Table: Structure of B.E. (CS) Program

S. No.	Courses		Credits							Actual Credits
		Total Credits	I&II	III	IV	V	VI	VII	VIII	
1.	Basic Science Courses (BSC)	20	17	4						21
2.	Engineering Science Courses (ESC)	30	19	5			5			29
3.	Humanities, Social Science and Management Courses (HSMC)	10	4		3	3				10
4.	Professional Core Courses (PCC)	60		11	19	10	10	7	7	64
5.	Professional Elective Courses (PEC)	18				4	4	3	4	15
6.	Open Elective Courses (OEC)	14				3	3	4	4	14
7.	Seminar	2						2		2
8.	Project	10						3	7	10
9.	Internships in industry	8		2		2		3		7
10.	Mandatory Courses (MC)	NC								-
	Total Credits	172	40	22	22	22	22	22	22	172

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Signing Date:14.06.2024
02:26

B.E II Year (Semester-III) Computer Science & Engineering
Course Structure & Evaluation Scheme

S.No.	Subject Category	Subject Code	Name of theSubject	Periods			EvaluationScheme				Subject Total	Credit
				L	T	P	Sessional			ESE		
							CT	TA	Total			
	THEORYSUBJECT											
1	PCC	BCS303	Software Engineering	3	0	0	30	10	40	60	100	3
2	PCC	BCS302	Data Structures	3	0	0	30	10	40	60	100	3
3	ESC	BEC301	Digital Electronics	3	1	0	30	10	40	60	100	4
4	MC	MC302	Human values & Professional Ethics	2	0	0	30	10	40	60	100	0
5	BSC	BSC301	Mathematics-III	3	1	0	30	10	40	60	100	4
6	PCC	BCS301	Database Management System	3	0	0	30	10	40	60	100	3
	PRACTICALS											
1	PCC	BCS352	Data Structure Lab	0	0	2	20	20	40	60	100	1
2	ESC	BEC351	Digital Electronics Lab	0	0	2	20	20	40	60	100	1
3	PCC	BCS351	Database Management System Lab	0	0	2	20	20	40	60	100	1
4	PROJECT	BCS353	Mini project/ Internship Assessment	0	0	-	-	-	100	0	100	2
			TOTAL	**17**	**3**	**6**			**460**	**540**	**1000**	**22**

Hours per week = 17 (L) +3 (T) +6(P) = 26 Hours

L-Lecture, P- Practical, CT-ClassTest, TA-Teacher'sAssessment, ESE-EndSemesterExamination

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

B.E II Year (Semester-IV) Computer Science & Engineering
Course Structure & Evaluation Scheme

S. No.	Subject Category	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Sessional			ESE		
							CT	TA	Total			
	THEORYSUBJECT											
1	PCC	BCS403	Design and Analysis of Algorithms	3	1	0	30	10	40	60	100	4
2	PCC	BCS401	Computer Organization	3	1	0	30	10	40	60	100	4
3	PCC	BCS402	OOPs using JAVA	3	0	0	30	10	40	60	100	4
4	PCC	BCS404	Discrete Mathematics	3	1	0	30	10	40	60	100	4
5	HSMC	BHSM401	Industrial Management	3	0	0	30	10	40	60	100	3
6	MC	MC401	Environment and Ecology	2	0	0	30	10	40	60	100	0
	PRACTICALS											
1	PCC	BCS451	OOPs using java Lab	0	0	4	20	20	40	60	100	2
2	PCC	BCS452	Design and Analysis of Algorithms lab	0	0	2	20	20	40	60	100	1
			TOTAL	**17**	**3**	**06**			**360**	**540**	**900**	**22**

Hours per week = 17 (L) +03 (T) +06 (P) = 26 Hours

L-Lecture, P- Practical, CT-ClassTest, TA-Teacher'sAssessment, ESE-EndSemesterExamination

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

B.E III Year (Semester-V) Computer Science & Engineering
Course Structure & Evaluation Scheme

S. No.	Subject category	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Sessional Assessment			ESE		
							CT	TA	Total			
	THEORYSUBJECT											
1	PCC	BCS501	Computer Network	3	0	0	30	10	40	60	100	3
2	PCC	BCS504	Theory of Computation	3	0	0	30	10	40	60	100	3
3	PEC	DE-CS501-503	Departmental Elective-1	3	0	0	30	10	`40	60	100	3
4	OEC	OE-CS 501-503	**Open Elective I**	3	0	0	30	10	40	60	100	3
5	PCC	BCS503	Operating System	3	0	0	30	10	40	60	100	3
6	HSMC	BHSM501	Economics for Industry	3	0	0	30	10	40	60	100	3
	PRACTICALS											
1	PCC	PCC551	Operating System Lab	0	0	2	20	20	40	60	100	1
2	PEC	DE-CS501-503	Departmental Elective-1	0	0	2	20	20	`40	60	100	1
3	Internship	BCS552	Internship Assessment	0	0	-	-	-	100	-	100	2
			TOTAL	**18**	**0**	**6**			**420**	**480**	**900**	**22**

Hours per week = 18 (L) +0 (T) +06(P) = 24 Hours

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

B.E III Year (Semester-VI) Computer Science & Engineering
Course Structure & Evaluation Scheme

S. No.	Subjectcategory	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Sessional Assessment			ESE		
							CT	TA	Total			
		THEORYSUBJECT										
1	PCC	BCS602	Compiler Design	3	1	0	30	10	40	60	100	4
2	PCC	BCS601	Artificial Intelligence	3	1	0	30	10	40	60	100	4
3	ESC	BEC602	Microprocessor & microcontroller	3	0	0	30	10	40	60	100	4
4	OEC	OE-CS601-604	**Open Elective II**	3	0	0	30	10	40	60	100	3
5	PEC	DE-CS601-603	**Departmental Elective 2**	3	1	0	30	10	40	60	100	4
6	MC	MC601	Occupational Health and Safety	2	0	0	30	10	40	60	100	0
		PRACTICALS										
1	PCC	BCS652	Compiler Design	0	0	2	20	20	40	60	100	1
1	PCC	BCS651	Artificial Intelligence Lab	0	0	2	20	20	40	60	100	1
2	ESC	BEC651	Microprocessor & Microcontroller Lab	0	0	2	20	20	40	60	100	1.
			TOTAL	17	4	06			360	540	900	22

Hours per week = 17 (L) +04 (T) +06 (P) = 27Hours

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Signing Date:14.06.2024
02:26

B.E IV Year (Semester-VII) Computer Science & Engineering
Course Structure & Evaluation Scheme

S.No.	Subject category	Subject Code	Name of theSubject	Periods			EvaluationScheme				Subject Total	Credit
				L	T	P	Sessional Assessment			ESE		
							CT	TA	Total			
		THEORY										
1	PCC	BCS701	Soft Computing	3	0	0	30	10	40	60	100	3
2	OEC	OE-CS701-703	**Open Elective III**	3	0	0	30	10	40	60	100	4
3	PCC	BCS702	Digital Image Processing	3	1	0	30	10	40	60	100	3
4	PEC	DE-CS701-703	**Departmental Elective III**	3	0	0	30	10	40	60	100	3
		PRACTICAL										
1	PCC	BCS751	Soft Computing Lab	0	0	2	20	20	40	60	100	1
2	Internship	BCS753	Internships	0	0	-	20	20	40	60	100	3
3	seminar	BCS754	Seminar	0	0	2	20	20	40	60	100	2
4	Project	BCS752	Minor Project	0	0	6	-	-	100	-	100	3
			TOTAL	12	01	12			380	420	800	22

Hours per week = 12 (L) +1 (T) +12 (P) = 25 Hours

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

B.E IV Year (Semester-VIII) Computer Science & Engineering
Course Structure & Evaluation Scheme

S. No.	Subject Category	Subject Code	Name of theSubject	Periods			EvaluationScheme				Subject Total	Credit
				L	T	P	Sessional Assessment			ESE		
							CT	TA	Total			
		THEORYSUBJECT										
1	PCC	BCS801	Cryptography and Network Security	3	1	0	30	10	40	60	100	4
2	PEC	DE-CS801-803	**Departmental Elective-IV**	3	1	0	30	10	40	60	100	4
3	OEC	OECS801-803	**Open Elective IV**	3	0	0	30	10	40	60	100	4
4	PCC	BCS802	**Advance Database Management System**	3	0	0	30	10	40	60	100	3
		PRACTICALS										
1	PROJECT	BCS851	Major Project	0	0	14	-	-	150	150	300	7
			TOTAL	**12**	**2**	**16**	**140**	**60**	**350**	**450**	**800**	**22**

