SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Computer Science and Engineering (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 CSE (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	5CSAI3-01	Information Theory & Coding	2	0	0	2	20	80	**100**	**2**
2	PCC/ PEC	5CSAI4-02	Compiler Design	3	0	0	3	30	120	**150**	**3**
3		5CSAI4-03	Operating Systems	3	0	0	3	30	120	**150**	**3**
4		5CSAI4-04	Software Engineering	3	0	0	3	30	120	**150**	**3**
5		5CSAI4-05	Analysis of Algorithms	3	0	0	3	30	120	**150**	**3**
6		Professional Elective 1: (anyone)		2	0	0	2	20	80	**100**	**2**
		5CSAI5-11	Wireless Communication								
		5CSAI5-12	AI in Health Care								
		5CSAI5-13	BioInformatics								
		Sub Total		**16**	**0**	**0**		**160**	**640**	**800**	**16**
PRACTICAL & SESSIONAL											
7	PCC	5CSAI4-21	Software Engineering lab	0	0	2	2	30	20	**50**	**1**
8		5CSAI4-22	Compiler Design Lab	0	0	2	2	30	20	**50**	**1**
9		5CSAI4-23	Analysis of Algorithms Lab	0	0	2	2	30	20	**50**	**1**
10		5CSAI4-24	Web Development Lab	0	0	2	2	30	20	**50**	**1**
11	PSIT	5CSAI7-30	Industrial Training	0	0	1		75	50	**125**	**2.5**
12	SODECA	5CSAI8-00	Social Outreach, Discipline & Extra-Curricular Activities						25	**25**	**0.5**
		Sub- Total		**0**	**0**	**9**		**195**	**155**	**350**	**7**
		TOTAL OF V SEMESTER		**16**	**0**	**9**		**355**	**795**	**1150**	**23**

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

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B. Tech CSE (Artificial Intelligence)
3rd Year – VI Semester

S.No.	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
THEORY											
1	ESC	6CSAI3-01	Digital Image Processing	2	0	0	2	20	80	**100**	**2**
2	PCC/ PEC	6CSAI4-02	Natural Language Processing	3	0	0	3	30	120	**150**	**3**
3		6CSAI4-03	Data Science	3	0	0	3	30	120	**150**	**3**
4		6CSAI4-04	Computer Architecture and Organization	3	0	0	3	30	120	**150**	**3**
5		6CSAI4-05	Cryptography and Network Security	3	0	0	3	30	120	**150**	**3**
6		Professional Elective 1 (anyone)		3	0	0	3	30	120	**150**	**3**
		6CSAI5-11	Cloud Computing								
		6CSAI5-12	Distributed System								
		6CSAI5-13	Computer Vision								
				17	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL & SESSIONAL											
7	PCC	6CSAI4-21	Digital Image Processing Lab	0	0	3	2	45	**30**	**75**	**1.5**
8		6CSAI4-22	Natural Language Processing Lab	0	0	3	2	45	**30**	**75**	**1.5**
9		6CSAI4-23	Data Science Lab	0	0	3	2	45	**30**	**75**	**1.5**
10		6CSAI4-24	Cryptography and Network Security Lab	0	0	3	2	45	**30**	**75**	**1.5**
11	SODECA	6CSAI8-00	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

Computer Science and Engineering (Artificial Intelligence) V & VI Semester

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

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5CSAI3-01: Information Theory & Coding

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

S.No.	Contents	Hours
1	**Introduction:** Objective, scope, and outcome of the course.	1
2	**Introduction to information theory:** Uncertainty, Information and Entropy, Information measures for continuous random variables, source coding theorem. Discrete Memoryless channels, Mutual information, Conditional entropy.	5
3	**Source coding schemes for data compaction:** Prefix code, Huffman code, Shannon-Fane code &Hempel-Ziv coding channel capacity. Channel coding theorem. Shannon limit.	5
4	**Linear Block Code:** Introduction to error connecting codes, coding & decoding of linear block code, minimum distance consideration, conversion of the non-systematic form of matrices into systematic form.	5
5	**Cyclic Code:** Code Algebra, Basic properties of Galois fields (GF) polynomial operations over Galois fields, generating cyclic code by generating polynomial, parity check polynomial. Encoder & decoder for cyclic codes.	6
6	**Convolution Code:** Convolutional encoders of different rates. Code Tree, Trellis, and state diagram. Maximum likelihood decoding of convolutional code: The Viterbi Algorithm fee distance of a convolutional code.	6
	TOTAL	28

