Minutes of Board of Studies (BOS) Meeting

Department of Computer Science & Engineering,

Aliah University

Date: Thursday 16.5.2024 at 8.00 PM **Mode: Online**

Internal Members Present:

Sl No.	Name	Designation
1	Dr. Abhishek Das	HoD & Chairman
2	Dr. Souvik Sengupta	Member
3	Dr. Sk Md Mosaddek Hossain	"
4	Sk Golam Sarowar Hossain	"
5	Dr. Zeenat Rehena	"
6	Dr. Ayatullah Faruk Mollah	"
7	Dr. Tapas Bhadra	"
8	Dr. Khondekar Lutful Hassan	"
9	Dr. Saiyed Umer	"
10	Dr. Md Azharuddin	"
11	Mrs. Amina Khatun	"
12	Mr. Zafar Sharif	"
13	Dr. Moumita Chatterjee	"
14	Mr. Ahsan Mullick	"

External Members Present:

Sl No.	Name	Designation
1	Prof. Amlan Chakraborty	Professor, A.K.Choudhury School of Information Technology, University of Calcutta, Kolkata
2	Prof. Diganta Saha	Professor, Dept. of Computer Sc. & Engineering, Jadavpur University, Kolkata
3	Mr. Abhijan Bhattacharya	Consultant, Sr. Scientist at TCS Research, Kolkata
4	Prof. Sk Manowar Hossein	Dean, Science & Technology, Aliah University,
5	Prof. Mehedi Kalam	Professor, Dept. of Physics, Aliah University
6	Dr. Sk. Babar Ali	Associate Professor, Dept. of ECE, Aliah University

Agenda:

1) Approval of BCA 4 Years curriculum and syllabus for ongoing 2023-24 batch and upcoming 2024-25 batch onwards.

2) Miscellaneous

Resolution of the Meeting:

Resolution of the Meeting:

1) The curriculum of the 1st and 2nd semester BCA 2023-24 has been ratified.
2) All BOS members present in the meeting unanimously given their consent on the modified curriculum and syllabus of 4-year BCA for the 2024-25 batch onwards which was earlier decided in the all faculty departmental meeting. The modified curriculum and syllabus of 4 year BCA is attached herewith.
3) The department will seek approval of AICTE for the new 4 yr BCA course.
4) All BOS members unanimously decided that the following papers may be offered to the other departments:

   1. CSAUGPC02: Programming for Problem Solving+ CSAUGPC04 : Programming for Problem Solving Lab
   2. CSAUGPC07: Data Structures and Algorithms + CSAUGPC10 : Data Structures and Algorithms Lab
   3. CSAUGOE01: Numerical Methods and Programming + CSAUGOE03 : Numerical methods and Programming Lab
   4. CSAUGPC32: Machine Learning + CSAUGPC35 : Machine Learning Lab

However, as the department conducts multiple UG & PG courses with limited resources, it will not be possible to assign a faculty member to teach the offered subjects in the other departments. Instead, the department will recommend names of guest faculties for teaching and evaluation of the offered subjects.

Having no more agendas, the meeting ended with a vote of thanks.

24/6/2024
Prof. Amlan Chakraborty
(External Member)

24/6/24
Prof. Diganta Saha
(External Member)

24/6/2024
Mr. Abhijan Bhattacharya
(External Member)

31/07/24
Prof. Sk Manowar Hossein
Dean, (Sc. & Tech.)

24/06/2024
Prof. Mehedi Kalam
(Physics Dept.)

24/06/24
Dr. Sk. Babar Ali
(ECE Dept.)

24/6/2024
Dr. Abhishek Das
(HoD & Chairman)

