNF including membership problem. | 8 |
| 3 | Nondeterministic PDA, Definitions, PDA and CFL, CFG for PDA, Deterministic PDA, and Deterministic PDA and Deterministic CFL, the pumping lemma for CFL, Closure Properties and Decision properties for CFL, Deciding properties of CFL. | 8 |
| 4 | Turing Machines: Introduction, Definition of Turing Machine, TM as language Acceptors and Transducers, Computable Languages and functions, Universal TM & Other modification, multiple tracks Turing Machine. Hierarchy of Formal languages: Recursive & recursively enumerable languages, Properties of RL and REL, Introduction of Context-sensitive grammars and languages, The Chomsky Hierarchy. | 8 |
| 5 | Tractable and Untractable Problems: P, NP, NP-complete and NP-hard problems, Undecidability, examples of these problems like vertex cover problem, Hamiltonian path problem, traveling salesman problem. | 8 |
| | **Total** | **40** |

**Suggested Books**


- Hopcroft J.E., Motwani R., and Ullman J.D, "Introduction to Automata Theory, Languages and Computat Second Edition, Pearson Education.
- John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGra Publishing Company, New Delhi
- Marvin L. Minsky "Computation: Finite and Infinite" – Prentice-Hall, 1967
- Michael Sipser "Introduction to the Theory of Computation", Third Edition, 2012 Cengage Learning
- Peter Lenz – An Introduction to Formal languages and Automata – 3rd Edition Narosa, 2003
- Thomas A. Sukamp – An introduction to the theory of computer science languages and machines – 3rd edition, P Education, 2007.


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# 5ML4-03: Operating Systems

| Credit: 3 | Max. Marks: 150(IA:30, ETE:120) |
|---|---|
| 3L+0T+0P | End Term Exam: 3 Hours |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 01 |
| 2 | **Introduction and History of Operating systems:** Structure and operations; processes and files. Processor management: inter-process communication, mutual exclusion, semaphores, wait and signal procedures, process scheduling, and algorithms, critical sections, threads, multithreading | 08 |
| 3 | **Memory management:** contiguous memory allocation, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing, segmentation, case study | 08 |
| 4 | **Deadlock:** Shared resources, resource allocation, and scheduling, resource graph models, deadlock detection, deadlock avoidance, deadlock prevention algorithms<br>**Device management:** devices and their characteristics, device drivers, device handling, disk scheduling algorithms and policies | 10 |
| 5 | **File management:** file concept, types, and structures, directory structure, cases studies, access methods and matrices, file security, user authentication | 07 |
| 6 | **UNIX and Linux operating systems as case studies;** Time OS and case studies of Mobile OS | 06 |
| | **Total** | 40 |

**Suggested Books**


- A. Silberschatz, P. B. Galvin and G. Gagne, Operating System Concepts (9th ed.), John Wiley, 2012. ISBI 978-1118063330.
- Tanenbaum, Modern Operating Systems (3rd ed.), Prentice Hall India Learning Private Limited, 2019. ISBI 978-8120339040.
- W. Stallings, Operating Systems Internals and Design Principles (7th ed.), Prentice-Hall, 2013. ISBN 97 9332518803.


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# 5ML4-04: Artificial Neural Networks

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S. No. | Contents | Hour |
|---|---|---|
| 1 | **Introduction:** A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence, and Neural Networks. Learning Process: Error Correction Learning, Memory-Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process. | 7 |
| 2 | **Single Layer Perceptron:** Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment<br>Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation, and Decision Rule, Computer Experiment, Feature Detection | 8 |
| 3 | **Back Propagation:** Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross-Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning | 10 |
| 4 | **Self-Organization Maps (SOM):** Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification | 10 |
| 5 | **Neuro Dynamics:** Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm.<br>Hopfield Models – Hopfield Models, Computer Experiment | 5 |
| **Total** | | **40** |

**Suggested Books**


- Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition
- Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005
- Neural Networks in Computer Intelligence, Li-Min Fu MC GRAW HILL EDUCATION 2003
- Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
- Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

