SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Artificial Intelligence & Machine Learning

V-VI Semester

Effective for the students admitted in year 2020-21 and onwards.

B. Tech. Artificial Intelligence and Machine Learning
3rd Year – V Semester

S.No.	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs	IA	ETE	Total	
THEORY											
1	ESC	5AM3-01	Mathematics and Statistics	2	0	0	2	20	80	100	**2**
2	PCC/ PEC	5AM4-02	Compiler Design	3	0	0	3	30	120	150	**3**
3		5AM4-03	Operating Systems	3	0	0	3	30	120	150	**3**
4		5AM4-04	Artificial Neural Networks	3	0	0	3	30	120	150	**3**
5		5AM4-05	Analysis of Algorithms	3	0	0	3	30	120	150	**3**
6		Professional Elective 1: (anyone)		2	0	0	2	20	80	100	**2**
		5AM5-11	AI in Healthcare								
		5AM5-12	Human-Computer Interaction								
		5AM5-13	Information Security System								
		Sub Total		**16**	**0**	**0**		**160**	**640**	**800**	**16**
PRACTICAL & SESSIONAL											
7	PCC	5AM4-21	Compiler Design Lab	0	0	2	2	30	20	50	**1**
8		5AM4-22	Neural Network Lab	0	0	2	2	30	20	50	**1**
9		5AM4-23	Analysis of Algorithms Lab	0	0	2	2	30	20	50	**1**
10		5AM4-24	Advance Java Lab	0	0	2	2	30	20	50	**1**
11	PSIT	5AM7-30	Industrial Training	0	0	1		75	50	125	**2.5**
12	Anandam	5AD8-00	ANANDAM						100	100	**2**
		Sub- Total		**0**	**0**	**9**		**195**	**230**	**425**	**8.5**
		TOTAL OF V SEMESTER		**16**	**0**	**9**		**355**	**870**	**1225**	**24.5**

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

B.Tech. Artificial Intelligence and Machine Learning
3rd Year – VI Semester

THEORY												
SN	**Category**	**Course**		**Contact hrs./week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	ESC	6AM3-01	Digital Image Processing	2	0	0	2	20	80	100	**2**
2	PCC/ PEC	6AM4-02	Natural Language Processing	3	0	0	3	30	120	150	**3**
3		6AM4-03	Soft Computing	3	0	0	3	30	120	150	**3**
4		6AM4-04	Computer Architecture and Organization	3	0	0	3	30	120	150	**3**
5		6AM4-05	Pattern Recognition	3	0	0	3	30	120	150	**3**
6		Professional Elective 1 (anyone)		3	0	0	3	30	120	150	**3**
		6AM5-11	Cloud Computing								
		6AM5-12	Distributed System								
		6AM5-13	Data Mining and Business Intelligence								
		Sub-Total		**17**	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL & SESSIONAL											
7	PCC	6AM4-21	Digital Image Processing Lab	0	0	3	2	45	30	75	**1.5**
8		6AM4-22	Natural Language Processing Lab	0	0	3	2	45	30	75	**1.5**
9		6AM4-23	Soft Computing Lab	0	0	3	2	45	30	75	**1.5**
10		6AM4-24	Mobile Application Development Lab	0	0	3	2	45	30	75	**1.5**
11	Anandam	6AD8-00	ANANDAM						100	100	**2**
		Sub- Total		**0**	**0**	**12**		**180**	**220**	**400**	**8**
		TOTAL OF VI SEMESTER		**17**	**0**	**12**		**350**	**900**	**1250**	**25**

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

SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Artificial Intelligence & Machine Learning

V-VI Semester

Effective for the students admitted in year 2020-21 and onwards.