(on Leave)
Dr. Sk Md Obaidullah

24.6.24
Dr. Souvik Sengupta

24/06/24
Dr. Sk Md Mosaddek Hossain

24/06/24
Sk Golam Sarowar Hossain

24/06/24
Dr. Zeenat Rehena

24/06/24
Dr. Ayatullah Faruk Mollah

24/06/2024
Dr. Tapas Bhadra

24/6/24
Dr. Khondekar Lutful Hassan

24/06/24
Dr. Saiyed Umer

24/06/24
Dr. Md Azharuddin

Amina Khatun
24/06/24
Mrs. Amina Khatun

24/06/24
Mr. Zafar Sharif

24/6/24
Dr. Moumita Chatterjee

Mullick
24/06/2024
Mr. Ahsan Mullick

Nesa. 24/6/24.
Dr. Nashreen Nesa

4 Year BCA Proposed Curriculum 2024-25

Semester I							
Sl. No.	Course Code	Course Name	L	T	P	Total	Credit Points
1	CSAUGPC01	Introduction to Computer Applications	3	0	0	3	3
2	CSAUGPC02	Programming for Problem Solving	3	0	0	3	3
3	CSAUGPC03	Digital Logic	3	0	0	3	3
4	UCCUGAU01	Elementary Arabic and Islamic Studies	4	0	0	4	0
5	MATUGBS01	Mathematics-I	4	0	0	4	4
6	CSAUGPC04	Programming for Problem Solving Lab	0	0	3	3	1.5
7	CSAUGPC05	Digital Logic Lab	0	0	3	3	1.5
8	CSAUGPC06	PC Software Lab	0	0	3	3	1.5
Total of Semester						26	17.5

Semester II							
Sl. No.	Course Code	Course Name	L	T	P	Total	Credit Points
1	CSAUGPC07	Data Structures and Algorithms	3	0	0	3	3
2	CSAUGPC08	Computer Organization	3	0	0	3	3
3	CSAUGPC09	Object Oriented Programming	3	0	0	3	3
4	MATUGBS02	Mathematics II	4	0	0	4	4
6	UCCUGMC02	Environmental Science	2	0	0	2	0
7	CSAUGPC10	Data Structures and Algorithms Lab	0	0	3	3	1.5
8	CSAUGPC11	Python Programming Lab	0	0	3	3	1.5
9	CSAUGPC12	OOPS Lab	0	0	3	3	1.5
Total of Semester						28	17.5

Semester III							
Sl. No.	Course Code	Course Name	L	T	P	Total	Credit Points
1	CSAUGPC13	Operating Systems	3	0	0	3	3
2	CSAUGPC14	Database Management Systems	3	0	0	3	3
3	CSAUGOE01	Open Elective I (Numerical Methods and Programming)	3	0	0	3	3
4	ECEUGOE02	Open Elective II (Microprocessor and Applications)	3	0	0	3	3
5	UCCUGAU03	Indian Constitution	2	0	0	2	0
6	CSAUGPC15	Operating Systems Lab	0	0	3	3	1.5
7	CSAUGPC16	Database Management Systems Lab	0	0	3	3	1.5
8	CSAUGOE02	Open Elective I (Numerical Methods and Programming Lab)	0	0	3	3	1.5
9	CSAUGPC17	Android Development Lab	0	0	3	3	1.5
Total of Semester						24	18

Semester IV							
Sl. No.	Course Code	Course Name	L	T	P	Total	Credit Points
1	CSAUGPC18	Computer Networks	3	0	0	3	3
2	CSAUGPC19	Web Technologies	3	0	0	3	3
3	CSAUGPC20	Formal Language and Automata Theory	3	0	0	3	3
4	MATUGBS05	Probability and Statistics	3	0	0	3	3
5	CSAUGOE03	Open Elective III (Principles of Communication)	3	0	0	3	3
6	ENGUGHU01	Communicative English	3	0	0	3	3
7	CSAUGPC21	Computer Networks Lab	0	0	3	3	1.5
8	CSAUGPC22	Web Technologies Lab	0	0	3	3	1.5
Total of Semester						24	21

Semester V								
Sl. No.	Course Code		Course Name	L	T	P	Total	Credit Points
1	CSAUGPC23		Design Analysis of Algorithms	3	0	0	3	3
2	CSAUGPC24		Computer Graphics	3	0	0	3	3
3	CSAUGPC25		Artificial Intelligence & Soft Computing	3	0	0	3	3
4	CSAUGPC26		Software Engineering	3	0	0	3	3
5	Professional Elective I	CSAUGPE01	Multimedia	3	0	0	3	3
		CSAUGPE02	Animation Techniques					
		CSAUGPE03	Audio Signal Processing					
		CSAUGPE04	GIS and Remote Sensing					
		CSAUGPE05	System Analysis and Design					
6	CSAUGPC27		Design Analysis of Algorithms Lab	0	0	3	3	1.5
7	CSAUGPC28		Computer Graphics Lab	0	0	3	3	1.5
8	CSAUGPC29		Artificial Intelligence & Soft Computing Lab	0	0	3	3	1.5
Total of Semester							24	19.5