Hours per week = 12 (L) +2 (T) +16 (P) = 30Hours

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Signing Date:14.06.2024
02:26

List of open elective subject

Open elective (OE1) semester 5	
OE-CS 501	Operation research
OE-CS 502	Graph theory
OE-CS 503	Computer based numerical and statistical techniques
Open elective (OE1) semester 6	
OE-CS 601	Modeling and simulation
OE-CS 602	IOT
Open elective (OE 3) semester 7	
OE-CS 701	Data science
OE-CS 702	Big data analytic
Open elective (OE 4) Semester 8	
OE-CS 801	Block chain
OE-CS 802	Computer vision

List of departmental elective subject

Departmental elective (DE 1) Semester 5	
DE-CS 501	Data compression
DE-CS 502	Computer Graphics
DE-CS 503	Data Mining and warehousing
Departmental elective (DE 2) Semester 6	
DE-CS 601	Advance Computer Architecture
DE-CS 602	Mobile computing
DE-CS 603	Parallel and distributed computing
Departmental elective (DE 3) Semester 7	
DE-CS 701	Embedded system
DE-CS 702	Web Technology
DE-CS 703	Mobile application development
Departmental elective (DE 4) Semester 8	
DE-CS 801	Machine learning
DE-CS 802	Deep learning
DE-CS 803	Natural Language Processing

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Computer Network

BCS501	**Computer Network**	**3L-T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1: To Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model. To understand the fundamentals and basics of Physical layer, and to apply them in real time applications.

CO2: to study and evaluate medium access layer protocols. To learn data link layer concepts, design issues, and protocols and to Demonstrate knowledge of various error detection, correction and flow control techniques in data link layer.

CO3: To classify the routing protocols, analyze how to assign the IP addresses for the given network and to evaluate different congestion control methods.

CO4: To understand, analyze and evaluate a number of Transport layer and presentation layer services, and protocols.

CO5: To understand the functions of Application layer paradigms and Protocols.

SYLLABUS

Unit -I

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, TCP/IP MODEL, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design.

Physical Level: Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch

Unit-II

Medium Access sub layer: Medium Access sub layer – Channel Allocations, LAN protocols , Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA.

Data Link Layer - Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ.

Unit - III

Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control, Internetworking -TCP / IP - IP packet, IP address, IPv6. '

Unit – IV

Transport Layer: Transport Layer - Design issues, connection management, session Layer Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP – Window Management.

Unit-V

Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application, Example Networks - Internet and Public Networks.

Suggested reference books:

1. Forouzen, "Data Communication and Networking", TMH

2. A.S. Tanenbaum, “Computer Networks”, 3rd Edition, Prentice Hall India, 1997.

3. S. Keshav, “An Engineering Approach on Computer Networking”, Addison Wesley, 1997

4. W. Stallings, “Data and Computer Communication”, Macmillan Press

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

THEORY OF COMPUTATION

BCS502	**Theory of Computation**	**3L-T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1 To use basic concepts of formal languages of finite automata techniques

CO2 To Design Finite Automata's for different Regular Expressions and Languages

CO3 To Construct context free grammar for various languages

CO4. To solve various problems of applying normal form techniques, push down automata and Turing Machines

CO5.To understand the concept of recursively enumerable language.

SYLLABUS

Unit -I

FINITE AUTOMATA (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT - II

REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.

UNIT - III

CONTEXT FREE GRAMMER (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted)

UNIT – IV

PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA.

TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters and TM as a computer of integer functions, Types of TMs.

UNIT V

RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP.

TEXT BOOKS:

1.John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdedition, Pearson Education, India.

REFERENCE BOOKS:

1. **1.** K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

OPERATING SYSTEM

BCS-503	**Operating System**	**3L-T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1: Analyze the structure of OS and basic architectural components involved in OS design

CO2: Analyze and design the applications to run in parallel either using process or thread models of different OS

CO3: Analyze the various device and resource management techniques for timesharing and distributed systems

CO4: Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

CO5: Interpret the mechanisms adopted for file sharing in distributed Applications

CO6: Conceptualize the components involved in designing a contemporary OS

SYLLABUS

Unit I Introduction : Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multi process Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.

Unit – II Concurrent Processes: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem; Inter Process Communication models and Schemes, Process generation.

Unit – III CPU Scheduling: Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.

Unit – IV Memory Management: Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.

Unit – V I/O Management and Disk Scheduling: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

References :

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. SibsankarHalder and Alex A Aravind, "Operating Systems", Pearson Education
3. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
4. D M Dhamdhere, "Operating Systems : A Concept basedApproach", McGraw Hill.
5. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education".
6. Stuart E. Madnick & John J. Donovan, " Operating Systems", Tata McGraw Hill

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

OPERATING SYSTEM LAB

BCS-551	**Operating System lab**	**L-T-2P**	**CREDIT -1**

Course outcome expected:

By end of this course the student should be able to

CO1. Experiment with Unix commands and shell programming

CO2. Build 'C' program for process and file system management using system calls

CO3. Choose the best CPU scheduling algorithm for a given problem instance

CO4 . Identify the performance of various page replacement algorithms

CO5. Develop algorithm for deadlock avoidance, detection and file allocation strategies.

List of experiment

1. To implement CPU Scheduling Algorithms using c /c++ language
1.1FCFS
1.2 SJF
1.3SRTF
1.4 PRIORITY
1.5 ROUND ROBIN

2. Simulate all Page Replacement Algorithms.
2.1FIFO
2.2LRU
3. Simulate Paging Technique of Memory Management

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

ECONOMICS FOR INDUSTRY

BHSM501	**Economics for industry**	**3L-0T-0P**	**CREDIT -3**

Course outcome:

At the end of the course, the students will be able to

CO1. Define the main concepts and describe the models and methods in economic analysis

CO2. Explain economic events in individual markets and the aggregate economy using basic theory and tools

CO3. Apply supply and demand analysis to relevant economic issues

CO4. Explain how individual decisions and actions as a member of society affect the economy locally, nationally and internationally

CO5. Distinguish between perfect competition and imperfect competition and explain the welfare loss in non-competitive markets

SYLLABUS

Unit I: Introduction of Engineering Economics and Demand Analysis: Meaning and nature of Economics, Relation between science, engineering, technology and economics; Meaning of Demand, Determinants of Demand, Shifts in demand, Law of Demand, Price Elasticity of Demand &Types, Income Elasticity, Cross price Elasticity, Determinants of Elasticity, uses and importance of elasticity.

Unit II: Concept of Supply: Law of Supply, Factors affecting Supply, Elasticity of supply.
Demand Forecasting: Introduction, Meaning and Forecasting, Methods or Techniques of Demand Forecasting, Criteria for Good Demand Forecasting, Demand Forecasting for a New Product;

Unit III: Cost Analysis- Introduction, Types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run; Short run and long run, Break-Even Analysis; Production functions: laws of variable proportions, law of returns; Economies of scale: Internal and external.

Unit IV: Market Structure: Market Structure Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

Unit V: Nature and characteristics of Indian economy, concepts of LPG, elementary concepts of National Income, Inflation and Business Cycles ,Concept of N.I. and Measurement., Meaning of Inflation, Types and causes , Phases of business cycle .Investment decisions for boosting economy(National income and per capital income)

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

.**Suggested reference books:**

1. Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)
2. Salvatore D, “Principles of Microeconomics”, Oxford University Press.
3. Koutsoyiannis A, “Modern Microeconomic”, Macmillan Education Ltd.
4. Dwivedi DN, “Principles of Microeconomics”, Pearson Education.
5. Cowell, FA, “Microeconomic Principles and Analysis”, Oxford University Press.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

BCS601	**Artificial Intelligence**	**3L-1T-P**	**CREDIT -4**

Course outcome expected:

By end of this course the student should be able to

CO1: To Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents. Apply concept of Natural Language processing to problems leading to understanding of cognitive computing.

CO2: To Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.

CO3: Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.

CO4: To study and apply the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as chaining, resolution, etc. that play an important role in AI programs.

CO5: To understand various machine learning techniques and models.