# 5ML4-05: Analysis of Algorithms

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S. No. | Contents | Hour |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 01 |
| 2 | **Background**: Review of Algorithm, Complexity Order Notations: definitions and calculating complexity.<br>**Divide And Conquer Method**: Binary Search, Merge Sort, Quicksort and Strassen's matrix multiplication algorithms. | 06 |
| 3 | **Greedy Method**: Knapsack Problem, Job Sequencing, Optimal Merge Patterns, and Minimal Spanning Trees.<br>**Dynamic Programming**: Matrix Chain Multiplication. Longest Common Subsequence and 0/1 Knapsack Problem. | 10 |
| 4 | **Branch And Bound**: Traveling Salesman Problem and Lower Bound Theory. Backtracking Algorithms and queens' problem.<br>**Pattern Matching Algorithms**: Naïve and Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms. | 08 |
| 5 | **Assignment Problems:** Formulation of Assignment and Quadratic Assignment Problem.<br>**Randomized Algorithms-** Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut, randomized algorithm for 2- SAT. Problem definition of Multicommodity flow, Flow shop scheduling, and Network capacity assignment problems. | 08 |
| 6 | **Problem Classes Np, Np-Hard, And Np-Complete:** Definitions of P, NP-Hard and NP-Complete Problems. Decision Problems. Cook's Theorem. Proving NP-Complete Problems - Satisfiability problem and Vertex Cover Problem. Approximation Algorithms for Vertex Cover and Set Cover Problem. | 08 |
| | **Total** | 41 |

**Suggested Books**


- E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galotia Publicatio
- T .H . Cormen, C .E .Leiserson, R .L .Rivest "Introduction to Algorithms", PHI.
- Sedgewich, Algorithms in C, Galgotia
- Richard Neopolitan, Kumar SS Naimipour, "Foundations of Algorithms"
- Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearso Education, Reprint 2006


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# 5ML5-11: Microprocessor and Interfaces

| Credit: 2 | Max Marks: 100 (IA :20, ETE:80) |
|---|---|
| 2L+ 0T+ 0P | End Term Exams: 2hr |

| S. No. | Contents | Hour |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 1 |
| 2 | **Introduction to Microprocessors,** microcontroller; 8085 Microprocessor Architecture, pin description, Bus concept, and organization; the concept of multiplexing and de-multiplexing of buses; the concept of static and dynamic RAM, type of ROM, memory map. | 7 |
| 3 | **Software architecture registers and signals**, Classification of instruction, Instruction set, addressing modes, Assembly Language Programming and Debugging, Programming Technique, instruction Format, and timing. | 8 |
| 4 | **Advance Assembly Language Programming,** Counter and time delay; types of Interrupts and their uses, RST instructions and their uses, 8259 programmable interrupt controllers; Macros, subroutine; Stack implementation and uses with examples; Memory interfacing. | 8 |
| 5 | **8085 Microprocessor interfacing:** 8255 Programmable Peripheral Interface, 8254 programmable interval timers, interfacing of Input/output device, 8279 Keyboard/Display interface. | 8 |
| **Total** | | 32 |

**Suggested Books**

- Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh S. Gaonkar Pul Penram International.
- Microprocessors and Interfacing, N. Senthil Kumar, M. Saravanan, S. Jeevanathan, S. K. Shah, Oxford
- Advanced Microprocessors, Daniel Tabak, McGraw-Hill
- Microprocessor & Interfacing - Douglas Hall, TMH
- 8086 Programming and Advance Processor Architecture, Savaliya M. T., Wiley India
- The 8088 and 8086 Microprocessors, Triebel & Singh, Pearson Education

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# 5ML5-12: Learning in Human and Machine

| Credit: 2 | Max Marks: 100 (IA :20, ETE:80) |
|---|---|
| 2L+ 0T+ 0P | End Term Exams: 2hr |

| S. No. | Contents | Hours |
|---|---|---|
| 1 | Introduction: Objective, scope, and outcome of the course. | 1 |
| 2 | introduction to cognitive psychology, cognition, and intelligence, fundamental ideas of cognitive psychology, cognition in the brain, intelligence, and neurons. | 6 |
| 3 | Visual perception, from senses to representation, how the visual system works, approaches to perception: bottom-up and top-down theories, perception of objects and forms, recognizing patterns and faces, attention and consciousness, habituation and adaptation, consciousness. | 6 |
| 4 | Memory models, tasks used for measuring memory, models of memory, working memory, and multiple memory systems, how memories are stored? Memory processes, forms of encoding, transfer of information from short-term to long-term memory, retrieval from short memory, intelligence and retrieval, mental images, maps, and propositions. | 8 |
| 5 | Mental manipulation of images, synthesizing images and propositions, spatial and cognitive maps. | 5 |
| 6 | Organization of knowledge in mind, declarative vs procedural knowledge, organization of declarative knowledge, and procedural. Language, language comprehension, understanding conversation, language in context, language | 5 |
| | **Total** | 31 |

**Suggested Books**

Cognitive Psychology, Robert J. Sternberg, Karin Stenberg, WADSWORTH, Cengate India.