Semester VI								
Sl. No.	Course Code		Course Name	L	T	P	Total	Credit Points
1	CSAUGPC30		Machine Learning	3	0	0	3	3
2	CSAUGPC31		Cryptography & Cyber Security	3	0	0	4	4
3	CSAUGPC32		Compiler Design	3	0	0	3	3
4	Professional Elective II	CSAUGPE06	Frontend Development with PHP and MySQL	3	0	0	3	3
		CSAUGPE07	Introduction to NoSQL					
		CSAUGPE08	Advanced Java Programming					
		CSAUGPE09	React and Node JS					
5	CSAUGPC33		Machine Learning Lab	0	0	3	3	1.5
6	CSAUGPC34		Compiler Design Lab	0	0	3	3	1.5
7	Professional Elective II lab	CSAUGPE10	Frontend Development with PHP and MySQL Lab	0	0	3	3	1.5
		CSAUGPE11	Introduction to NoSQL Lab					
		CSAUGPE12	Advanced Java Programming Lab					
		CSAUGPE13	React and Node JS Lab					
8	CSAUGPC35		Research Methodology	2	0	0	2	2
Total of Semester							31	19.5

Semester VII								
Sl. No.	Course Code		Course Name	L	T	P	Total	Credit Points
1	CSAUGPC36		Digital Image Processing	3	0	0	3	3
2	CSAUGPC37		Natural Language Processing	3	0	0	3	3
3	CSAUGPC38		Internet of Things	3	0	0	3	3
4	Professional Elective III	CSAUGPE14	Cyber Laws	3	0	0	3	3
		CSAUGPE15	Wireless and Sensor Networks					
		CSAUGPE16	Blockchain Technologies					
		CSAUGPE17	Green Computing					
		CSAUGPE18	Ethical Hacking					
		CSAUGPE19	Cyber Forensics					
		CSAUGPE20	Cloud Computing					
5	CSAUGPC39		Digital Image Processing Lab	0	0	3	3	1.5
6	MBAUGHU01		Industrial Management	3	0	0	3	3
7	CSAUGPC40		Project Dissertation - I	0	0	8	8	4
8	CSAUGPC41		Summer Internship	0	0	0	0	2
Total of Semester							25	22.5

Semester VIII								
Sl. No.	Course Code		Course Name	L	T	P	Total	Credit Points
1	CSAUGPC42		Mobile Computing	3	0	0	3	3
2	MBAUGHU02		Professional Values and Ethics	4	0	0	4	4
3	Professional Elective IV	CSAUGPE21	Data warehousing & Data Mining	3	0	0	3	3
		CSAUGPE22	Pattern Recognition					
		CSAUGPE23	Deep Learning					
		CSAUGPE24	Bigdata Analytics					
		CSAUGPE25	Computational Biology					
4	Professional Elective IV Lab	CSAUGPE26	Data warehousing & Data Mining Lab	0	0	3	3	1.5
		CSAUGPE27	Pattern Recognition Lab					
		CSAUGPE28	Deep Learning Lab					
		CSAUGPE29	Bigdata Analytics Lab					
		CSAUGPE30	Computational Biology Lab					
5	CSAUGPC43		Project Dissertation - II	0	0	16	16	8
6	CSAUGPC44		Comprehensive Viva-Voce	0	0	0	0	2
Total of Semester							29	21.5

Courses offered to other departments

Sl. No.	Course Code	Course Name	L	T	P	Total	Credit Points
1	BCAUGMIN1102	Programming for Problem Solving	3	0	3	6	4
2	BCAUGMIN1204	Data Structures and Algorithms	3	0	3	6	4
3	BCAUGMIN2306	Numerical Methods and Programming	3	0	0	3	3
4	BCAUGMIN2407	Introduction to Machine Learning	3	0	3	6	4

Syllabus

Programming for Problem Solving

Code: BCAUGMIN1102

Contacts: 3L + 3P

Credits: 4

Course Objectives:

- To provide a comprehensive study of the C programming language, stressing upon the strengths of C.
- To provide the students with the means of writing modular, efficient, maintainable, and portable code.