SYLLABUS

UNIT I Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

Unit II Introduction to Search : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning

Unit III Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

Unit IV Machine Learning : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning,

Unit V Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

Text books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education
4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India,

BEC-651	Artificial Intelligence Lab	L-T-2P	CREDIT-1

Course outcome expected:

By end of this course the student should be able to

CO1. To implements basic concepts of prolog.

CO2. To performs some mathematical concepts like factorial, Fibonacci using prolog.

CO3. To demonstrate various AI problems like water-jug, 4 queen's problem, etc

CO4. To implement search problems like A* algorithm.

List of experiments

1. Study of Prolog
2. Write simple fact for the statements using PROLOG.
3. Write a program to implement family tree.
4. Write a program to implement monkey banana problem using prolog.
5. To implement I/O in prolog.
6. Program to implement cut and fail operations.
7. To implement towers of Hanoi problem.
8. WAP to implement factorial, Fibonacci of a given number.
9. Write a program to implement water jug problem.
10. WAP to implement A* Algorithm using PROLOG.
11. Write a program to solve 4-Queen problem.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

COMPILER DESIGN

BCS 602	**Compiler Design**	**3L-1T-P**	**CREDIT -4**

Course outcome expected:

By end of this course the student should be able to

CO1: Identify all essential steps for automatically converting source code into object code.(Understand)

CO2: Generate the low-level code for calling functions/methods in modern languages. (Apply)

CO3: Discuss opportunities for optimization introduced by naïve translation and approaches for achieving optimization such as instruction selection, instruction scheduling , register allocation, and peephole optimization.(Apply)

CO4: Interpret benefits and limitations of automatic memory management. (Understand)

CO5: Explain advantages, disadvantages and difficulties of just in time and dynamic recompilation. (Understand)

SYLLABUS

Unit 1 introduction to Compiler, Phases and passes, Bootstrapping, Finite 8 state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX- compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

Unit II Basic Parsing Techniques: Parsers, Shift reduce parsing, operator 8 precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.

Unit_III Syntax-directed Translation: Syntax-directed Translation schemes, 8 Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements. IV Symbol Tables: Data structure for symbols tab

Unit – IV Symbol Tables: Data structure for symbols tables, representing scope 8 information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

Unit –V Code Generation: Design Issues, the Target Language. Addresses 8 in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Textbooks:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education

2. V Raghvan, " Principles of Compiler Design", TMH

3. Kenneth Louden," Compiler Construction", Cengage Learning.

4. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

Refrences:

1.K. Muneeswaran,Compiler Design,First Edition,Oxford University Press.

2.J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill,2003.

3.Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

COMPILER DESIGN LAB

BCS652	**Compiler Design Lab**	**0L-0T-2P**	**CREDIT -1**

Course outcome expected:

By end of this course the student should be able to

C01. By this laboratory, students will understand the practical approach of how a compiler works.

CO2. This will enable him to work in the development phase of new computer languages in industry.

C03 Student will learn is the Lexical Analyser's Basic Mechanism?

CO4 Generate machine code from the intermediate code forms

CO5 student will learn the ability to design and analyze a compiler

LIST OF EXPERIMENTS

1.Implementation of lexical analyzer for if statement and arithmetic expression

2.Construction of NFA from regular expression

3.Construction of DFA and NFA

4.Construction of recursive descent parser for the grammar

5.Write a c program to implement operator precedence parser

6.Implement to shift reduce parser algorithm

7.Design a code optimization for implementing constant propagation

8.write a program to perform loop unrolling for code optimization

9 .implementing code generator

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

MICROPROCESSOR AND MICROCONTROLLER

BEC-602	**Microprocessor & Microcontroller**	**3L-1T-0P**	**CREDIT-4**

Course outcome expected:

By end of this course the student should be able to

CO1. Recall and apply a basic concept of digital fundamentals to microprocessor based personal computer system and Recall the memory types and understand the interfacing of memory with microprocessor.

2. Understand the internal architecture and organization of 8085 & 8086.

CO2 .1. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller.

2. Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.

CO3. Discuss how the different peripherals are interfaced with microprocessor like 8255,8253/54,8237,8279,etc.

CO4. 1.To analyze the concepts of memory interfacing for faster execution of instructions and improves the speed of operations & hence performance of microprocessors.

2.To Understand the basic knowledge of advanced processor and Analyze the internal architecture of 80286,80486 and Pentium processor.

CO5 1. Analyze the internal architecture and real time control of 8051.

2. Analyze the internal architecture of ARM Processors.

SYLLABUS

Unit-I Introduction to Microprocessor:Evolution of Microprocessors, Register structure, ALU, Bus Organization, Timing and Control.
8-bit microprocessor: 8085 Microprocessor and its Architecture, Addressing Modes, The 8085 Programming Model, Instruction Classification, Instruction Format, Overview of Instruction set- Data Transfer Operation, Arithmetic Operation, Logic Operation and Branch Operation; Introduction to Assembly language program., Assembler Directives, Parameter passing and recursive procedures.

Unit-II Programming Technique With Additional Instruction: Looping, Counting, Indexing, Additional data Transfer and 16 bit Arithmetic instruction, Counters and time delays, Stack and Subroutine.
16 bit Microprocessor: Architecture of 8086- Register Organization, Execution unit, Bus Interface Unit, Signal Description, Physical Memory Organization, Mode of Operation, I/O Addressing Capabilities.Features of Numeric processor 8087,Floating point representation, range resolution, normalization, representation of zero, unused codes, parity bit and error detection.

Unit- III Basic of Interfacing:Programmed I/O, Interrupt driven I/O, DMA(8257), Parallel I/O (8255-PPI), Serial I/O(8251/8250, RS-232 standard)8259Programmable Interrupt Controller, 8237-DMA Controller, 8253/8254 Programmable Timer/Counter,(8279) Keyboard and display interface, ADC and DAC interfacing

Unit-IV Memory Interfacing: Types of memory, RAM and ROM , Concepts of virtual memory, Cache memory. Advanced coprocessor Architecture-286,486, Pentium

Unit-VAn Introduction to Microcontroller 8051 : The 8051 Architecture, Instructionset,Basic Assembly language programming concept.**Introduction to Risc Processor:** ARM microcontrollers Interface design.

Textooks:

1. Douglas V.Hall/8086 Microprocessors Architecture
2. R.S. Gaonker/Microprocessor Architecture: Programming and Applications with the 8085/8080A/ PenramInterational Publishing,1996.
3. Kenneth J.Ayala/The 8051 Microcontroller/Penram International Publishing.
4. Liu Gibson/Microprocessor
5. Ray, A.K. &Burchandi, K.M./ "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing"/ Tata McGraw Hill.
6. Brey, Barry B. / "INTEL microprocessors" / Prentice Hall (India) /4th Ed.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

MICROPROCESSOR AND MICROCONTROLLER

BEC-651	**Microprocessor & Microcontroller lab**	**0L-0T-2P**	**CREDIT-1**

Course outcome expected:

By end of this course the student should be able to

CO1. Do basic assembly language programming of 8085.

CO2. Do advance assembly language programming of 8086.

CO3. Do basic assembly language programming of 8085 for interfacing of peripherals.

CO4. Do advance assembly language programming of 8086 for interfacing of peripherals.

List of Experiments

1. Signed and Unsigned binary addition.
2. Signed Multiplication.
3. Signed and Unsigned binary division
4. BCD addition and subtraction.
5. Ascending and Descending.
6. BCD and binary conversion
7. Binary to BCD conversion
8. Programs for 16 bit arithmetic operations for 8086
9. Program for sorting an array for 8086
10. Program for searching for a number or character in a string for 8086
11. Interfacing with seven segment display
12. Interfacing with 8255 in I/O mode and BSR mode
13. Interfacing with 8253
14. Interfacing with ADC/DAC
15. Look up table method for finding the ASCII of an alpha numeric code.
16. Programming using arithmetic, logical and bit manipulation instructions of 8051
17. Program and verify Timer/Counter in 8051.
18. Program and verify interrupt handling in 8051.
19. UART operation in 8051.
20. Interfacing LCD to 8051.
21. Interfacing matrix or keyboard to 80

OCCUPATIONAL HEALTH AND SAFETY

MC601	**Occupational Health and Safety**	**2L-0T-P**	**NO CREDIT**

Course outcome expected:

By end of this course the student should be able to

CO1 Identify the diseases associated with occupation.