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# 5ML5-13 : Bioinformatics

| Credit: 2 | Max Marks: 100 (IA :20, ETE:80) |
|---|---|
| 2L+ 0T+ 0P | End Term Exams: 2hr |

| S. No. | Contents | Hour |
|---|---|---|
| 1 | **Introduction:** Introduction to computational genomics, DNA, RNA, Proteins, Central dogma in molecular biology, Splicing, Gene structure, History of genetics and scope of computational genomics, Current active areas and open problems in computational genomics; Exact Sequence Searches: Z-algorithms, Knuth-Morris, BoyerMoore, Rabin-Karp. | 8 |
| 2 | **Sequence Alignments**: Dynamic Programming, Homology, Global sequence alignment, Local Sequence alignment, Heuristic local alignment, BLAST algorithm, Biologically relevant scoring for alignment, RNA folding, Advanced alignment techniques: Linear space, Affine gaps, Banded linear time alignments, Time warping, Burrow Wheeler Index; Hidden Markov Models: Markov Chains and Hidden Markov models, The Viterbi algorithm, Parameter estimation of HMMs, Connection between pair HMMs and alignments, Forward-Backward algorithm, CRFs, HMMs for motif-finding. | 8 |
| 3 | **Applications of alignments and HMMs:** Analysis of a genome, The human genomes: Chromosomes, Repeats, Genes and SNPs, Gene Prediction, Suffix Trees, Comparative genomics, Efficient alignment algorithms, Cross-species comparison based gene recognition, Microarrays and Gene Regulation; Sequencing of a genome: Sequencing methods- Shotgun sequencing, BAC to BAC Sequencing and other modern methods, Computational assembly of a genome, Gene Expression Analysis, Clustering and trees, Parsimony problems-small and large, Sequencing by hybridization, SBH, Spectrum Graphs, Spectral Convolution, Spectral Alignment. | 8 |
| 4 | **Phylogenetic:** Introduction to phylogeny, Limitations, and workaround, Neighbor-joining, Fitch's algorithm, Parsimonious trees, Fast alignment, and tree building; Multiple Sequence Alignments: Multiple Sequence Alignments and their scoring methods, progressive alignment, CLUSTALW, Expectation maximization, Gibbs sampling. | 8 |
| | **Total** | 32 |

**Suggested Books**


- Jones N.C. and Pevzner P.A., An introduction to bioinformatics algorithms (1 ed.), MIT Press Books 2004. ISBN 978-0262101066.
- Dublin R., Eddy R., Krogh A. and Mitchinson G., Biological Sequence Analysis (1 ed.), Cambridg University Press, 2003. ISBN 978-0521540797.

# 5ML4-21: Neural Networks Lab

| Credit: 1 | Max Marks: 50 (IA :30, ETE:20) |
|---|---|
| 0L+ 0T+ 2P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | Write a program to implement Perceptron |
| 2 | Write a program to implement Multilayered feed-forward neural Network |
| 3 | Implement Binary Classification Using neural network |
| 4 | To study Convolutional Neural Network and Recurrent Neural Network |
| 5 | Implement Multi-Class Classification using Neural network |
| 6 | Implement Binary Classification Using CNN |
| 7 | Implement Multi-Class Classification Using CNN |
| 8 | Implement traveling salesperson problem (tsp) using Self Organizing maps |
| 9 | Write a program to implement Classification using Back-Propagation |
| 10 | To study and implement the Weighted machine problem |

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# 5ML4-22: Analysis of Algorithms Lab

| Credit: 1 | Max Marks: 50 (IA :30, ETE:20) |
|---|---|
| 0L+ 0T+ 2P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted, and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. |
| 2 | Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted, and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. |
| 3 | a. Obtain the Topological ordering of vertices in a given digraph. b. Compute the transitive closure of a given directed graph using Warshall's algorithm. |
| 4 | Implement 0/1 Knapsack problem using Dynamic Programming. |
| 5 | From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. |
| 6 | Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm. |
| 7 | a. Print all the nodes reachable from a given starting node in a digraph using the BFS method. b. Check whether a given graph is connected or not using the DFS method. |
| 8. | Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm. |
| 9. | Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. |
| 10 | Implement N Queen's problem using Back Tracking. |