Course Outcomes:

CO 1: Students should be able to write, compile and debug programs in C language.
CO 2: They should be able to use different data types in a computer program.
CO 3: They should be able to design programs involving decision structures, loops and functions.
CO 4: Students should be able to explain the difference between call by value and call by reference.
CO 5: Students should be able to understand the dynamics of memory by the use of pointers.
CO 6: Students should be able to use different data structures and create/update basic data files.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	√	√	√				
CO2		√	√			√	
CO3	√	√	√	√	√		√
CO4		√	√	√		√	
CO5		√	√		√		
CO6	√			√	√		√

Module - 1 [14 Hrs]

Introduction: History of Computing, Evolution of Programming Languages, Compilers, Interpreters.[2L]

Problem Solving Method: Algorithms and Flowcharts.**[2L]**

Overview of C: Brief History of C, C Standards, Structure of a C Program, C Libraries and Linking, Compiling a C Program.**[2L]**

Expressions: Basic Data Types, Variables, Type Qualifiers, Storage Class Specifiers, Variable Scopes, Constants, Operators, Operator Precedence, Expression Evaluation, Type Conversion in Expressions, Type Casting**[6L]**

Module - 2 [15 Hrs]

Statements: Selection Statements (if, switch-case), Iteration Statements (for loop, while loop, dowhile loop), Jump Statements (return, goto, break, exit, continue).**[4L]**

Arrays and Strings: Single Dimension Arrays, Double Dimension Arrays, Strings, Arrays of Strings, String LibraryFunctions.**[4L]**

Functions: General Form, Function Prototypes, Parameter Passing Mechanisms, Command Line Arguments,Recursion.**[4L]**

Module - 3 [15 Hrs]

Pointers: Pointer Variables, Pointer Operators, Pointer Expressions, Pointers and Arrays, Functions and Pointers, Pointers to Functions, Dynamic Memory Allocation. **[3 L]**

Structures, Unions, Enumerations and Typedef: Structures, Arrays of Structures, Structure, Pointers, Unions, Bit Fields, Enumerations, Typedef **[4L]**

Console I/O: Reading and Writing Characters, Reading and Writing Strings, Formatted ConsoleI/O. **[1 L]**

File I/O: Data Organization, File Operations, Text Files and Binary Files, Random Access.**[2L]**

The Preprocessor: Preprocessor Directives, Macros, Macro vs. Function, File Inclusion, Conditional Compilation.**[2L]**

Suggested Books:

1. Herbert Schildt: "C: The Complete Reference", 4th Edition, Tata McGraw Hill, 2000.
2. Stephen Prata: "C Primer Plus", 5th Edition, SAMS Publishing, 2005.
3. Brian W. Kernighan and Dennis M. Ritchi: "C Programming Language", 2nd Edition, Pearson Education, 2006.
4. Samuel P. Harbison and Guy L. Steele: "C: A Reference Manual", 5th Edition, Prentice Hall, 2003.
5. Yashwant Kanetkar: "Let Us C", BPB Publications, 9th Edition, 2008.
6. K. N. King: "C Programming: A Modern Approach", 2nd Edition, W. W. Norton and Company, 2008.
7. Andrew Koenig: "C Traps and Pitfalls", Addison Wesley Professional, 1989.

Data Structures and Algorithms

Code: BCAUGMIN1204

Contacts: 3L + 3P

Credits: 4

Course Objectives:

- Identify and use appropriate data structure for a given problem with effective utilization of space and time.
- Describe the linear and nonlinear data structures.
- Analyze the complexities of different sorting techniques.
- Identify trees, recursive functions and Graphs.

Course Outcomes:

CO 1: Get concept of Data Structure and different data types.

CO 2: Understand the time and space complexities of Algorithms.

CO 3: Design a solution to a given problem using arrays.

CO 4: Understand different applications of stacks, queues and linked lists.

CO 5: Choose the appropriate nonlinear data structure and perform operations on them.

CO 6: Understand different sorting techniques and their performances.