CO2 Manage safety in industries by suggesting safety measures.

CO3 Identify the accidental causes & apply the preventions.

CO4 Identify Fire Explosion & apply PPE.

CO5 Identify & apply Hazards & Risk identification, Assessment and control techniques.

SYLLABUS

Unit I Occupational Health: Classification of occupational health hazards, dangerous properties of chemical and their health effects, routes of entry of toxic material into human body, permissible exposure limits, Threshold limit value, lethal dose and lethal concentration, Ergonomics, constituents of ergonomics, application of ergonomics for safety & health, occupational diseases due to metals & dusts, fumes & chemical compounds.

Unit II Safety : Concept, Philosophy & Psychology of safety: Concept of safety, Nature of concept of safety, Philosophy of safety, safety terminology, philosophy of total safety concept, safety psychology, accident causative factors, general psychological factors

Unit III Accident Causes and prevention: Causation, Accident problem, Reasons for prevention, factors impending safety, Accident prevention **Safety Management:**Concept of management, element of management, functions, management principles, safety management & its responsibilities, safety Organization **Electrical Safety:**Electricity and Hazardous, Indian standards, effects of electrical parameters on human body, safety measures for electric works

Unit IV Fire and Explosion: Fire phenomena, classification of fire and extinguishers, statutory and other standards, fire prevention & protection system, explosion phenomena, explosion control devices, fire awareness signs

Personal Protective Equipment: Need of PPE, Indian standards, factors of selection of PPE, non respiratory equipments, respiratory equipments.

Unit V Hazards & Risk identification, Assessment and control techniques: Hazards, Risks & detection techniques, Preliminary hazard analysis(PHA) & hazard analysis(HAZAN), failure mode effect analysis(FMEA), Hazard and operability(HAZOP) study, Hazard ranking (DOW & MOND index), Fault tree analysis, Event tree analysis(ETA), major accident hazard control, on-site and off-site emergency plans. Safety in different industries as case study

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Soft Computing

BCS701	Soft Computing	**3L-0T-0P**	**CREDIT -3**

Course outcome expected:

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

CO1: To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
CO2: Apply perceptron and backprogation technique for classification.
CO3: Understand the concepts of crisp fuzzy sets.
CO4: knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic and apply fuzzification and defuzzinfication.
CO5: Analyze the genetic algorithms and their applications. Apply genetic algorithms to combinatorial optimization problems

SYLLABUS

Unit-I : Neural Networks-1(Introduction & Architecture) Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.
Unit-II : Neural Networks-II (Back propogation networks) Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.

Unit-III : Fuzzy Logic-I (Introduction) Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV : Fuzzy Logic –II (Fuzzy Membership, Rules) Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Unit-V : Genetic Algorithm(GA) Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications” Prentice Hall of India.
2. N.P.Padhy,”Artificial Intelligence and Intelligent Systems” Oxford University Press

Reference Books:

1. Siman Haykin,”Neural Netowrks”Prentice Hall of India
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
3. Kumar Satish, “Neural Networks” Tata Mc Graw Hill

Soft Computing Lab

BCS751	Soft Computing LAB	**0L-0T-2P**	**CREDIT -1**

Course outcome expected:

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

CO1: Learn McCulloch-pits

CO2: Execute Hebb's Net and Perceptron Training Algorithm

CO3: Learn and execute logic gates and Genetic Algorithm

List Of Experiments

1. Write A Program For Implementing Linear Saturating Function.
2. Generate ANDNOT function using McCulloch-Pitts neural net.
3. Generate XOR function using McCulloch-Pitts neural net.
4. Write A Program To Implement Hebb's Net to classify two dimensional input patterns in bipolar with given targets.
5. Perceptron net for an AND function with bipolar inputs and targets.
6. Write A Program Of Perceptron Training Algorithm.
7. Write A Program For Back Propagation Algorithm .
8. Write A Program To Implement Logic Gates.
9. To perform Union, Intersection and Complement operations.
10. To plot various membership functions.
11. Implement fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
12. Study and Analysis Of Genetic Algorithm Life Cycle.
13. To implement Genetic Algorithm.
14. Implement travelling sales person problem (tsp) using genetic algorithms.

REFERENCE BOOKS :

1. S.N. Shivnandam, "Principle of soft computing", Wiley.

2. S. Rajshekaran and G.A.V. Pai, "Neural Network , Fuzzy logic And Genetic Algorithm", PHI.

3. Jack M. Zurada, "Introduction to Artificial Neural Network System" JAico Publication.

4. Simon Haykins, "Neural Network- A Comprehensive Foudation"

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Digital Image Processing

BCS702	Digital Image Processing	**3L-1T-P**	**CREDIT -4**

Course Outcomes Expected:

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

CO1: Review the fundamental concepts of a digital image processing system.

CO2 : Analyze images in the frequency domain using various transforms.

CO3 : Evaluate the techniques for image enhancement and image restoration.

CO4 : Categorize various compression techniques.

CO5: Interpret Image compression standards.

CO6 : Interpret image segmentation and representation techniques.

SYLLABUS

UNIT-I

Introduction and Fundamentals Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

UNIT-II

IMAGE ENHANCEMENT : Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier

Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement Sharpening – The Laplacian

UNIT-III

Image Restoration Image Enhancement in Spatial Domain

Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction,Image Averaging; Basics of Spatial Filtering; A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

UNIT-IV

Morphological Image Processing

Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

UNIT-V

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Signing Date:14.06.2024
02:26

Registration Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

TOTAL: 45 PERIODS

REFERENCES:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by:

Pearson Education.

2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and

Sons, NY.

3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle

River, NJ.

4. Sonka, Digital Image Processing and Computer Vision, Cengage Learning

5. Gonzalez and Woods, Digital Image Processing, Addison Wesley.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Cryptography and Network Security

BCS801	**Cryptography and Network Security**	**3L-1T-0P**	**CREDIT -4**

Course Outcomes

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

CO1 Illustrate the concepts of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security.

CO2 Classify various Algorithms to be used at various TCP/IP Layers & to operate Digital Signature in Real World Situation

CO3 Summarize different Authentication Techniques & Describe programs like PGP & S/MIME

CO4 Implement IP Security Architecture &Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks, and apply them to design and evaluate counter-measure tools

CO5 Implement Firewall design principles and identify various intrusion detection systems and be able to achieve highest system security

Syllabus

Unit-I Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

Unit-II Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.

Unit-III Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Unit-IV Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.

Unit-V IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

References:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersy.

2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.

3. Bruce Schiener, "Applied Cryptography".

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Advance Data base management system

BCS802	AdvanceDatabase management system	3L-0T-0P	CREDIT -3

Course outcome expected:

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

CO1: Exposure to fundamentals of DBMS and its importance.

CO2: Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries, Cursor Management, Triggers, Transaction Processing & Locking using concept of Concurrency control.

CO3 Understand the importance of Functional Dependency and Functional Decomposition and apply normalization techniques.

CO4: Apply transaction management techniques to database.

CO5: Apply concurrency control methods on database.

Syllabus:

Unit I: Basics:

Formal review of relational database and FDs Implication, Closure, its correctness

Unit-II : Advanced SQL:

SQL for set theory queries, joins, Transactional Control(Commit, Save point) DCL Commands (Grant and Revoke) Types of locks on DB, Indexing, Views, Cursors, Triggers, Synonymes, Exceptions.

Unit-III : Functional Dependency and Decomposition:

Basics of Functional Dependency, Armstrong's Axioms for functional dependencies ,Redundant functional dependencies, Closures of a set of functional dependencies Type of FD, 1NF, 2NF,3NF and BCNF, Decomposition and synthesis approaches(Lossy Decomposition, Lossless join decomposition, Dependency-Preserving Decomposition)

Unit-IV : Transaction:

Introduction to transaction concepts, DB transactions, ACID properties, interleaved executions, schedules, serializability, Correctness of interleaved execution

Unit-V : Concurrency:

Concurrency, Methods for Concurrency, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm.