# 5ML4-23: Advance Java Lab

| Credit: 1 | Max Marks: 50 (IA :30, ETE:20) |
|---|---|
| 0L+ 0T+ 2P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | Introduction To Swing, MVC Architecture, Applets, Applications, and Pluggable Look and Feel, Basic swing components: Text Fields, Buttons, Toggle Buttons, Checkboxes, and Radio Buttons |
| 2 | Java Database Programming, java.sql Package, JDBC driver, Network Programming With java.net Package, Client and Server Programs, Content and Protocol Handlers |
| 3 | RMI architecture, RMI registry, writing distributed application with RMI, Naming services, Naming And Directory Services, Overview of JNDI, Object serialization and Internationalization |
| 4 | J2EE architecture, Enterprise application concepts, n-tier application concepts, J2EE platform, HTTP protocol, web application, Web containers, and Application servers |
| 5 | Server-side programming with Java Servlet, HTTP and Servlet, Servlet API, life cycle, configuration and context, Request and Response objects, Session handling and event handling, Introduction to filters with writing simple filter application |
| 6 | JSP architecture, JSP page life cycle, JSP elements, Expression Language, Tag Extensions, Tag Extension API, Tag handlers, JSP Fragments, Tag Files, JSTL, Core Tag library, an overview of XML Tag library, SQL Tag library, and Functions Tag library |

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# 5ML4-24: Probability and Statistical Programming Using R

| Credit: 1 | Max Marks: 50 (IA :30, ETE:20) |
|---|---|
| 0L+ 0T+ 2P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | Study of R language and its tools; perform all basic operations at command level. |
| 2 | Study data Objects and perform various operations on data Objects. |
| 3 | Perform simple, conditional, and iterative programs and functions. |
| 4 | Perform Statistical Probability Functions and other statistical functions. |
| 5 | Plotting the data using Scatterplots, Histogram, Boxplots, bar plots, and using other plotting techniques. |
| 6 | Perform sample average, sample variance, sample standard deviation, and standard error of the mean on the given data set, |
| 7 | Perform the Various distributions using the R tool, find out the mean and standard deviation on the given data set. |
| 8 | Perform z-test-test, chi-test on any given data set. |
| 9 | Perform Hypothesis testing and find out null hypothesis, alternate hypothesis, draw the picture (graph) to visualize the problem. |
| 10 | Case Study: - Forecasting, e.g., sales, crops, productions, etc. |

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# 6ML3-01: Digital Image Processing

| Credit: 2 | Max. Marks: 100(IA:20, ETE:80) |
|---|---|
| 2L+0T+0P | End Term Exam: 2 Hours |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 01 |
| 2 | **Introduction to Image Processing:** Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation. | 04 |
| 3 | **Image Transformation & Filtering:** Intensity transform functions, Histogram processing, Spatial filtering, Fourier transforms and its properties, Frequency Domain filters, color models, Pseudo coloring, color transforms, Basics of Wavelet Transforms. | 06 |
| 4 | **Image Restoration:** Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering. | 07 |
| 5 | **Image Compression:** Coding redundancy, Interpixel redundancy, Psych visual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression. | 05 |
| 6 | **Image Segmentation & Representation:** Point, Line, and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region-Based Segmentation, Boundary representation, Boundary Descriptors. | 05 |
| | **Total** | 28 |

**Suggested Books**


- Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", 4th Edition, Pearson, 2018.
- Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
- Anil K.Jain, "Fundamentals of Digital Image Processing", Person Education, 2003.


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# 6ML4-02: Deep Learning

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S. No. | Contents | Hour |
|---|---|---|
| 1 | **NEURAL NETWORK**: Mechanics of Machine Learning, Neuron, Linear Perceptron, Feed Forward Neural Networks, Sigmoid, Tanh, and ReLU Neurons, Training Feed-Forward Neural Networks, Fast Food Problem, Gradient Descent, Delta Rule and Learning Rates. | 8 |
| 2 | **CONVOLUTIONAL NEURAL NETWORKS**: TensorFlow: Creating and Manipulating TensorFlow Variables, TensorFlow Operations, Neurons in Human Vision, Convolutional Layer, building a Convolutional Network, Visualizing Learning in Convolutional Networks, Learning Lower Dimensional Representations, Principal Component Analysis (PCA), Autoencoder Architecture, Implementing an Autoencoder in TensorFlow. | 8 |
| 3 | **RECURRENT NEURAL NETWORKS:** Recurrent Neural Networks, Challenges with Vanishing Gradients, Long Short-Term Memory (LSTM) Units. TensorFlow Primitives for RNN Models, implementing a Sentiment Analysis Model, solving seq2seq Tasks with Recurrent Neural Networks, Memory Augmented Neural Networks: Neural Turing Machines, Attention Based Memory Access, Differentiable neural Computers (DNC), Memory Reuse, Temporal Linking, DNC Controller Network, Visualizing Implementing the DNC in TensorFlow. | 8 |
| 4 | **DEEP REINFORCEMENT LEARNING:** Deep Reinforcement Learning - Masters Atari Games, Markov Decision Processes, Policy Versus Value Learning, Pole-Cart with Policy Gradients-Q-Learning and Deep Recurrent Q-Networks. | 8 |
| 5 | **APPLICATIONS**: Applications in Object Recognition and Computer Vision- Unsupervised or generative feature learning supervised feature learning and classification- Applications in Multimodal and Multi-task Learning- Multimodalities: Text and image-Speech and image- multi-task learning within the speech, NLP or image domain. | 8 |
| | **Total** | 40 |