CO 7: Develop operations on Binary Search Trees and Graphs.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	√	√	√				
CO2		√	√	√			
CO3		√	√	√			
CO4		√	√	√			
CO5		√	√	√			
CO6	√	√		√			
CO7		√	√				

Module - 1 [14 Hrs]

Introduction: Data and Information, Program Structures, Abstract Data Type, Data Structure - Static and Dynamic Data Structures. [3L]

Arrays: Representation of Polynomials and Sparse Matrix, Linear List. [3L] **Linked List:** Single Linked Lists, Doubly Linked Lists, Circularly Linked Lists, Linked List Representation of Polynomial and Applications. [6L]

Module - 2 [15Hrs]

Sorting and Searching Algorithms: Bubble sort, Insertion sort, Selection sort, Merge, Quick, Heap, Radix, Bucket sort, Linear and Binary Search.[6L]

Stack and Queue: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions.[4L]

Recursion: Basic concept, Design of recursive algorithms, Tail recursion.[2L]

Module - 3 [12 Hrs]

Trees: Binary Trees, Binary Search Trees, Height-Balanced And Weight-Balanced Trees, 2-3 Tree, B-Trees, B+ -Trees. Applications of Trees. [6L]

Graphs: Adjacency Matrix and List, Graph Search Algorithms, Spanning Tree Algorithms, Shortest Path Algorithms. [4L]

Hashing: Terminologies, Hashing Functions, Collision Resolution Techniques, Types of Hashing. [2L]

Suggested Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed: "Fundamentals of Data Structures in C", Second Edition, Universal Press, 2007.

2. M. A. Weiss: "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2002.

3. A. V. Aho, J. E. Hopcroft and J. D. Ullman: "Data Structues and Algorithms", First Edition, Pearson Education, 2002.

4. R. K. Kruse, Bruce P. Leung: "Data Structures and Program Design", Prentice Hall, 2006.

5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein: "Introduction to Algorithms", Third Edition, PHI Learning Pvt. Ltd, 2010.

6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum: "Data Structures using C and C++", Second Edition, Pearson Education, 2015.

Numerical Methods and Programming

Code: BCAUGMIN2306
Contacts: 3L
Credits: 3

Course Objectives:

- The purpose of this course is to provide basic understanding of the derivation and integration.
- The purpose of this course use of the numerical methods along with the knowledge of finite precision arithmetic.
- To give the knowledge of few interpolation formulas.
- To give some knowledge of linear equations, differential equations etc.

Course Outcomes:

CO 1: Recall the distinctive characteristics of various numerical techniques and the associated error measures.

CO 2: Understand the theoretical workings of various numerical techniques to solve the engineering problems and demonstrate error.

CO 3: Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.

CO 4: Familiar with numerical solutions of nonlinear equations in a single variable.

CO 5: Apply the principles of various numerical techniques to solve various problems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2		√		√			

CO3				√			
CO4		√		√			
CO5				√			

Module-1 (14 hours)

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. Interpolation: Newton forward & backward interpolation,

Lagrange"s and Newton"s divided difference Interpolation.

Module-2 (15 hours)

Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Jacobi and GaussSeidel iterative methods.

Numerical solution of Algebraic equation: Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method.

Module-3 (14 hours)

Numerical solution of ordinary differential equation: Taylor"s series method, Euler"s method, Runge Kutta methods, Predictor-Corrector methods and Finite Difference method.

Numerical integration: Trapezoidal rule, SimPOn"s 1/3 rule, Weddle"s rule.

Suggested Readings:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

Machine Learning

Code: BCAUGMIN2407

Contacts: 3L + 3P

Credits: 4

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To explain mathematical background of the Machine Learning Algorithms
- To develop skills for solving practical problems using Machine Learning

Course Outcomes:

Students will be able to:

CO 1: Recognize characteristics of machine learning that make it useful in certain types of real-world analysis problems.

CO 2: Understanding machine learning problems as supervised, semi-supervised, and unsupervised.

CO 3: Become familiar with feature engineering and Dimensionality reduction Techniques

CO 4: implementing regression, clustering, classification, and reinforcement task

CO 5: Using Python Machine Learning libraries

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2		√		√			
CO3	√	√		√			
CO4		√		√	√		
CO5				√	√		

Module 1 (18 hours)

Introduction: Overview of topics and applications

Supervised Learning: Linear Regression: gradient descent, Normal equations, Probabilistic Interpretation, Logistic Regression, Newton's method, Locally weighted Linear Regression, Nearest Neighbors, Exponential Families, Generalized Linear Models, Optimization: Convex functions, Convex problems, Generative Learning Algorithms, Gaussian Discriminant Analysis, Feature selection, Kernels, Support vector Machine.