Text Books:

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Departmental Elective

DATA COMPRESSION

DECS 501	**Data Compression**	**3L-0T-0P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

C01 Students will able to understand important of data compression

Co2 Student will be able to learn application different type of compression

CO3 Student is able to select methods and techniques appropriate for the task

CO4 Student is able to develop the methods and tools for the given task

CO5.student will learn different type of Distortion criteria

SYLLABUS

Unit - I: Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes

Unit – II: The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

Unit-III: Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Moveto-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression

Unit – IV: Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

Unit-V: Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured VectorQuantizers.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

REFERENCES:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers
2. Elements of Data Compression,Drozdek, Cengage Learning
3. Introduction to Data Compression, Second Edition,KhalidSayood,The Morgan aufmannSeries
4. Data Compression: The Complete Reference 4th Edition byDavid Salomon, Springer
5. Text Compression1st Edition by Timothy C. Bell Prentice Hall

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

DATA COMPRESSION

DECS-551	**Data Compression Lab**	**L-T-2P**	**CREDIT -1**

Course outcome expected:

By end of this course the student should be able to

CO1. Students will able to understand important of data compression

CO2. Student will be able to develop a reasonably sophisticated data compression application

CO3 Student is able to select methods and techniques appropriate for the task

CO4. Student is able to develop the methods and tools for the given task

LIST OF EXPERIMENT

1. Compress a file (bitmap format) having some diagram in it.Transfer the file to another system & decompress to display the original file.
2. Compress an audio file.Transfer the file to another system & decompress to display the original file.
3. Compress a video file.Transfer the file to another system & decompress to display the original file.
4. Implement Huffman coding with minimum variance, optimal,non-binary, extended and adaptive.
5. Implement applications and limitation of Huffman codes(Run length encoding, Arithmetic coding, Predictive coding)
6. Implement Lossy compression techniques-JPEG.
7. Implement dictionary based compression- Lempel-Ziv-Welch, LZ77 and LZ-78
8. Implement Shannon Fano Algorithm

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

COMPUTER GRAPHICS

DECS-502	**Computer Graphics**	**3L-T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1:-To know the foundations of computer graphics.

CO2:-To comprehend the concept of geometric, mathematical and algorithmic concepts necessary for programming computer graphics

CO3:-To understand the comprehension of windows, clipping and view-ports object representation in relation to images displayed on screen.

CO4:- To apply the concept of 3D transformation for the creation of objects

CO5:-To understand the basics of curves and surfaces and to recognize the software utilized in constructing computer graphics applications

SYLLABUS

Unit – I Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.

Unit – II Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing.

Unit –III Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non-rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Curve clipping, Text clipping.

Unit – IV Three Dimensional: 3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.

Unit – V Curves and Surfaces:Quadric surfaces, Spheres, Ellipsoid, Blobby objects, introductory concepts of Spline, B-spline and Bezier curves and surfaces. Hidden Lines and Surfaces:Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, diffuse reflection, specular reflection

References :

1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education

2. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, Tata MCGraw Hill.

3. Donald Hearn and M Pauline Baker, “Computer Graphics with OpenGL”, Pearson education

4. R.K. Maurya, “Computer Graphics ” Wiley Dreamtech Publication.

5. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill

6. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited, Delhi India.

7.Foley, Vandam, Feiner, Hughes – "Computer Graphics principle", Pearson Education.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

DECS 552	Computer Graphics lab	0L-0T-2P	CREDIT -1

Course outcome expected:

By end of this course the student should be able to

CO1. To implement the line and circle drawing algorithm

CO2. To implement the translation, rotation, scaling, reflection and sharing.

CO3. Execute scan line polygon filling

CO4 Implement basic transformations on objects

CO5 Implement clipping algorithm on lines

LIST OF EXPERIMENT

1. To implement DDA algorithms for line and circle.
2. To implement Bresenham's algorithms for line, circle and ellipse drawing
3. To implement Mid-Point Circle algorithm using C.
4. To implement Mid-Point Ellipse algorithm using C.
5. To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing.
6. To implement Cohen–Sutherland 2D clipping and window–viewport mapping.
7. To implement Liang Barksy Line Clipping Algorithm.
8. To perform 3D Transformations such as translation, rotation and scaling.
9. To convert between color models.
10. To perform animation using any Animation software
11. To perform basic operations on image using any image editing software
12. To draw different shapes such as hut,face ,kite ,fish etc.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

DATA MINING AND DATA WAREHOUS

DECS 503	**DATA MINING AND DATA WAREHOUSING**	**3L-T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1 Be familiar with mathematical foundations of data mining tools.

CO2 Understand and implement classical models and algorithms in data warehouses and data mining

CO3 Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

CO4 Master data mining techniques in various applications like social, scientific and environmental context.

CO5 Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

SYLLABUS

UNIT – I Data Warehouse: Introduction to Data Ware House, Differences between operational database systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction-Transformation-Loading, Logical (Mulit-Dimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; Fact-Less-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.

UNIT – II Introduction to Data Mining: Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT – III Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation, APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set-Maximal Frequent Item Set, Closed Frequent Item Set.

UNIT –IV Classification: Problem definition, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision trees-Decision Tree Construction, Methods for expressing attribute test conditions, Measures for Selecting the Best split, Algorithm for Decision tree Induction, Naïve-Bayes Classifier, Bayesian Belief Networks; K-nearest neighbor classification-Algorithm and characteristics.

UNIT – V Clustering: Problem Definition, Clustering overview, Evaluation of clustering algorithms,Partitioning clustering K-Means Algorithm, K-Means Additional Issues, PAM Algorithm,Hierarchical Clustering-Algorithm- Agglomerative Methods and Divisive Methods, BasicAgglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues inHierarchical Clustering, Strengths and weakness, Outlier Detection.

TEXT BOOKS:

1) Data Mining-Concepts and Techniques- Jiawei Han, MichelineKamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.

2) Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

REFERENCES BOOKS:

1) Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.

2) Data Ware Housing Fundamentals, PualrajPonnaiah, Wiley Student Edition.

3) The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.

4) Data Mining, VikaramPudi, P Radha Krishna, Oxford University.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

DATA MINING AND DATA WAREHOUSING LAB

DECS 553	**DATA MINING AND DATA WAREHOUSING LAB**	**L-T-2P**	**CREDIT -1**

Course outcome expected:

By end of this course the student should be able to

CO1. To evaluate the different models of OLAP and data preprocessing.

CO2. To enlist various algorithms used in information analysis of Data Mining Techniques.

CO3 To demonstrate the knowledge retrieved through solving problems

LIST OF EXPERIMENT

1. List all the categorical (or nominal) attributes and the real-valued attributes separately.
2. .What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes.
3. .One type of model that you can create is a Decision Tree -train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.
4. Suppose you use your above model trained on the complete dataset, and classify 16 credit good/bad for each of the examples in the dataset.
5. One approach for solving the problem encountered in the previous question is using 21 cross-validation? Describe what is cross -validation briefly. Train a Decision Tree again using cross -validation and report your results. Does your accuracy increase/decrease? Why?
6. Do you think it is a good idea to prefer simple decision trees instead of having long 34 complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model?

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

DECS 601	Advance Computer architecture	3L-1T-P	CREDIT -4

Course outcome expected:

By end of this course the student should be able to

CO1 Understand the Concept of Parallel Processing and its applications

CO2 Implement the Hardware for Arithmetic Operations

CO3 Analyze the performance of different scalar Computers

CO4 Develop the Pipelining Concept for a given set of Instructions

CO5 Distinguish the performance of pipelining and non pipelining environment in a processor

SYLLABUS

UNIT 1 Pipeline and vector processing : Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

UNIT II Computer Arithmetic : Addition and Subtraction, Hardware Implementation, Multiplication Algorithms and Hardware Implementation, Division Algorithms and Hardware Implementation, Floating Point Arithmetic Operations.

UNIT III Parallel Computer Models : Evolution of Computer Architecture, System Attributes to Performance, Shared Memory Multiprocessors, Distributed Memory Multicomputers, Vector Super Computers, SIMD Super Computers.

UNIT IV Processors and Memory Hierarchy : Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC scalar Processors, RISC scalar Processors, Super Scalar and Vector Processors: Superscalar Processors.

UNIT V Pipelining and Superscalar Techniques : Linear Pipeline Processors: Asynchronous and Synchronous models, Clocking and Timing Control, Speedup, Efficiency and Throughput, Pipeline Schedule Optimization, Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques.

Text Books

1. Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
2. Advanced Computer Architecture, Kai Hwang, McGraw-Hill, India.