5AM3-01: Mathematics and Statistics

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:** Engineering application of optimization, Statement and classification of the optimization problem, single variable and multivariable optimization with and without constraints.	5
3	**Project Scheduling:** Project Scheduling by PERT and CPM, Network Analysis. Sequencing Theory: General Sequencing problem n-jobs through 2 machines & 3 machines and 2-jobs through m machines.	6
4	**Transportation problem:** Introduction, balanced and unbalanced transportation, northwest corner rule, lowest cost entry method, and Vogel's approximation, optimality test, degeneracy in transportation problem. Assignment problem: Introduction, Hungarian method.	6
5	**Applied Statistics:** Introduction to statistics and data analysis- Mean, Mode, Median, variance and standard deviation. Testing of hypothesis – Introduction-Types of errors, critical region, the procedure of testing hypothesis-Large sample tests- Z test for Single Proportion, Difference of Proportion, mean and difference of means.	6
6	**Small sample tests-** Students t-test, F-test- chi-square test- the goodness of fit - independence of attributes- Design of Experiments - Analysis of variance – one- and two-way classifications - CRD-RBD- LSD.	6
	Total	30

Suggested Books

- Fundamentals of Mathematical statistics- by S. C. Gupta and V. K. Kapoor; S. Chand & sons
- Advanced Engg. Mathematics - by Erwin Kreyszig John; willey & sons
- Advanced Engg. Mathematics - by R. K. Jain & S. R. K Iyenger; Narosa publishing House.
- Higher Engg. Mahematics by Dr. B. S. Grewal- Khanna publications

5AM4-02: 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, Parameter 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. ISBN 978-0321547989.

Reference Books

- John Levine, Tony Mason and Doug Brown, Lex and Yacc (1 ed.), O'Reilly Media, 1992. ISBN 978-1565920002.
- Kenneth C. Louden, Compiler Construction Principles and Practice (1 ed.), Course Technology Inc, 1997. ISBN 978-0534939724.
- Dhamdhere, Compiler Construction (2 ed.), Macmillan Publication, 2003. ISBN 978-0333904060

5AM4-03: Operating Systems

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 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 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

- Silberschatz, P. B. Galvin and G. Gagne, Operating System Concepts (9 ed.), John Wiley, 2012. ISBN 978-1118063330.
- Tanenbaum, Modern Operating Systems (3 ed.), Prentice Hall India Learning Private Limited, 2019. ISBN 978-8120339040.
- W. Stallings, Operating Systems Internals and Design Principles (7 ed.), Prentice-Hall, 2013. ISBN 978-9332518803
- Operating Systems – William Stallings, Pearson Education Asia (2002)
- Operating Systems - Nutt, Pearson Education Asia (2003)

5AM4-04: Artificial Neural 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.	**01**
2	**Artificial Neural Networks** Introduction and ANN Structure, Biological neurons and artificial neurons. Model of an ANN. Activation functions are used in ANNs. Typical classes of network architectures. supervised and unsupervised learning rules, Neural Network applications: Pattern classification, Recognition of Olympic games symbols, Recognition of Printed Characters. Recognition of handwritten characters	**07**
3	**Mathematical Foundations and Learning mechanisms:** Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning. Memory-based learning, Hebbian learning. Competitive learning. Delta learning rule, Windrow-Hoff learning rule.	**8**
4	**Single-layer perceptron**: Structure and learning of perceptron, Pattern classifier, introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence. Limitations of a perceptron:	**7**
5	**Feedforward neural network**: Feedforward ANN, Structures of Multi-layer feedforward networks. Backpropagation algorithm, Backpropagation - training and convergence, Functional approximation with backpropagation. Practical and design issues of backpropagation learning.	**8**
6	**Self-organizing networks:** Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification Korhonen algorithm, Hopfield Networks: Hopfield network algorithm, Adaptive resonance theory: Network and learning rules.	**7**
	Total	**38**

Suggested Books

- Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.
- B. Yegnanarayana - Artificial neural network PHI Publication
- Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.
- Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.
- Neural Networks in Computer Intelligence, Li-Min Fu MC GRAW HILL EDUCATION 2003
- Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005

5AM4-05: Analysis of Algorithms

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	**Background**: Review of Algorithm, Complexity Order Notations: definitions and calculating complexity. **Divide And Conquer Method**: Binary Search, Merge Sort, Quick sort, and Strassen's matrix multiplication algorithms.	**06**
3	**Greedy Method**: Knapsack Problem, Job Sequencing, Optimal Merge Patterns, and Minimal Spanning Trees. **Dynamic Programming**: Matrix Chain Multiplication. Longest Common Subsequence and 0/1 Knapsack Problem.	**09**
4	**Branch And Bound**: Traveling Salesman Problem and Lower Bound Theory. Backtracking Algorithms and queens' problem. **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. Randomized **Algorithms-** Las Vegas algorithms, Monte Carlo algorithms, a 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	**40**