Suggested Books

- T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley
- R. Togneri, C.J.S DeSilva, Fundamentals of Information Theory and Coding Design, Taylor and Franc
- R. J. McEliece, The Theory of Information and Coding, Cambridge University Press
- R. Bose, Information Theory Coding and Cryptography, Tata McGraw Hill
- Digital and Analog Communication Systems Shanmugam, K. Sam, Wiley India

5CSAI4-02: 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.	1
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.	6
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.	8
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.	7
	TOTAL	42

Suggested Books

- A aho, Ullman," Compilers: Principles Techniques and Tool," Pearson.
- A Aho, Ullman," Principles Of Compiler Design,"

5CSAI4-03: 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.	1
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	4
3	**Memory management:** contiguous memory allocation, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing, segmentation, Case study	6
4	**Deadlock:** Shared resources, resource allocation and scheduling, resource graph models, deadlock detection, deadlock avoidance, deadlock prevention algorithms **Device management:** device sand their characteristics, device drivers, device handling, disk scheduling algorithm m sand policies	14
5	**File management:** file concept, types, and structures, directory structure, cases studies, access methods and matrices, file security, user authentication	7
6	**UNIX and Linux operating systems as case studies;** Time O Sand case studies of Mobile OS	8
	Total	40

Suggested Book

- Silber Schatz, P. B. Galvin and G. Gagne, "Operating System Concepts ", John Wiley.
- Tanenbaum, "Modern Operating Systems," Prentice-Hall India Learning Private Limited.
- William Stallings," Operating Systems Internals and Design Principles", Prentice-Hall.
- William Stallings, "Operating Systems" Pearson Education Asia.
- Nutt, "Operating Systems" Pearson, Education Asia.

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5CSAI4-04: Software Engineering

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr Hours
SN	**Contents**	**HOURS**
1.	Introduction, software life-cycle models, software requirements specification, formal requirements specification, verification, and validation.	8
2.	Software Project Management: Objectives, Resources, and their estimation, LOC and FP estimation, effort estimation, COCOMO estimation model, risk analysis, software project scheduling.	8
3.	Requirement Analysis: Requirement analysis tasks, Analysis principles. Software prototyping and specification data dictionary, Finite State Machine (FSM) models. Structured Analysis: Data and control flow diagrams, control and process specification behavioral modeling.	8
4.	Software Design: Design fundamentals, Effective modular design: Data architectural and procedural design, design documentation.	8
5.	Object-Oriented Analysis: Object-oriented Analysis Modeling, Data modeling. Object-Oriented Design: OOD concepts, Class and object relationships, object modularization, Introduction to Unified Modeling Language.	8
	Total	**40**

Suggested Book

- Roger S. Pressman, "Software Engineering – A Practitioner 's Approach", McGraw-Hill International.
- Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia.
- Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited.
- Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India..

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5CSAI4-05: Analysis of Algorithms

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr Hours
S.No.	**Contents**	**HOURS**
1	**Introduction:** Objective, scope, and outcome of the course.	1
2	**Background:** 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.	6
3	**Greedy Method:** Knapsack Problem, Job Sequencing, Optimal Merge Patterns, and Minimal Spanning Trees. Dynamic Programming: Matrix Chain Multiplication. Longest Common Subsequence and 0/1Knapsack Problem.	10
4	**Branch And Bound:** Traveling Salesman Problem and Lower Bound Theory. Backtracking Algorithms and queens' problem. Pattern Matching Algorithms: Naïveand Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms.	8
5	**Assignment Problems:** Formulation of Assignment and Quadratic Assignment Problem. Randomized Algorithms- LasVegas 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.	8
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.	8
	Total	42

Suggested Book

- E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of ComputerAlgorithms," 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", Pearso Education, Reprint 2006

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5CSAI5-11: Wireless Communication

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	**Wireless Channels:** Large scale path loss– Path loss models: Free Space and Two-Ray models -Link Budget design–Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth– Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.	6
3	**Cellular Architecture:** Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand-off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.	5
4	**Digital Signaling for Fading Channels:** Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.	5
5	**Multipath Mitigation Techniques:** Equalization–Adaptive equalization, Linear and Non-Linear equalization, zero forcing, and LMS Algorithms. Diversity–Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.	6
6	**Multiple Antenna Techniques:** MIMO systems – spatial multiplexing -System model -Pre-coding - Beamforming - transmitter diversity, receiver diversity- Channel state information capacity in fading and non-fading channels.	5
	Total	28

Suggested Books

- Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005.
- Wireless Communications and Networking, Vijay Garg, Elsevier
- J. Schiller, "Mobile Communication," Pearson Education,
- Iti Saha Misra, "Wireless Communication and Networks: 3G and Beyond",, McGraw Hill Educatio (India) Private Ltd, New Delhi.
- Andreas.F. Molisch, "Wireless Communications", John Wiley – India.
- Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts" Riv Publishers, Denmark, (Indian reprint).

