SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE (ARTIFICIAL INTELLIGENCE)

V & VI Semester

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

Office: Bikaner Technical University, Bikaner
Karni Industrial Area, Pugal Road, Bikaner-334004
Website: https://btu.ac.in

B.Tech.: Artificial Intelligence
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	5AI3-01	Mathematics and Statistics	2	0	0	2	20	80	100	**2**
2	PCC/ PEC	5AI4-02	Introduction to Machine Learning	3	0	0	3	30	120	150	**3**
3		5AI4-03	Computer Architecture and Organization	3	0	0	3	30	120	150	**3**
4		5AI4-04	Artificial Neural Networks	3	0	0	3	30	12	150	**3**
5		5AI4-05	Theory of Computation	3	0	0	3	30	120	150	**3**
6		Professional Elective 1: (anyone)		2	0	0	2	20	80	100	**2**
		5AI5-11	Advances in AI								
		5AI5-12	Data Communication & Computer Networks								
		5AI5-13	AI in Healthcare								
		Sub Total		**16**	**0**	**0**		**160**	**640**	**800**	**16**
PRACTICAL & SESSIONAL											
7	PCC	5AI4-21	Probability and Statistical Programming Using R	0	0	2	2	30	20	50	**1**
8		5AI4-22	Machine Learning Lab	0	0	2	2	30	20	50	**1**
9		5AI4-23	LISP Lab	0	0	2	2	30	20	50	**1**
10		5AI4-24	Neural Networks Lab	0	0	2	2	30	20	50	**1**
11	PSIT	5AI7-30	Industrial Training	0	0	1		75	50	125	**2.5**
12	SODECA	5AI8-00	Social Out Reach, 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.: Artificial Intelligence
3rd Year - VI Semester

THEORY												
SNo.	Category	Course		Contact hrs./week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
1	ESC	6AI3-01	Digital Image Processing	2	0	0	2	20	80	100	2
2	PCC/ PEC	6AI4-02	Natural Language Processing	3	0	0	3	30	120	150	3
3		6AI4-03	Analysis of Algorithms	3	0	0	3	30	120	150	3
4		6AI4-04	Soft Computing	3	0	0	3	30	120	150	3
5		6AI4-05	Operating Systems	3	0	0	3	30	120	150	3
6		Professional Elective 1 (anyone)		3	0	0	3	30	120	150	3
		6AI5-11	Computer Vision								
		6AI5-12	Compiler Design								
		6AI5-13	Big Data Analytics								
		Sub-Total		**17**	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL & SESSIONAL											
7	PCC	6AI4-21	Digital Image Processing Lab	0	0	3	2	45	30	75	1.5
8		6AI4-22	Natural Language Processing Lab	0	0	3	2	45	30	75	1.5
9		6AI4-23	Analysis of Algorithms Lab	0	0	3	2	45	30	75	1.5
10		6AI4-24	Soft Computing Lab	0	0	3	2	45	30	75	1.5
11	SODE CA	6AI8-00	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

(ARTIFICIAL INTELLIGENCE)

V & VI Semester

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

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

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5AI3-01: 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, to 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
- Higher Engg. Mathematics by Dr. B. S. Grewal- Khanna publications
- Advanced Engg. Mathematics - by Erwin Kreyszig John; Willey & sons
- Advanced Engg. Mathematics - by R. K. Jain & S. R. K Iyenger; Narosa Publishing House.

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5AI4-02: Introduction to Machine Learning

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	**Preliminaries,** what is machine learning; varieties of machine learning, learning input/output functions, bias, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination Methods.	08
3	**Neural Networks,** threshold logic units, linear machines, networks of threshold learning units, Training of feed-forward networks by back propagations, neural networks vs. knowledge-based systems	07
4	**Statistical Learning,** background, and general method, learning belief networks, nearest neighbor. Decision trees supervised learning of uni-variance decision trees, network equivalent of decision trees, overfitting, and evaluation.	07
5	**Inductive Logic Programming,** notation, and definitions introduce recursive programs, inductive logic programming, and decision tree induction.	07
6	**Computational learning theory,** fundamental theorem, Vapnik- Chernenko's dimension, linear dichotomies, and capacity. Unsupervised learning, clustering methods based on Euclidian distance and probabilities, hierarchical clustering methods. Introduction to reinforcement and explanation-based learning.	08
	Total	38