Suggested Books

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

5AM5-11: AI in Healthcare

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.	01
2	**Course Overview,**: Introduction to Module, Operationalizing Consumerism Using AI, Operationalizing a New Supply Chain, Machine Learning, Artificial Intelligence, and Decision Support.	7
3	Journey Mapping and Pain Points, Patient Monitoring, Differential Diagnosis, Care Management, Preventive Screening, Avoidable Readmissions, Disease Burden as a Predictor of Cost, Data Sourcing, Data Enrichment.	6
4	Provider Taxonomies and Relationships, Predictive Modeling Process, Analytic Maturity Model, Identifying Historic Addressable Opportunity, Predicting Addressable Opportunity, Measuring Predictive Accuracy, Making Recommendations	5
5	A review of the state of AI in health care, A review of the pending research and development CDS open problems, A review of important AI data mining technologies and their application to medicine,	5
6	A description of BDA and its application to health care, The use of technology underneath, Summary of important issues of AI in health care. Physician point of view and case studies on Radiology and Physiological Tests	6
	Total	30

Suggested Books

- Prashant Natarajan, John C. Frenzel, and Detlev H. Smaltz Demystifying Big Data and Machine Learning for Healthcare (1 ed.), CRC Press, 2017. ISBN 978-
- 1138032637.
- Arjun Panesar, Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes (1 ed.), Apress, 2019. ISBN 978-1484237984.
- Raghupathi W, Raghupathi V., Big data analytics in healthcare: promise and potential, Health info science and syst.,2014.
- Chen Y, Argentinis E, et al., Clinical therapeutics, IBM Watson: how cognitive computing can be applied to big data challenges in life sciences research. 2016.

5AM5-12: Human-Computer Interaction

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.	01
2	Historical evolution of the field, Interactive system design, Concept of usability -definition and elaboration, HCI and software Engineering, GUI design and Aesthetics, Prototyping techniques.	02
2	**Model-based Design and evaluation:** Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN- GOMS), Fitts' law and Hick-Hyman's law, Model-based design case studies.	04
3	**Guidelines in HCI:** Schneiderman's eight, golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with examples of its use Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.	05
4	**Empirical research methods in HCI:** Introduction (motivation, issues, research question formulation techniques), Experiment design, and data analysis (with an explanation of one-way ANOVA).	06
5	**Task modeling and analysis:** Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT), Introduction to formalism in dialog design, design using FSM (finite state machines) Statecharts and (classical) Petri Nets in dialog design.	07
6	**Introduction to CA**, CA types, the relevance of CA in IS design Model Human Processor (MHP), OOP- Introduction OOM- Object-Oriented Modeling of User Interface Design.	05
	Total	30

Suggested Books

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human-Computer Interaction, 3rd Edition, Pearson Education, 2004Brian Fling, ―Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009)
- Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O'Reilly, 2009. (

5AM5-13: Information Security System

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.	01
2	**Introduction to security attacks:** services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers.	05
3	**Modern block ciphers**: Block Cipher structure, Data Encryption Standard (DES) with an example, the strength of DES, Design principles of block cipher, AES with structure, its transformation functions, key expansion, example, and implementation. Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode.	06
4.	**Public Key Cryptosystems with Applications:** Requirements and Cryptanalysis, RSA cryptosystem, Rabin cryptosystem, Elgamal cryptosystem, Elliptic curve cryptosystem.	05
5	**Cryptographic Hash Functions, their applications:** Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers. Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm.	07
6	**Key management and distribution:** symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, public key infrastructure. Remote user authentication with symmetric and asymmetric encryption, Kerberos Web Security threats and approaches, SSL architecture and protocol, Transport layer security, HTTPS, and SSH.	06
	Total	30

Suggested Books

- Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
- Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
- Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
- Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

5AM4-21: Compiler Design Lab

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

S.No.	List of Experiments
1	Introduction: Objective, scope and outcome of the course.
2	To identify whether a given string is a keyword or not.
3	Count total no. of keywords in a file. [Taking file from user]
4	Count total no of operators in a file. [Taking file from user]
5	Count the total occurrence of each character in a given file. [Taking file from user]
6	Write a C program to insert, delete and display the entries in the Symbol Table.
7	Write a LEX program to identify following: 1. Valid mobile number 2. Valid url 3. Valid identifier 4. Valid date (dd/mm/yyyy) 5. Valid time (hh:mm:ss)
8	Write a lex program to count blank spaces,words,lines in a given file.
9	Write a lex program to count the no. of vowels and consonants in a C file.
10	Write a YACC program to recognize strings aaab,abbb using a^nb^n, where b>=0.
11	Write a YACC program to evaluate an arithmetic expression involving operators +,-,* and /.
12	Write a YACC program to check validity of a strings abcd, aabbcd using grammar a^nb^nc^md^m, where n , m>0
13	Write a C program to find first of any grammar.