References

1. Computer Organization and Achitecture, William Stallings ,8th edition,PHI
2. Computer Organization, Carl Hamachar, Vranesic,Zaky, 5th edition, McGraw Hill.

DECS 602	**Mobile computing**	**3L-1T-P**	**CREDIT -4**

Course outcome expected:

By end of this course the student should be able to

CO1: Understand and identify the GSM, CDMS and GPES for mobile computing

CO2: Understand the concept of wireless technology and WAP architecture .The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.

CO3: To learn the concept of database management concept .Understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities

CO4: Analyze QOS over wire and wireless channels

CO5: Able to promote the awareness of the life-long learning, business ethics, professional ethics and current marketing scenarios.

SYLLABUS

Unit – I Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit - II Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit – III Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations.

Unit - IV Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit – V Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

References

1. J. Schiller, Mobile Communications, Addison Wesley.

2. A. Mehrotra , GSM System Engineering.

3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.

4. Charles Perkins, Mobile IP, Addison Wesley.

5. Charles Perkins, Ad hoc Networks, Addison Wesley.

PARALLEL AND DISTRIBUTED COMPUTING

DECS 603	**PARALLEL AND DISTRIBUTED COMPUTING**	**3L-1T-P**	**CREDIT -4**

Course outcome expected:

By end of this course the student should be able to

CO 1: Develop programs with distributed parallelism, parallel debugging included;

CO 2: Construct parallel algorithms, i.e. identify parallelism in a given algorithm and implement **it;**

CO 3: Analyse properties such as efficiency, speedup etc., of parallel algorithms;

CO 4: Analyse performance of parallel algorithms**.**

CO 5: Understand different parallel and distributed paradigms and algorithms

SYLLABUS

UNIT I Introduction: Scope , issues, applications and challenges of Parallel and Distributed Computing

Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, coprocessing. Principles of Parallel Algorithm Design: Decomposition Techniques,Characteristics of Tasks and Interactions,Mapping Techniques for Load Balancing.

UNIT II CUDA programming model: Overview of CUDA, Isolating data to be used by parallelized

code, API function to allocate memory on parallel computing device, to transfer data, Concepts of

Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function.

UNIT III Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs,

Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of

Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time

UNIT IV Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms Graph Algorithms: Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph

UNIT V Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms,

Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms

Text books:

1. A Grama, AGupra, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003.

2. C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company, 2008.

3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming. Morgan Kaufmann Publishing and Elsevier, 2013.

4. T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

EMBEDDED SYSTEM

DE-CS701	**Department Elective III**	**3L-0T-0P**	**CREDIT -3**

COURSE OUTCOME EXPECTED

- **CO1:** Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..
- **CO2**: Become aware of the architecture of the ATOM processor and its programming aspects (assembly Level)
- **CO3:** Become aware of interrupts, hyper threading and software optimization.
- **CO4:** Design real time embedded systems using the concepts of RTOS.
- **CO5:** Analyze various examples of embedded systems based on ATOM processor.

SYLLABUS

UNIT 1 Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT 2-Embedded Networking: Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

UNIT 3.Embedded Firmware Development Environment: Embedded Product Development Life Cycleobjectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT 4.RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, чC/OS-II, RT Linux.

UNIT 5.Embedded System Application Development: Design issues and techniques Case Study of Washing Machine- Automotive Application- Smart card System Application.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Web Technology

OE-CS702	**Department Elective III**	**3L-0T-0P**	**CREDIT -3**

COURSE OUTCOME EXPECTED

CO1 : Students are able to develop a dynamic webpage by the use of java script and DHTML.

CO2 : Students will be able to write a well formed / valid XML document.

CO3 : Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.

CO4 : Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.

CO5 : Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database.

SYLLABUS

Unit I

Introduction :Introduction and Web Development Strategies, History of Web and Internet, Protocols governing Web, Writing Web Projects, Connecting to Internet, Introduction to Internet services and tools, Introduction to client-server computing. Core Java: Introduction, Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Event handling, Introduction to AWT, AWT controls, Layout managers.

Unit II

Web Page Designing:HTML: list, table, images, frames, forms, CSS, Document type definition, XML: DTD, XML schemes, Object Models, presenting and using XML, Using XML Processors: DOM and SAX, Dynamic HTML.

Unit III

Scripting: Java script: Introduction, documents, forms, statements, functions, objects; introduction to AJAX, VB Script, Introduction to Java Beans, Advantage, Properties, BDK, Introduction to EJB, Java Beans API.

Unit IV

Server Site Programming: Introduction to active server pages (ASP), Introduction to Java Server Page (JSP), JSP Application Design, JSP objects, Conditional Processing, Declaring variables and methods, Sharing data between JSP pages, Sharing Session and Application Data, Database Programming using JDBC, development of java beans in JSP, Introduction to Servelets, Lifecycle, JSDK, Servlet API, Servlet Packages, Introduction to COM/DCOM/CORBA.

Unit V.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

PHP (Hypertext Preprocessor): Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form, mail, file upload, session, error, exception, filter, PHP-ODBC,

Text books:

1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, " Web Technology and Design" , New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
4. Bhave, "Programming with Java", Pearson Education
5. Herbert Schieldt, "The Complete Reference:Java", TMH.
6. Ullman, "PHP for the Web: Visual QuickStart Guide", Pearson Education
7. Margaret Levine Young, "The Complete Reference Internet", TMH
8. Naughton, Schildt, "The Complete Reference JAVA2", TMH
9. Balagurusamy E, "Programming in JAVA", TMH

References:

1. Ramesh Bangia, "Internet and Web Design" , New Age International
2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
3. Deitel, "Java for programmers", Pearson Education
4. Chris Bates, "Web Programing Building Internet Applications", 2nd Edition, WILEY, Dreamtech
5. Joel Sklar , "Principal of web Design" Vikash and Thomas Learning
6. Horstmann, "CoreJava", Addison Wesley

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

MOBILE APPLICATION DEVELOPMENT

DE-CS703	**Department Elective III**	**3L-0T-0P**	**CREDIT -3**

COURSE OUTCOME :

At the end of this course student will:

CO1: Apply essential Android Programming concepts.

CO2: Develop various Android applications related to layouts & rich uses interactive interfaces

CO3: Develop Android applications related to mobile related server-less database like SQLITE

SYLLABUS

UNIT I

INTRODUCTION: Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II

BASIC DESIGN: Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III

ADVANCED DESIGN: Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV

TECHNOLOGY I – ANDROID: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V

TECHNOLOGY II – iOS: Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace. Swift: Introduction to Swift, features of swift.

REFERENCES:

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012
2. AnubhavPradhan , Anil V Despande Composing Mobile Apps,Learn ,explore,apply
3. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS
6 Development: Exploring the iOS SDK”, Apress, 2013.

Machine Learning

DE-CS801	**Department Elective IV**	**3L-1T-0P**	**CREDIT -4**

COURSE OUTCOME EXPECTED

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

CO1: Gain knowledge about basic concepts of Machine Learning

CO2: Identify machine learning techniques suitable for a given problem

CO3: Solve the problems using various machine learning techniques

CO4: Apply Dimensionality reduction techniques.

CO5: Design application using machine learning techniques

SYLLABUS

UNIT 1. INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

UNIT 2.DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; **ARTIFICIAL NEURAL NETWORKS –** Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation AlgorithmConvergence, Generalization;

UNIT 3.Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; **Bayesian Learning**: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;

UNIT 4.Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

UNIT 5.Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithmsGeneral to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q Learning.

TEXT BOOK

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

DEEP LEARNING

DE-CS802	**Department Elective IV**	**3L-1T-0P**	**CREDIT -4**

Course outcome expected

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

CO1.To understand the theory behind deep learning methods such as Convolutional Neural Networks, Autoencoders and Boltzmann Machines,

CO2.To have a grasp of the open issues and trends in deep learning research,

CO3 To have a feeling of when to use or avoid deep learning methods.

SYLLABUS

UNIT 1 INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT 2 DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep LearningBackpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning

UNIT 3 DIMENTIONALITY REDUCTION Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT 4 OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT 5 CASE STUDY AND APPLICATIONS : Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene UnderstandingGathering Image Captions

TEXT BOOK

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.

2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.