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5CSAI5-12: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	**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.

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5CSAI5-13: Bioinformatics

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:** Basics of biology	2
3	**Sequences:** Problem Statement, edit distance and substitution matrices, HMMs and pairwise HMMs, Global and local alignments, Spliced alignment, Space-efficient sequence alignment, Multiple alignment, Database searching tools, Sequence by hybridization, Profile HMMs	7
4.	**Structures:** Protein Structure alignment, Protein structure prediction	6
5	**Phylogenetic trees:** Large parsimony and small parsimony problems, Probabilistic approaches, Grammar-based approaches	7
6	**Miscellaneous topics:** Pathways and networks, Microarrays, Biomedical images	5
	Total	28

Suggested Books

- Jones N.C. and Pevzner P.A.," An introduction to bioinformatics algorithms", MIT Press Books.
- Dublin R., Eddy R., Krogh A. and Mitchinson G., "Biological Sequence Analysis", Cambridg University Press.
- Michael S. Waterman,"Introduction to Computational Biology: Maps, Sequences and Genomes" Chapman & Hall--CRC Press. Cambridge University Press.
- Clote and R. Backofen, "Comptuational Molecular Biology: An Introduction" Wiley.

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5CSAI4-21: Software Engineering Lab

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

S.No.	Contents
1.	Development of requirements specification, function-oriented design using SA/SD, object-oriented design using UML, test case design, implementation using Java and testing. Use appropriate CASE tools and other tools such as configuration management tools and program analysis tools in the software life cycle.
2.	Develop Software Requirements Specification (SRS) for a given problem in IEEE template.
3.	Develop DFD model (level-0, level-1 DFD, and Data dictionary) of the project.
4.	Develop structured design for the DFD model developed.
5.	Developed all Structure UML diagrams of the given project.
6.	Develop Behavior UML diagram of the given project.
7.	Manage file, using the Project Libre project management software tool.

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5CSAI4-22: Compiler Design Lab

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

S.No.	Contents
1	Introduction: Objective, scope and outcome of the course.
2	To identify whether given string is 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 total occurrence of each character in a given file. [Taking file from user] 6
6	Write a C program to insert, delete and display the entries in 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.

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5CSAI4-23: Analysis of Algorithms Lab

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

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

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5CSAI4-24: Web Development 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 Flask** **Installation:** Creating the application directory, Virtual Environments, creating a virtual environment with Python 3 and Python 2, Working with Virtual Environment, installing python packages using pip.
2.	**Basic Application Structure**: Initialization, Routes and View functions, a complete application, development web server, dynamic routes, debug mode, command-line options, The request-response cycle: Application and Request contexts, request dispatching, the Request Object, Request Hooks, Responses. Flask Extensions.
3.	**Templates:** The Jinja2 Template Engine, Rendering Templates, Variables, Control Structures, Bootstrap Integration with Flask-Bootstrap, Custom Error Pages, Links, Static Files, Localization of Dates and Times with Flask-Moments.
4.	**WebForms:** Configuration, Form Classes, HTML Rendering of Forms, Form Handling in View functions, Redirects and User Sessions, Message Flashing.
5.	**Databases:** SQL Databases, SQL, Python database Frameworks, Database Management with Flask-SQL Alchemy, Model Definition, Relationships, Database Operations- creating the tables, inserting rows, modifying rows, deleting rows, querying rows, Database use in View Functions, Integration with the Python Shell, Database Migration with Flask-Migrate, Creating Migration Repository, Creating a Migration Script, Upgrading the database, Adding More Migrations.
6.	**Email:** Email Support with Flask -Mail, Sending Email from Python Shell, Integrating Emails with Application, Sending Asynchronous Email.
7.	**Large Application Structure**: Project Structure, Configuration Options, Application Package-Using an application factory, Implementation application functionality in a blueprint, Application Script, Requirements File, Unit Setup, Database Setup, Running the application.

Suggestedbooks:

- Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming- An Introduction to Computt Science Using Python 3.6, Shroff Publications and Distributors
- Miguel Grinberg, Flask Web Development, O'Reilly
- John V Guttag, Introduction to Computation and Programming Using Python '', Revised and expande Edition, MIT Press , 2013
- Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inte disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
- Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
- Rossum, Introduction To Python ,Shroff Publications and Distributors
- Downey, Think Python 2/ED, Shroff Publications and Distributors

6CSAI3-01: 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.	1
2	**Introduction to Image Processing:** Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.	4
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.	6
4	**Image Restoration:** Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering.	7
5	**Image Compression:** Coding redundancy, Inter-pixel redundancy, Psych visual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.	5
6	**Image Segmentation & Representation:** Point, Line, and Edge Detection, Thresholding, Edge, and Boundary linking, Hough transforms, Region-Based Segmentation, Boundary representation, Boundary Descriptors.	5
	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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6CSAI4-02: Natural Language Processing