5AM4-22: 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 feedforward 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

5AM4-23: 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 Backtracking.

5AM4-24: 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, overview of XML Tag library, SQL Tag library and Functions Tag library

6AM3-01: Digital Image Processing

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.	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, Psychovisual 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.

6AM4-02: 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

- Natural Language understanding by James Allen, Pearson Education 2008
- NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall 1995
- Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press 2000
- An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education 2008
- Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley 1989

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6AM4-03: Soft Computing

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 to Soft Computing & Neural Networks:** Brief Review of Neural Network, Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics	06
3	**Fuzzy Logic:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making. Applications of Fuzzy Set,	07
4	**GENETIC ALGORITHMS:** Main Operators- Genetic Algorithm Based Optimization-Principle of Genetic Algorithm- Genetic Algorithm with Directed Mutation- Comparison of Conventional and Genetic Search Algorithms Issues of GA in practical implementation. Introduction to Particle swarm optimization-PSO operators-GA and PSO in engineering applications. Machine Learning Approach to Knowledge Acquisition.	09
5	**New trends in Evolutionary Algorithms:** Ant Colony Optimization: Ant system, MM-AS, Ant Miner, Snake-Ant Algorithm. Artificial Bee Colony, Cuckoo Search Algorithm. Co-evolution, Plasticity and lifetime learning, Lamarckian learning, the "No free lunch" theorem**.**	06
6	**Matlab/Python Lib:** Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic	09
	Total	38

Suggested Books

- Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications,S.Rajasekaran, G. A. Vijayalakshami, PHI.
- Genetic Algorithms: Search and Optimization, E. Goldberg.
- L.Fausett, Fundamentals of Neural Networks, Prentice Hall
- T.Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill

6AM4-04: Computer Architecture and Organization

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	**Computer Data Representation:** Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit. Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit.	10
3	**Programming The Basic Computer:** Introduction, Machine Language, Assembly Language, assembler, Program loops, Programming Arithmetic and logic operations, subroutines, I-O Programming. Micro programmed Control: Control Memory, Address sequencing, Micro program Example, design of control Unit.	07
4	**Central Processing Unit:** Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC)Pipeline And Vector Processing, Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline, Vector Processing, Array Processors.	08
5	**Computer Arithmetic:** Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, **Decimal Arithmetic Unit.** Input-Output Organization, Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPUIOP Communication, Serial communication.	08
6	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. **Multiprocessors:** Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter- processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.	08
	Total	42

Suggested Books

- William Stallings, “Computer Organization and Architecture, PHI” 2. M. Morris Mano,
- M. Morris Mano, “Computer System Architecture”, PHI
- J.D. Carpinelli, “Computer Systems Organization and Architecture,” Pearson Education
- Heuring and Jordan, Pearson Education, “Computer Systems Design and Architecture”
- Tor M. Aamodt, Wilson Wai Lun Fung, Timothy G. Rogers General-Purpose Graphics Processor Architecture