**Suggested Books**


- Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generatio Machine Intelligence Algorithms", O'Reilly Media, 2017.
- Li Deng and Dong Yu "Deep Learning Methods and Applications", Foundations and Trends in Signa Processing,
- Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machin Learning series", MIT Press, 2017.
- Sandro Skansi"Introduction to Deep Learning From Logical Calculus to Artificial Intelligence" Springe 2018. 3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

# 6ML4-03: Big Data Analytics

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 1 |
| 2 | Introduction to Big Data: Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error. | 6 |
| 3 | Data Analysis, Clustering & Classification: Regression Modelling - Multivariate Analysis - Bayesian Modelling - Support Vector and Kernel Methods- Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction. Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions. - Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier. | 9 |
| 4 | Stream Memory: Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real-time Analytics Platform (RTAP) Applications - Case Studies - Real-Time Sentiment Analysis, Stock Market Predictions. | 8 |
| 5 | Association and Graph Memory: Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Choosing Graph Analytics - Graph Analytics Use Cases - Graph Analytics Algorithms and Solution Approaches - Technical Complexity of Analyzing Graphs. | 8 |
| 6 | Frameworks and Visualization: MapReduce – Hadoop, Hive, MapR – Shading – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages- Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association-Intelligence from unstructured information-Text analytics-Understanding of emerging trends and Technologies-Industry challenges and application of Analytics | 8 |
| | **TOTAL** | 40 |

**Suggested Books**


- Michael Minelli,Michele Chambers and Ambiga Dhiraj, Big Data, Big analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses (1 ed.), Wiley CIO, 2013.
- Alapati Sam R., Expert Hadoop Administration: Managing, Tuning, and Securing Spark, YARN, and HDFS (1 ed.), Pearson Education, 2017.
- T. White, Hadoop: The Definitive Guide (3 ed.), O'Reilly Media, 2012.


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# 6ML4-04: Data Communication and Computer Networks

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope and outcome of the course. | 1 |
| 2 | **Introductory Concepts:** Network hardware, Network software, topologies, Protocols, and standards, OSI model, TCP model, TCP/IP model, Physical Layer: Digital and Analog Signals, Periodic Analog Signals, Signal Transmission, Limitations of Data Rate, Digital Data Transmission, Performance Measures, Line Coding, Digital Modulation, Media, and Digital Transmission System | 7 |
| 3 | **Data Link Layer:** Error Detection and Correction, Types of Errors, Two-dimensional parity check, Detection versus correction, Block Coding, Linear Block Coding, Cyclic Codes, Checksum, Standardized Polynomial Code, Error Correction Methods, Forward Error Correction, Protocols: Stop and wait, Go-back-N ARQ, Selective Repeat ARQ, Sliding window, Piggybacking, Pure ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA | 9 |
| 4 | **Network Layer:** Design issues, Routing algorithms: IPV4, IPV6, Address mapping: ARQ, RARQ, Congestion control, Unicast, Multicast, Broadcast routing protocols, Quality of Service, Internetworking | 8 |
| 5 | **Transport Layer:** Transport service, Elements of transport protocols, User Datagram Protocol, Transmission Control Protocol, Quality of service, Leaky Bucket and Token Bucket algorithm | 8 |
| 6 | **Application Layer:** WWW, DNS, Multimedia, Electronic mail, FTP, HTTP, SMTP, Introduction to network security | 7 |
| | **Total** | 40 |

**Suggested Books**


- Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2013.
- James Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3r Edition, Pearson Education.
- William Stallings, "Data and Computer Communications", 8thedition, Pearson Education.
- Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill Education.
- Larry Peterson and Bruce Davie, "Computer Networks: A Systems Approach", 4th Edition, Morga Kaufmann Publishers | Elsevier.