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 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

- Jurafsky, David, and James H. Martin. Speech and Language Processing: An Introduction to Natura Language Processing, Computational Linguistics and Speech Recognition, PEARSON
- James Allen. Natural Language Understanding. The Benjamin/Cummings Publishing Company Inc..
- Manning, Christopher D., and Hinrich Schütze. Foundations of Statistical Natural Language Processing Cambridge, MA: MIT Press
- Steven Bird, Ewan Klein, and Edward Loper. Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit

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6CSAI4-03: Data Science

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.	**Toolboxes:** Python, fundamental libraries for Data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.	7
3.	**Descriptive statistics,** data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance, and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values.	8
4.	**Supervised Learning**: First step, learning curves, training validation and test. Learning models generalities, support vector machines, random forest. Examples	7
5.	**Regression analysis,** Regression: linear regression simple linear regression, multiple & Polynomial regression, Sparse model. Unsupervised learning, clustering, similarity and distances, quality measures of clustering, case study.	10
6.	**Network Analysis**, Graphs, Social Networks, centrality, drawing centrality of Graphs, PageRank, Ego-Networks, community Detection.	7
	Total	40

Suggested Books

- Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, .
- Cathy O'Neil and Rachel Schutt , **"Doing Data Science", O'Reilly**.
- David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC.
- Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

6CSAI4-04: 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.	1
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, Interposes 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

6CSAI4-05: Cryptography and Network Security

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 security attacks:** Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. Services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers.	6
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.	10
4	**Public Key Cryptosystems with Applications:** Requirements and Cryptanalysis, RSA cryptosystem, Rabin cryptosystem, Elgamal. Kerberos, x.509 Authentication Service, Public-Key Infrastructure.	6
5	**IP Security:** IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.	8
6	**Intruders & Policies Network Security:** Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security. Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection.	10
	Total	41

Suggested Books

- Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill. Re print 2015.
- Stallings William, "Cryptography and Network Security - Principles and Practice.
- William Stallings, "Network Security Essentials Applications and Standards", Pearson Education.
- Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication In Public World", PHI.
- Godbole," Information Systems Security", Wiley.

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6CSAI5-11: 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. **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	01 + 06
2	**Cloud Computing Architecture:** Cloud Reference Model, Layer and Types of Clouds, Services models, Data center 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
3	**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.	09
4	**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
5	**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, Wile
- Barrie Sosinsky, Cloud Computing Bible, Wiley
- Jim Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, MK Elsevi

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6CSAI5-12: Distributed System

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

S.No.	Contents	Hr
1	**Introduction:** Objective, scope, and outcome of the course.	1
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, and 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 and events in a distributed system, time, clocks, and event precedence, recording the state of distributed systems.	8
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.	8
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	8
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.	8
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.	8
	Total	41

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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 an 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

6CSAI5-13: Computer Vision

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	**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 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 shape 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) , ISB 978-0131653160

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6CSAI4-21: 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.

6CSAI4-22: 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 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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6CSAI4-23: Data Science Lab

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

S.No.	Contents
1	Interactive commands in Python, data operations, simple programs for writing into files and reading from files. Data file manipulations programs.
2	Familiarization with IDE in Python.
3	Writing programs for standard algorithms of sorting and searching in Python.
4	Plotting the data using X-Y graph, Bar- chart, and using other plotting techniques.
5	Write programs to perform exploratory data analysis: variance, standard derivation, summarization, distribution, and statistical inference.
6	Plotting the various distributions for given data sets.
7	Classifying and presentation of data using support vector machine.
8	Write programs for k-means clustering and presentation for given data sets.
9	Write programs on graphs of social networks for community detection.
10	Write programs for analysis of graphs to find centrality and page-rank.

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6CSAI4-24: Cryptography and Network Security Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P		End Term Exams: 2hr
S.No.	List of Experiments	
1	Write a program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.	
2	Write a program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.	
3	Write a program to perform encryption and decryption using the following algorithms a. Ceaser cipher b. Substitution cipher c. Hill Cipher Demonstrate a bigram language model	
4	Write a program to implement the DES algorithm logic.	
5	Write a program to implement the Blowfish algorithm logic.Generate regular expression for a given text.	
6	Write a program to implement the Rijndael algorithm logicer form Lemmatization.	
7	Write a program to implement RSA algorithm	
8	Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.	
9	Write a program. To Calculate the message digest of a text using the SHA-1 algorithm.	
10	Write a program Calculate the message digest of a text using the MD5 algorithm.	

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