6AM4-05: Pattern Recognition

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	**BASICS OF PROBABILITY, RANDOM PROCESSES AND LINEAR ALGEBRA Probability:** independence of events, Conditional and joint probability, Bayes' theorem; Random Processes: Stationary and nonstationary processes, Expectation, Autocorrelation, Cross-Correlation, Spectra, Linear Algebra: Inner product, outer product, Inverses, Eigenvalues, Eigen vectors, Bayes Decision theory	09
3	**BAYES DECISION THEORY** Minimum-error-rate classification, Classifiers, Discriminate functions, Decision surfaces, Normal density and discriminant functions, Discrete features	08
4	**PARAMETER ESTIMATION METHOD**S Maximum-Likelihood estimation, Gaussian case, Maximum a Posteriori estimation, Bayesian estimation, Gaussian case	07
5	**UNSUPERVISED LEARNING AND CLUSTERING** Criterion functions for clustering, Algorithms for clustering, K-Means, Hierarchical and other methods, Cluster validation, Gaussian mixture models, Expectation-Maximization method for parameter estimation, Maximum entropy estimation	07
6	**SEQUENTIAL PATTERN RECOGNITION**: Hidden Markov Models (HMMs), Discrete HMMs, Continuous HMMs, NONPARAMETRIC TECHNIQUES FOR DENSITY ESTIMATION: Parzen-window method, K-Nearest Neighbor method, LINEAR DISCRIMINANT FUNCTIONS Gradient descent procedures, Perceptron, Support vector machines	08
	Total	40

Suggested Books

- Pattern Classification, Richard O. Duda, Peter E. Hart, David G. Stork John Wiley 2001
- Pattern Recognition, Konstantinos Koutroumbas and Sergios Theodoridis 4th Edition., Academic Press 2009
- Pattern Recognition and Machine Learning, Bishop, Christopher, Springer 2006

6AM5-11: Cloud Computing

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. Introduction Cloud Computing: Nutshell of cloud computing, Enabling Technology, Historical development, Vision, feature Characteristics and components of Cloud Computing. Challenges, Risks and Approaches of Migration into Cloud. Ethical Issue in Cloud Computing, Evaluating the Cloud's Business Impact and economics, Future of the cloud. Networking Support for Cloud Computing. Ubiquitous Cloud and the Internet of Things	06
3	**Cloud Computing Architecture:** Cloud Reference Model, Layer and Types of Clouds, Services models, Data centre Design and interconnection Network, Architectural design of Compute and Storage Clouds. Cloud Programming and Software: Fractures of cloud programming, Parallel and distributed programming paradigms-Map Reduce, Hadoop, High-level Language for Cloud. Programming of Google App Engine.	10
4	**Virtualization Technology:** Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure/Tools and Mechanisms, Hypervisor VMware, KVM, Xen. Virtualization: of CPU, Memory, I/O Devices, Virtual Cluster and Resources Management, Virtualization of Server, Desktop, Network, and Virtualization of data-Centre.	9
5	**Securing the Cloud:** Cloud Information security fundamentals, Cloud security services, Design principles, Policy Implementation, Cloud Computing Security Challenges, Cloud Computing Security Architecture. Legal issues in Cloud Computing. Data Security in Cloud: Business Continuity and Disaster Recovery, Risk Mitigation, Understanding and Identification of Threats in Cloud, SLA-Service Level Agreements, Trust Management	07
6	**Cloud Platforms in Industry:** Amazon web services, Google AppEngine, Microsoft Azure Design, Aneka: Cloud Application Platform -Integration of Private and Public Clouds Cloud applications: Protein structure prediction, Data Analysis, Satellite Image Processing, CRM	07
	Total	40

Suggested Books

- Dan C Marinescu, Cloud Computing, Theory and Practice, MK Elsevier
- Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley
- Barrie Sosinsky, Cloud Computing Bible, Wiley
- Jim Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, MK Elsevier