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# 6ML4-05: Natural Language Processing

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 1 |
| 2 | **Introduction to NLP:** Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit distance, N-gram Language Models, Evaluating Language Models. | 6 |
| 3 | **Syntactic Analysis:** English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging, HMM Part-of-Speech Tagging, Maximum Entropy Markov Models, Grammar Rules for English, Treebanks, Grammar Equivalence and Normal form, Lexicalized Grammar. | 8 |
| 4 | **Semantic Analysis:** Representation of Sentence Meaning: Computational Desiderata for Representations, Model Theoretic Semantics, First-Order Logic Event and State Representations, Description Logics, Semantic roles, Semantic Role labeling. | 10 |
| 5 | **Sequence parsing with recurrent networks:** Simple Recurrent Networks, Applications of RNNs and Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Characters, and Byte-Pairs. | 9 |
| 6 | **Case Study:** Sentiment Classification, Dialog Systems, and Chatbots. | 6 |
| | **Total** | 40 |

**Suggested Books**


- Daniel Jurafsky & Ja, es H. Martin, Pearson Education Asia.
- James A.. Natural language Understanding 2e, Pearson Education, 1994
- Bharati A., Sangal R., Chaitanya V.. Natural language processing: a Paninian perspective, PHI, 2000
- Siddiqui T., Tiwary U. S.. Natural language processing and Information retrieval, OUP, 2008


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# 6ML5-11: Information Retrieval

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S. No. | Contents | Hrs |
|---|---|---|
| 1 | **Introduction:** Text analysis, Types of text analysis, Information retrieval, IR system architecture: Text processing, Indexes, and query matching; Text processing: Text format, Tokenization, stemming, lemmatization, Language modeling, Examples of open-source IR Systems; Query processing models. Probabilistic models (Binary independence model, Robertson/Spark Jones weighting formula, Two-Poisson model), Relevance feedback (Term selection, Pseudo relevance feedback). | 8 |
| 2 | **Language models:** Unigram, Bigram language models, generating queries from documents, Language models and smoothing, ranking with language models, Kullback Leibler divergence, Divergence from randomness, Passage retrieval and ranking. Management of Information | 6 |
| 3. | **Retrieval Systems:** Knowledge management, Information management, Digital asset management, Network management, Search engine optimization, Records compliance and risk management, Version control, Data and data quality, Information system failure. Types of information retrieval systems: Web retrieval and mining, Semantic web, XML information retrieval, Recommender systems and expert locators, Knowledge management systems, Decision support systems, Geographic information system (GIS). Indexing: Inverted indices, Index components and Index life cycle, Interleaving Dictionary and Postings lists, Index construction. | 10 |
| 4 | **Query processing for ranked retrieval, Compression:** General-purpose data compression, Symbol-wise data compression, Compressing posting lists, Compressing the dictionary; Information categorization and filtering: Classification, Probabilistic classifiers, linear classifiers, Similarity-based classifiers, Multi category ranking, and classification, learning to rank; Introduction to the clustering problem, Partitioning methods, Clustering versus classification, Reduced dimensionality/spectral methods. | 8 |
| 5 | **Sentiment Analysis:** Introduction to sentiment analysis, Document-level sentiment analysis. Sentence-level sentiment analysis, Aspect-based sentiment analysis; Comparative sentiment analysis, baseline algorithm, Lexicons, Corpora, Tools of Sentiment analysis, Applications. | 8 |
| | **Total** | 40 |

**Suggested Books**


- Butcher S., Clarke C.L.A., and Cormack G., Information Retrieval (1 ed.), The MIT Press, 2010.
- Bates M.J., Understanding Information Retrieval Systems (1 ed.), CRC Press, 2011.
- Manning C.D., Raghavan P. and Schütze H., Introduction to Information Retrieval (1 ed.), Cambridg University Press, 2008.
- Baeza-Yates R.and Ribeiro-Neto B., Modern Information Retrieval (1 ed.), Addison-Wesley, 1999.