4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

NATURAL LANGUAGE PROCESSING

DE-CS803	**Department Elective IV**	**3L-1T-0P**	**CREDIT -4**

COURSE OUTCOME EXPECTED

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

CO1: Summarize the concepts of automata and compiler

CO2: Learn the concepts of parsing and Normal forms of grammer .

CO3: Illustrate the concepts of semantic and pragmatic approach.

CO4: Learn the basic concepts of Speech processing

CO5: Analyse the concepts of pattern comparison technique and normalization .

SYLLABUS

Unit I

INTRODUCTION : Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance WORD LEVEL ANALYSIS Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Unit II

SYNTACTIC ANALYSIS : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Unit III

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Unit IV

BASIC CONCEPTS OF SPEECH PROCESSING: Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.

Unit V

SPEECH ANALYSIS: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Text books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Lawrence RabinerAndBiing-Hwang Juang, "Fundamentals Of Speech Recognition", Pearson Education, 2003.
4. Daniel JurafskyAnd James H Martin, "Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition", Pearson Education, 2002.
5. Frederick Jelinek, "Statistical Methods Of Speech Recognition", MIT Press, 1997.
6. 1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015. 7. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
8. NitinIndurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

OPEN ELECTIVES

OPERATION RESEARCH

OECS501	**OPERATION RESEARCH**	**3L-T-P**	**CREDIT-3**

Course outcome expected:

By end of this course the student should be able to

CO1 Express objective function and resource constraint in LP model in term of decision variable and parameters. CO**2.** Construct the initial transportation table for a trans-shipment problem and to solve a profit maximization transportation problem using suitable changes in the transportation algorithm.
CO3. Appreciate application of integer LP problem in several areas of managerial decision- making and to use linear programming approach to compute the value of the game when dominance rule do not apply.

CO4. Derive replacement policy for items whose running cost increases with time and to use various selective inventory control techniques to classify inventory items into broad categories.

CO5.Derive relationship among variety of performance measures using Probability Distributions and Dynamic Programming are used for Optimization.

SYLLABUS

UNIT-1 Introduction To Linear Programming : Definition and scope of operations research (OR), OR model, Problem Formulation and Application of LPP model, Graphical LPP solution, Simplex method, Big M-method, Two phase method, Special cases in Simplex method application, Duality in Linear Programming, Dual Simplex method, Sensitivity analysis, various industrial application of Linear Programming

UNIT-2 Linear Programming Extension -Transportation Models: Formulation and Optimal solution of Transportation problem, Method of finding Initial Solution – **NWCM,, LCM, VAM**, Close loop in Transportation Table and its properties, Variation in Transportation problem – Degeneracy and its resolution, Trans Shipment models, Assignment models - Hungarian method for solving Assignment Problem, Travelling Salesman problem.

UNIT-3 Integer Programming ,Game Theory ,Sequencing and Project Management:

Integer Programming -Formulation and solution of Integer linear programming problems, Enumeration and cutting plane solution concept, Branch and Bound algorithm. **Game Theory** : Introduction, Two person Zero Sum Game, Minimax and, Maximin Principles Rules of Dominance. **Sequencing problems**- Travelling Salesman problem, Machine-scheduling problem (Job shop). **Project Management-** Objectives of **CPM** and **PERT,** Characteristic of **CPM/PERT** projects..

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Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

UNIT-4Replacement and Inventory models:

Replacement Problems- Optimal age of equipment replacement, Replacement of items that fail, Individual and group replacement policies.

Inventory models- Deterministic Inventory models, Classic **EOQ** model, **EOQ** with price breaks, single item Inventory control models without/with shortage, multi-item Inventory control models with constraints, single item Inventory control models with quantity discounts.

UNIT-5 Queuing Theory and Dynamic Programming:

Queuing Theory – Structure of a Queuing system,Probability Distribution in Queuing System, classification of Queuing models - Single server Queuing models/Multi server Queuing models.

Dynamic Programming- Dynamic Programming formulations, Bellman's principle of optimality, computation in Dynamic Programming, Forward and Backward recursions.

References:

1. Wayne L. Winston, "Operations Research" Thomson Learning,2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education,2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V. K .Khanna, "Total Quality Management" New Age International, 2008.
5. Rao S.S. " Optimization Theory and Applications ", Willey Eastern Limited.
6. Taha H.A., " Operation Research-An Introduction ", Macmillan.
7. J .K. Sharma," Applied Operations Research", Trinity.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

OECS 502	**GRAPH THEORY**	**3L-T-0P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

After the course the student will have a strong background of the graph theory which has diverse applications in the area of computer science, biology, chemistry, physics & engineering.

SYLLABUS

UNIT 1.Graphs: Graphs, Sub graphs, some basic properties, various example of graphs & their sub graphs, walks, trails, path & circuits, connected graphs, disconnected graphs and its components, various operation on graphs, unicursal line, Euler graphs, Hamiltonian paths and circuits, Hamiltonian graph, traveling salesman problem, Chinese Postman problem. Fleury's algorithm for constructing an Euler line in a graph G, directed graphs, types of directed graphs, directed paths and connectedness, circuits in digraph, Hamiltonian and Euler digraphs.

UNIT 2.Trees: Trees and its characterization, distance, eccentricity and centre, diameters, radius of a tree and pendent vertices, rooted and binary trees, spanning trees, height of a binary tree, traversing binary tree, depth-first search and breath first search in a graph. Branches and chord, rank and nulity, on counting trees, trees with directed edges, fundamental circuits, finding all spanning trees of a graph and a weighted spanning tree, minimum weight spanning tree algorithm, , Prim's, Kruskal's and Dijkstra's algorithm.

UNIT 3. Cut sets & Network flow, Planar Graphs: Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity in a graph and separable graph.

Transportation Networks: Networks flows, Max-flow-min cut theorem.
Planar Graphs: planar graphs, region and its degree, Euler's formula, Kuratowski's theorem and its application to planarity detection of graphs,dual graphs, combinational and geometrical dual, thickness and crossings.

UNIT 4.Matrix Representation and Colouring of Graphs: Incidence matrix of graph, sub matrices of A(G), circuit matrix, cut set matrix, fundamental circuit matrix and rank of matrix B, path matrix ,adjacency matrices, adjacency matrix of a digraph and their properties .**Colouring Of Graphs** : Colouring, , chromatic number, colour critical graph, chromatic partitioning, chromatic polynomials, matching, maximal matching, augmenting path, covering, minimal covering , Four colour problems, five colour theorem.

UNIT 5.Enumeration of graphs: Enumeration: types of enumeration, counting of labelled and unlabelled graphs and trees, cycle index of permutation group, Cayley's theorem, statement of Burnside's theorem, figure counting series and configuration series, Polya's Enumeration(or counting)theorem, Application of Polya's theorem in Graph Enumeration.

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Signing Date:14.06.2024
02:26

REFERENCE

1. Deo N., Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall, Inc.
2. Bondy and Murthy: Graph theory and application. Addison Wesley.
3. John M. Aldous and Robin J. Wilson: Graphs and Applications-An Introductory Approach, Springer
4. Robin J, Wilson: Introduction to Graph Theory, Addison Wesley
5.Kalika Patraj: Graph theory, S.K. Kataria & Son's, N .Delhi.

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Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

OECS 503	**COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES**	**3L-T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1. Analyse the asymptotic performance of algorithms.

CO2. Write rigorous correctness proofs for algorithms.

CO3. Demonstrate a familiarity with major algorithms and data structures.

CO4. Apply important algorithmic design paradigms and methods of analysis.

CO5. Synthesize efficient algorithms in common engineering design situations.

SYLLABUS

Unit 1: Introduction: Numbers and their accuracy,Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation.
Solution of Algebraic and Transcendental Equation: Bisection method, Iteration method, Aitken's Δ^2 method, method of False position, Newton-Raphson method, methods of finding complex roots, Rate of convergence of Iterative methods.

Unit-II: Interpolation: Finite Differences, Difference tables, Polynomial Interpolation**,** Newton's forward and backward formula Central Difference Formulae, Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula, Hermite's Interpolation.

Unit-III :Solution of Simultaneous Algebraic Equations: Gauss elimination method, Gauss Jordan method, Factorization method, Jacobi's method, Gauss-Seidal method.
Numerical Integration and Differentiation: Introduction, Numerical differentiation, Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Boole's rule, Waddle's rule.