Suggested Book

- Introduction to Machine learning, Nils J.Nilsson
- Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
- Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sara Guido, O'Reilly

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5AI4-03: Computer Architecture and Organization

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	**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.	7
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	8
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.	8
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.	8
	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 Processo Architecture

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5AI4-04: Artificial Neural Networks

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	**Artificial Neural Networks** Introduction and ANN Structure, Biological neurons and artificial neurons. Model of an ANN. Activation functions 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	7
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
3	**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:	8
4	**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
5	**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.	8
	Total	40

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

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5AI4-05: Theory of Computation

` 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	**Finite Automata & Regular Expression:** Basic machine, Finite state machine, Transition graph, Transition matrix, Deterministic and non-deterministic finite automation, Equivalence of DFA and NDFA, Decision properties, minimization of finite automata, Mealy & Moore machines. 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.	7
3	**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
4	**Nondeterministic PDA, Definitions,** PDA and CFL, CFG for PDA, Deterministic PDA, and Deterministic PDA and Deterministic CFL, The pumping lemma for CFL's, Closure Properties and Decision properties for CFL, Deciding properties of CFL.	8
5	**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
6	**Tractable and Untractable Problems:** P, NP, NP-complete and NP-hard problems, Un-decidability, 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 an Computations," Second Edition, Pearson Education.
- John C Martin, "Introduction to Languages and the Theory of Computation," Third Edition, Tata McGra Hill 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, Pearson Education, 2007.

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5AI5-11: Advances in AI

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	**Information Extraction (IE):** bootstrapping, semantic draft, Zipf distribution, Never Ending Learning (NELL), macro reading vs. micro reading, Open IE, relation kernels, distant supervision, deep learning for IE, reinforcement learning for IE	6
3	**Knowledge Base Inference:** Horn clause inference, random walks over graphs, neural models, text as an interlingua, text for inference, temporal scoping.	6
4	**Question Answering:** Open question answering, semantic parsing, Highway networks, Maxout networks, additive vs. multiplicative models	5
5	**Research Trends in Question Answering:** dependency tree, Recurrent Neural Networks (RNN, weighted rank loss, deep feature fusion networks, QA in the real-world, Siamese networks vs. Long Sort-Term Memory	6
6	**Generative:** Hierarchical Neural Networks, Memory Networks, Generative Adversarial Networks, chatbots	6
	Total	30

Suggested Books

- Russell, Artificial Intelligence: A Modern Approach (1 ed.), Pearson Education India, 2015. ISBN 978-9332543515.
- Denis Rothman, Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial (1 ed.), Packt Publishing, 2018. ISBN 978-
- 1788990547.
- Dirk V. Arnold, Noisy Optimization With Evolution Strategies (Genetic Algorithms and Evolutionary Computation) (1 ed.), Springer, 2012. ISBN 978-1461353973.

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5AI5-12: Data Communication and Computer Networks

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.	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,	6
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,	6
4	**Network Layer:** Design issues, Routing algorithms: IPV4, IPV6, Address mapping: ARQ, RARQ, Congestion control, Unicast, Multicast, Broadcast routing protocols, Quality of Service, Internetworking	6
5	**Transport Layer:** Transport service, Elements of transport protocols, User Datagram Protocol, Transmission Control Protocol, Quality of service, Leaky Bucket and Token Bucket algorithm	6
6	**Application Layer:** WWW, DNS, Multimedia, Electronic mail, FTP, HTTP, SMTP,	5
	Total	30

Suggested Book:

- A. S. Tannenbaum, D. Wetherall, "Computer Networks," Prentice-Hall, Pearson, 5th Edition
- Behrouz A. Forouzan, "Data Communications and Networking," Tata McGraw- Hill, 4th Ed
- Fred Halsall, "Computer Networks," Addison – Wesley Pub. Co. 1996.
- Larry L, Peterson, and Bruce S. Davie, "Computer Networks: A System Approach," Elsevier, 4th Ed.
- William Stallings, "Data and Computer Communications," Prentice-Hall, Imprint of Pearson, 9th Ed.