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# 6ML5-12: Compiler Design

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Objective, scope, and outcome of the course. | 01 |
| 2 | **Introduction:** Objective, scope, and outcome of the course. Compiler, Translator, Interpreter definition, Phase of the compiler, Bootstrapping, Review of Finite automata lexical analyzer, Input, Recognition of tokens, Idea about LEX: A lexical analyzer generator, Error handling. | 06 |
| 3 | **Review of CFG Ambiguity of grammars:** Introduction to parsing. Top-down parsing, LL grammars & passers error handling of LL parser, Recursive descent parsing predictive parsers, Bottom-up parsing, Shift reduce parsing, LR parsers, Construction of SLR, Conical LR & LALR parsing tables, parsing with ambiguous grammar. Operator precedence parsing, Introduction of automatic parser generator: YACC error handling in LR parsers. | 10 |
| 4 | **Syntax directed definitions;** Construction of syntax trees, S- Attributed Definition, L-attributed definitions, Top-down translation. Intermediate code forms using postfix notation, DAG, three address code, TAC for various control structures, Representing TAC using triples and quadruples Boolean expression and control structures. | 10 |
| 5 | **Storage organization:** Storage allocation, Strategies, Activation records, accessing local and non-local names in a block-structured language, Parameters passing, Symbol table organization, Data structures used in symbol tables. | 08 |
| 6 | **Definition of basic block control flow graphs;** DAG representation of basic block, Advantages of DAG, Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization, Issues in the design of code generator, A simple code generator, Code generation from DAG. | 07 |
| | **Total** | 42 |

**Suggested Books**


- A.V. Aho, J. D. Ullman, Monica S. Lam, and R. Sethi, Compilers Principles, Techniques and Tools (2 ed.), Pearson Education, 2005.
- John Levine, Tony Mason, and Doug Brown, Lex and Yacc (1 ed.), O'Reilly Media, 1992.
- Dhamdhere, Compiler Construction (2 ed.), Macmillan Publication, 2003.


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# 6ML5-13: Digital Signal Processing

| Credit: 3 | Max Marks: 150 (IA :30, ETE:120) |
|---|---|
| 3L+ 0T+ 0P | End Term Exams: 3hr |

| S.No. | Contents | Hours |
|---|---|---|
| 1 | **Review of Signals and Systems:** Discrete-time complex exponentials and other basic signals, scaling of the independent axis and differences from its continuous-time counterpart, system properties (linearity, time-invariance, memory, causality, BIBO stability), LTI systems and convolution, solving linear constant coefficient differential equations. Continuous- and Discrete-Time Fourier Series: Representation of periodic signals using Fourier series, properties of Fourier series, mean-square convergence, Gibbs' phenomenon, the relationship between discrete-time Fourier series (DTFS) and the Discrete Fourier Transform (DFT). | 10 |
| 2 | **Continuous- and Discrete-Time Fourier Transform:** Representation of aperiodic signals using the Fourier transform, properties, the relationship between the DiscreteTime Fourier Transform and the Continuous-Time Fourier Series, the notion of the frequency transfer function. Z-Transform: Definition--the region of convergence (RoC) and its properties, z-transform properties, inversion methods: partial fraction expansion, power series, contour integral method, causality, stability, and their implications on pole locations. | 10 |
| 3 | **Frequency Domain Analysis of Discrete-Time LTI Systems:** Transfer function definition for LTI systems, rational transfer functions corresponding to systems described by linear constant-coefficient difference equations, frequency response: magnitude and phase response, geometric interpretation of frequency response, magnitude response of single complex pole or zero, second-order resonator, comb filtes, notch filter, phase response, principal phase, phase unwrapping, the phase response of a single complex zero, the concept of trivial pole/zero, phase response, group delay, importance of linear phase, conditions under which a digital filter has linear phase, Type I, Type II, Type III, and Type IV linear phase FIR filters, the relationship between two zeros of an FIR filter, constrained zeros of FIR filters. | 10 |
| 4 | **Sampling:** Impulse train sampling, the relationship between the impulse-train sampled signal spectrum and the corresponding discrete-time sequence's DTFT, scaling of the frequency axis, normalized frequency, effect of sampling frequency on bandwidth. Fast Fourier Transform: Introduction to the decimation-in-time FFT algorithm. | 10 |
| | **Total** | 40 |

**Suggested Books**


- B.P. Lathi, Signal Processing and Linear Systems (2 ed.), Oxford University Press, 2009. ISBN 978 0195392579.
- A.V. Oppenheim and A.S. Willsky, Signals and Systems (2 ed.), Prentice Hall Upper Saddle River NJ, 199(
- Alan V. Oppenheim and Ronald W. Schafer, Discrete-Time Signal Processing (3 ed.), Prentice Hall Uppe Saddle River NJ, 2013. ISBN 978-1292025728.
- John G. Proakis and Dimitris K. Manolakis, Digital Signal Processing (4 ed.), Prentice Hall Upper Saddl River NJ, 2007. ISBN 978-0131873741.
- Sanjit Mitra, Digital Signal Processing (4 ed.), McGraw-Hill New York NY, 2011. ISBN 978-0070429536.