Unit-IVNumerical Solution of differential Equations: Introduction, Picard's method, Euler's method, Taylor's method, Runge-Kutta methods, Predictor Corrector methods (Milne's method & Adams-Bash-forth method).

Unit-VStatistical Computation: Moments, Central moments, Raw moments, Moments about the origin, Karl Pearson's $\beta and \gamma$ Coefficients, Moment generating function, Data fitting with Cubic splines, Correlation, Regression Analysis, Linear and Non linear Regression, Properties of Regression Coefficients.

References:

1. Rajaraman V, "Computer Oriented Numerical Methods", Pearson Education.

2. Gerald & Whealey, "Applied Numerical Analyses", AW.

3. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.

4. Grewal B S, "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi.

5. T. Veerarajan, T. Ramachandran, “Theory and Problems in Numerical Methods,
TMH.
6. Pradip Niyogi, “Numerical Analysis and Algorithms”, TMH.
7. Francis Scheld, ” Numerical Analysis”, TMH.
8. Sastry S. S, “Introductory Methods of Numerical Analysis”, Pearson Education.
9. Gupta C.B., Vijay Gupta, “Introduction to Statistical Methods”, Vikas Publishing.
10. Goyal, M, “Computer Based Numerical and Statistical Techniques”, Firewall Media, New Delhi.

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Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Modeling and System simulation

OECS 601	**Modeling And System simulation**	**3L-0T-P**	**CREDIT -3**

Course outcome expected:

By end of this course the student should be able to

CO1: Understand the basics of simulation modeling and replicating the practical situations in organizations.

CO2: Realize Concepts in Discrete-Event Simulation and analyze and develop a number of simulation softwares.

CO3: understand and simulate various statistical and mathematical models

CO4: Generate random numbers and random variates using different techniques.

CO5: Analyze simulation data using input modelling as well as Understand Verification and Validation of simulation model.

SYLLABUS

Unit 1:Introduction- advantages and disadvantages of simulation, application areas in communication, computer and software design, systems and systems environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event simulation, steps in a simulation study. Simulation Examples- Simulation of queueing systems, on-demand and inventory systems, simulation for reliability analysis etc.

Unit 2:General Principles: Concepts in Discrete-Event Simulation, List Processing: properties and operations, data structures and dynamic allocation, techniques.**Simulation Software:** Selection of Simulation Software, review of some existing softwares like: Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc., Experimentation and Statistical-Analysis Tools.

Unit 3: Statistical Models in Simulation: Useful Statistical Models, Discrete Distribution s, Continuous Distributions, Poisson Process, Empirical Distributions.**Queuing Models:** Characteristics of Queuing systems, Queuing Notation, Long Run Measures of performance of Queuing Systems, Steady State Behavior of infinite Population Markovian Models, Steady State Behavior of finite Population Models, Networks of Queues.

Unit 4:Random Number Generation: Properties of Random Numbers, Generation of Pseudo-Random Numbers, Techniques for Generating Random Numbers, Tests for Random Numbers, Inverse transform Techniques, Convolution Methods, and Acceptance –Rejection Techniques.

Unit 5:Input Modeling: Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile-Quantile Plots. Parameter Estimation: Sample Mean and Sample Variance and various biased and unbiased Estimators. Goodness of Fit Tests, Multivariate and Time-Series Input Models .**Verification and Validation of Simulation Models:** Model Building, Verification & Validation, Verification of simulation Models, Calibration & Validation of Models.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Suggested Readings/ Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, Discrete-Event System and Simulation, Prentice Hall of India, New Delhi, 2005.

2. Deo Narsingh, “System Simulation with Digital Computers”, PHI, New Delhi 1993.

3. Gordon G, “System Simulation”, PHI 2nd Edition 1998.

4. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009.

5. K S Trivedi, “Probability and Statistics with Reliability, Queuing and Computer Science Application”, PHI

6. Kleinrock, L.: Queuing Systems Vol.I, Vol.II, Wiley & Sons, London, 1975.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Internet Of Thing

OECS602	**Internet Of Thing**	**3L-0T-0P**	**CREDIT-3**

Course outcome expected:

By end of this course the student should be able to

CO1:-To understand the fundamental concepts of IoT and apply them.

CO2:-To know the different hardware's used to embed them with IoT for the development of embedded applications.

CO3:-To learn the networking and communication aspects in IoT and analysis of different protocol used in IoT.

CO4:-Design and develop an application of IOT using ardunio platform.

CO5:-To comprehend the challenges faced for the development of an IoT application.

SYLLABUS

Unit I . Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples . Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.

Unit II Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.

Unit III Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Unit IV Programming the Ardunio: Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.

Unit V Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications : Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, Communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.

References:

1.Olivier Hersent,DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti" Internet of Things(A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,HakinCassimally "Designing the Internet of Things" Wiley India

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Data science

OE-CS 701	Data science	**3L-0T-0P**	**CREDIT -4**

Course outcomes Expected

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

CO1.Describe what Data Science is and the skill sets needed to be a data scientist. • Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.

CO2. Use R to carry out basic statistical modeling and analysis.

CO3. Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.

CO4. Describe the Data Science Process and how its components interact

CO5 Use APIs and other tools to scrap the Web and collect data. And Apply EDA and the Data Science process in a case study.

SYLLABUS

Unit 1. Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed . Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

Unit 2. Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm) Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means

Unit 5. One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

Unit 4 Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system 8. Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs

Unit 5. Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset 10. Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

References

Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

• Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)

• Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.

• Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.

• Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)

• Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science

• Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.

• Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

BIG DATA ANALYTICS

OE-CS702	**Open Elective III**	**3L-0T-0P**	**CREDIT -4**

COURSE OUTCOME EXPECTED:

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

CO1:- To know the fundamental concepts of big data and analytics.
CO2:- To understand the different way to classify the given data using different techniques.
CO3:- To explore tools and practices for working with big data
CO4:- To learn about stream computing.
CO5:- To know about the research that requires the integration of large amounts of data.

SYLLABUS

UNIT I

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 - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

UNIT II

CLUSTERING AND CLASSIFICATION

Advanced Analytical Theory and Methods: Overview of Clustering - K-means.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.

UNIT III

ASSOCIATION AND RECOMMENDATION SYSTEM

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity.
Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT IV

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. Using Graph Analytics for Big Data: Graph Analytics

UNIT V

NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION

NoSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive – Sharding Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

TEXT BOOKS:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

BLOCKCHAIN

OE-CS801	**Open Elective IV**	**3L-0T-0P**	**CREDIT -4**

Course outcome expected:

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

CO1: To explore of blockchain and its architecture.

CO2: Understand the consensus, Consensus protocols for Permissioned Blockchains.

CO3: understand the Hyperledger Fabric and its implementation.

CO4: Applies blockchain concept in Financial Software and Systems, trade/supply chain (use cases).

CO5: Applies blockchain concept for Government(use case).

SYLLABUS

Unit-I Introduction :
Introduction to Blockchain: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms

Unit-II : Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains:Design goals, Consensus protocols for Permissioned Blockchains

Unit-III : Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation Hyperledger Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool

Unit-IV: Use case 1 : Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance Use case 2: Blockchain in trade/supply chain: (i) P Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc

Unit-V Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social

Text Books:

3. Mstering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
4. Blockchain by Melanie Swa, O'Reilly
5. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
6. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Computer Vision

OE-CS802	**Open Elective IV**	**3L-0T-0P**	**CREDIT -4**

Course outcome expected:

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

CO1: To explore fundamental image processing techniques required for computer vision
CO2: Understand Image formation process and Generate 3D model from images.

CO3: Perform feature extraction and motion estimation on the images.

CO4: To perform shape analysis and perform segmentation.

CO5: Perform Object Analysis and do processing.

SYLLABUS

Unit-I Introduction :

Image Processing, Computer Vision and Computer Graphics , 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.

Unit-II : Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, 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.

Unit-III :

Image Processing , Feature Extraction and Motion Estimation : Image preprocessing, Image representations (continuous and discrete) , Edge detection, Regularization theory , Optical computation , Stereo Vision , Motion estimation , Structure from motion

Unit-IV :

Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multiresolution analysis.

Unit-V

Object recognition and Image understanding: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis , Shape priors for recognition, Pattern recognition methods, HMM, GMM and EM.

Registrar:RAJEEV KUMAR
Signing Date:14.06.2024
02:26

Text Books:

7. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill
8. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
9. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992
10. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.