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5AI5-13:AI in Health Care

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

S.No	Contents	Hours
1	Course Overview, Introduction to Module, Operationalizing Consumerism Using AI, Operationalizing a New Supply Chain, Machine Learning, Artificial Intelligence, and Decision Support.	6
2	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
3	Provider Taxonomies and Relationships, Predictive Modeling Process, Analytic Maturity Model, Identifying Historic Addressable Opportunity, Predicting Addressable Opportunity, Measuring Predictive Accuracy, Making Recommendations	6
4	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,	6
5	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.

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5AI4-21: Probability and Statistical Programming Using R

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

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.

5AI4-22: Machine Learning Lab

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

S.No.	List of Experiments
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a . CSV file.
2	For a given set of training data examples stored in a . CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.
3	Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a . CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set. You can use Java/Python ML library lasses/API.
8	Apply EM algorithm to cluster a set of data stored in a . CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library lasses/API in the program.
9	Write a program to implement a k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

5AI4-23: LISP Lab

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

S.No.	List of Experiments
1	Write simple programs in LISP and execute them using online/offline compilers/interpreters
2	Study of a basic building blocks in LISP.
3	Study and implementation of Data types in LISP.
4	Implementation of Macros and Function in LISP.
5	Execution of Global, Local variables and constants in LISP.
6	Execute various types of operators and conditional statements in LISP.
7	Implement various data structures in LISP. Arrays List Sequence Others
8	Create hash-table in LISP.
9	File handling in LISP.
10	Implement packages in LISP.

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5AI4-24: Neural Networks lab

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

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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6AI3-01: 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.

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6AI4-02: 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, 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 & Jaes 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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6AI4-03: Analysis of Algorithms

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	**Background:** Review of Algorithm, Complexity Order Notations: definitions and calculating complexity. **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. **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. **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	41

Suggested Books

- E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galotia Publication
- 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," Pearsor Education, Reprint 2006

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6AI4-04: 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	08
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,	08
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.	08
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	06
	Total	40

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

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6AI4-05: 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)

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6AI5-11: Computer Vision

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.	1
2	**What is Computer Vision** - Low-level, Mid-level, High-level, Overview of Diverse Computer Vision Applications: Document Image, Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.	7
3	**Image Formation Models:** Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Photometric Stereo, Depth from Defocus, Construction of the 3D model from images.	8
4	**Image Processing, Feature Extraction, and Motion Estimation**: Image pre-processing, Image representations (continuous and discrete), Edge detection, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.	6
5	**Shape Representation and Segmentation**: Contour-based representation, Region-based representation, De-formable curves and surfaces, Snakes and active contours, Level set representations, Fourier, and wavelet descriptors, Medial representations, Multi-resolution analysis, Object recognition.	8
6	**Image Understanding and Computer Vision Applications:** Pattern recognition methods, Face detection, Face detection, Face recognition, 3D shapes models of faces Application: Surveillance-foreground-background separation–human gait analysis Application: In-vehicle vision system: locating roadway–road markings–identifying road signs-locating pedestrians.	8
	Total	38

Suggested Books

- D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall
- Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA), Springer, 2010
- E. R. Davies, Computer & Machine Vision, Academic Press, 2012
- Dana H. Ballard, Christopher M. Brown, Computer Vision, Prentice Hall 1st Edition (May 1, 1982), ISBN-9 0131653160

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6AI5-12: Compiler Design

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:** Compiler, Translator, Interpreter definition, Phase of the compiler, Bootstrapping, Review of Finite automata lexical analyzer, Input, Recognition of tokens, Idea about LEX: 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. ISBN 978-0321547989.
- 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, 199 ISBN 978-0534939724.
- Dhamdhere, Compiler Construction (2 ed.), Macmillan Publication, 2003. ISBN 978-0333904060

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6AI5-13: Big Data Analytics

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.	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– Sharding – 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

- David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

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- Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
- Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007
- EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
- Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
- Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 201

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6AI4-21: Digital Image Processing Lab

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

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 between 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.

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6AI4-22: Natural Language Processing Lab

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

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 expression 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

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6AI4-23: Analysis of Algorithms Lab

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

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 BFS method. b. Check whether a given graph is connected or not using 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.

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6AI4-24: Soft Computing lab

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

S.No.	List of Experiments
1	Create a perceptron with an appropriate number of inputs and outputs. Train it is using 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 Backpropagation
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 the 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 backpropagation 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 Algorithm Synthesis and Applications, Prentice Hall of India
- L. Fausett, Fundamentals of Neural Networks, Prentice Hall

Experiments can be implemented on Matlab

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