# 6ML4-21: Digital Image Processing Lab

| Credit: 1.5 | Max Marks: 75 (IA :45, ETE:30) |
|---|---|
| 0L+ 0T+ 3P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | Point-to-point transformation. This laboratory experiment provides for thresholding an image and the evaluation of its histogram. Histogram equalization. This experiment illustrates the relationship among the intensities (gray levels) of an image and its histogram. |
| 2 | Geometric transformations. This experiment shows image rotation, scaling, and translation. Two-dimensional Fourier transform |
| 3 | Linear filtering using convolution. Highly selective filters. |
| 4 | Ideal filters in the frequency domain. Non-Linear filtering using convolutional masks. Edge detection. This experiment enables students to understand the concept of edge detectors and their operation in noisy images. |
| 5 | Morphological operations: This experiment is intended so students can appreciate the effect of morphological operations using a small structuring element on simple binary images. The operations that can be performed are erosion, dilation, opening, closing, open-close, and close-open. |

# 6ML4-22: Deep Learning Lab

| Credit: 1.5 | Max Marks: 75 (IA :45, ETE:30) |
|---|---|
| 0L+ 0T+ 3P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | **NEURAL NETWORK:**<br>1. Write a program in Python to Calculate the output of a simple neuron<br>2. Construct a Perceptron for the classification of data in Python<br>3. Develop the Python code to Classify the 4-class problem with Multi-layer Perceptron<br>4. Implement the back-propagation algorithm for neural networks and apply it to the task of handwritten digit recognition |
| 2 | **CONVOLUTIONAL NEURAL NETWORKS:**<br>Implement linear regression in TensorFlow<br>1. Build a simple deep neural network with many layers in Python using TensorFlow<br>2. Implement binary classification for medical diagnosis for a single medical condition like saying disease vs. no disease based on a battery of tests.<br>3. Explore multi-class with Rock Paper Scissors dataset<br>4. Implement an Autoencoder in TensorFlow. |
| 3 | **RECURRENT NEURAL NETWORKS:**<br>1. Implementing a Sentiment Analysis Model in TensorFlow<br>2. Solve seq2seq Tasks with Recurrent Neural Networks using TensorFlow<br>3. Implementing the DNC in TensorFlow |
| 4 | **DEEP REINFORCEMENT LEARNING:**<br>1. Implement a policy-gradient agent to solve the pole-cart-reinforcement learning problems.<br>2. Implementing Experience Replay in Q-Network using TensorFlow |
| 5 | **APPLICATIONS:**<br>1. Build a model to classify movie reviews as positive or negative using TensorFlow<br>2. Develop the CNN Model for Image Classification |

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# 6ML4-23: Natural Language Processing Lab

| Credit: 1.5 | Max Marks: 75 (IA :45, ETE:30) |
|---|---|
| 0L+ 0T+ 3P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | Convert the text into tokens |
| 2 | Find the word frequency |
| 3 | Demonstrate a bigram language model |
| 4 | Demonstrate a trigram language model |
| 5 | Generate regular expressions for a given text. |
| 6 | Perform Lemmatization |
| 7 | Perform Stemming |
| 8 | Identify parts of Speech using the Penn Treebank tag set. |
| 9 | Implement RNN for sequence labeling |
| 10 | Build a Chunker |
| 11 | Find the synonym of a word using WordNet |
| 12 | Implement semantic role labeling to identify named entities |
| 13 | Translate the text using First-order logic |
| 14 | Implement RNN for sequence labeling |
| 15 | Implement POS tagging using LSTM |
| 16 | Implement Named Entity Recognizer |
| 17 | Word sense disambiguation by LSTM/GRU |

# 6ML4-24: Mobile Application Development Lab

| Credit: 1.5 | Max Marks: 75 (IA :45, ETE:30) |
|---|---|
| 0L+ 0T+ 3P | End Term Exams: 2hr |

| S.No. | List of Experiments |
|---|---|
| 1 | To study Android Studio and android studio installation. Create a "Hello World" application. |
| 2 | To understand Activity, Intent, Create a sample application with login module. (Check username and password). |
| 3 | Design simple GUI application with activity and intents e.g. calculator. |
| 4 | Develop an application that makes use of RSS Feed. |
| 5 | Write an application that draws basic graphical primitives on the screen |
| 6 | Create an android app for database creation using SQLite Database. |
| 7 | Develop a native application that uses GPS location information |
| 8 | Implement an application that writes data to the SD card. |
| 9 | Design a gaming application |
| 10 | Create an application to handle images and videos according to size. |

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