6AM5-12: Distributed System

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	**Distributed Systems:** Features of distributed systems, nodes of a distributed system, Distributed computation paradigms, Model of distributed systems, Types of Operating systems: Centralized Operating System, Network Operating Systems, Distributed Operating Systems & Cooperative Autonomous Systems, design issues in distributed operating systems. Systems Concepts and Architectures: Goals, Transparency, Services, Architecture Models, Distributed Computing Environment (DCE). Theoretical issues in distributed systems: Notions of time and state, states & events in a distributed system, time, clocks & event precedence, recording the state of distributed systems.	08
3	**Concurrent Processes and Programming:** Processes and Threads, Graph Models for Process Representation, Client/Server Model, Time Services, Language Mechanisms for Synchronization, Object Model Resource Servers, Characteristics of Concurrent Programming Languages (Language not included).Inter-process Communication and Coordination: Message Passing, Request/Reply and Transaction Communication, Name and Directory services, RPC, and RMI case studies.	08
4	**Distributed Process Scheduling:** A System Performance Model, Static Process Scheduling with Communication, Dynamic Load Sharing and Balancing, Distributed Process Implementation. Distributed File Systems: Transparencies and Characteristics of DFS, DFS Design and implementation, Transaction Service and Concurrency Control, Data and File Replication. Case studies: Sun network file systems, General Parallel file System and Window's file systems. Andrew and Coda File Systems	08
5	**Distributed Shared Memory:** Non-Uniform Memory Access Architectures, Memory Consistency Models, Multiprocessor Cache Systems, Distributed Shared Memory, Implementation of DSM systems. Models of Distributed Computation: Preliminaries, Causality, Distributed Snapshots, modelling a Distributed Computation, Failures in a Distributed System, Distributed Mutual Exclusion, Election, Distributed Deadlock handling, Distributed termination detection.	08
6	**Distributed Agreement**: Concept of Faults, failure and recovery, Byzantine Faults, Adversaries, Byzantine Agreement, Impossibility of Consensus and Randomized Distributed Agreement. Replicated Data Management: concepts and issues, Database Techniques, Atomic Multicast, and Update Propagation. CORBA case study: Introduction, Architecture, CORBA RMI, CORBA Services.	08
	Total	41

Suggested Books

- Andrew S. Tannenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson
- George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair, Distributed Systems: Concepts and Design, Addison Wesley
- P. K. Sinha, Distributed Operating Systems: Concepts and Design, IEEE press
- M. Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems,, McGraw-Hill

6AM5-13: Data Mining & Business Intelligence

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 -** Evolution and importance of Data Mining-Types of Data and Patterns mined Technologies-Applications-Major issues in Data Mining. Knowing about Data- Data Preprocessing: Cleaning– Integration–Reduction–Data transformation and Discretization.	8
3	**BI- Data Mining & Warehousing**: Basic Concepts-Data Warehouse Modeling-OLAP and OLTP systems - Data Cube and OLAP operations–Data Warehouse Design and Usage-Business Analysis Framework for Data Warehouse Design- OLAP to Multidimensional Data Mining. Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods – Mining Association Rules – Association to Correlation Analysis.	9
4	**Classification and Prediction: Issues** - Decision Tree Induction - Bayesian Classification – Rule-Based Classification – k-Nearest mining Classification. Prediction –Accuracy and Error measures.	7
5	**Clustering:** Overview of Clustering – Types of Data in Cluster Analysis – Major Clustering Methods.	7
6	**Introduction to BI** -BI definitions and concepts- BI Framework-Basics of Data integration Introduction to Business Metrics and KPI - Concept of the dashboard and balanced scorecard. Tool for BI: Microsoft SQL server: Introduction to Data Analysis using SSAS tools Introduction to Data Analysis using SSIS tools- Introduction to Reporting Services using SSRS tools- Data Mining Implementation Methods.	8
	Total	40

Suggested Books

- Han, M. Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann
- M. Kantardzic, “Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc
- Paulraj Ponnian, “Data Warehousing Fundamentals”, John Willey.
- M. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education.
- G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, Wiley India

6AM4-21: 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, close-open.

6AM4-22: 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 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

6AIMIL4-23: Soft Computing Lab

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

S.No.	List of Experiments
1	Create a perceptron with an appropriate number of inputs and outputs. Train it using a fixed increment learning algorithm until no change in weights is required. Output the final weights
2	Training a feed forward Neural network.
3	Train Feed Forward neural Network with Back propagation
4	Building a Linear Regression Neural network
5	Implementation of Radial basis function network
6	Implementing crisp partitions for real-life Iris dataset
7	Implement Union, Intersection, Complement and Difference operations on fuzzy sets.
8	Create Fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on two fuzzy relations
9	Write a program to implement Hebb's rule and Delta rule
10	Implementing SVM (Support Vector Machine) classification by fuzzy concepts.
11	Implementation of Self-Organizing Map
12	Implementation of back propagation algorithm for solving face recognition problem
13	Implementation of Ant Colony Optimization on real life dataset
14	Implementation of Neuro-Fuzzy-GA methods on real life dataset.

Suggested Books

- R. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India
- L. Fausett, Fundamentals of Neural Networks, Prentice Hall

Experiments can be implemented on Matlab

6AM4-24: 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 "Hello World" application.
2	To understand Activity, Intent, Create 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.