Module 2 (18 hours)

*Unsupervised Learning:*Curse of Dimensionality, Dimensionality Reduction, PCA, Mixture of Gaussians, EM Algorithm, Examples of EM, clustering, spectral clustering, Multi-dimensional Scaling (MDS), Isomaps, Non Negative Matrix Factorization.

Module 3 (12 hours)

Probabilistic Graphical Models: Introduction, Representation, Markov Blanket, variable elimination, HMM, Inference on a chain (sum-product specific case), Kalman Filters, Directed / Undirected graphs, MRFs, Sum-product, Max-product.

Special Topic: Graphical Models, Deep Learning.

Reference Books:

- Machine Learning, Tom Mitchell, McGraw Hill
- The Elements of Statistical Learning Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Springer
- EthemAlpaydin, Introduction to Machine Learning, PHI
- Chris Bishop, Pattern Recognition and Machine Learning

4-Year BCA
(Bachelor of Computer Application)
Syllabus [CBCS]
[W.E.F. Academic Year 2024-2025]

A four year fulltime UG programme in Bachelor of Computer Application

Total Credit: 182

I	II	III	IV	V	VI	VII	VIII	Total
22	22	22	22	22	24	24	24	182

Department of Computer Science & Engineering Aliah University
II A/27, New Town
Kolkata – 700156, West Bengal, India.

Program Outcomes (PO)

After successfully completing the program, students will be able to -

PO1: Pursue further studies with a specialization in Computer Science and Applications and Business Administration.

PO2: Apply knowledge of mathematics, computer science and management in practice.

PO3: Develop skills in computer programming languages, networking, applications and packages, system administration, Web Technologies, and modern IT tools.

PO4: Blend analytical, logical and managerial skills with the technical aspects to resolve real world issues.

PO5: Become employable in various IT companies and government jobs.

PO6: Effectively communicate business issues, management concepts, plans and decisions both in oral and written form.

PO7: Capable of recognizing and solving ethical issues.

Semester I

Semester I

Introduction to Computer Applications

Code: CSAUGPC01

Contacts: 3L

Credits: 3

Course Objectives:

- To develop the programming skills of students
- To know the principles of designing structured programs
- To write basic C programs using
    i) Selection statements
    ii) Repetitive statements
    iii) Functions
    iv) Pointers
    v) Arrays
    vi) Strings

Course Outcomes:

CO 1: Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
CO 2: Write, Compile and Debug programs in C language and use different data types for writing the programs.
CO 3: Design programs connecting decision structures, loops and functions.
CO 4: Explain the difference between call by value and call by address.
CO 5: Understand the dynamic behavior of memory by the use of pointers.
CO 6: Use different data structures and create/ manipulate basic data files and developing Applications for real world problems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√				
CO2		√		√			
CO3		√		√			
CO4		√	√	√			
CO5			√	√			
CO6			√				

Module 1: [14 Hrs]

Background: History of computing, overview of computers, basic organization of the von Neumann machine; instruction fetch, decode, and execution;
Programming languages and the compilation process. Fundamental programming constructs: Syntax and semantics of a higher-level language like C; variables, types, expressions, and assignment; simple I/O; conditional and iterative control structures; functions and parameter passing; structured decomposition.

Module 2: [14 Hrs]

Algorithms and problem-solving: Problem-solving strategies; the concept of an algorithm; properties of algorithms; implementation strategies; concept of recursion; sequential and binary search algorithms; quadratic sorting algorithms (selection, insertion).

Module 3: [15 Hrs]

Fundamental data structures: Primitive types; arrays; records; strings and string processing; pointers and references; runtime storage management. Machine level representation of data: Bits, bytes, and words; binary representation of integers; representation of character data; representation of records and arrays. Introduction to data structures: stacks and queues.

Suggested Books:

1. Parsons and Oja: "Computer Concepts--Illustrated Series", Introductory, 6th Edition, (Concepts Textbook),
2. Beskeen, Cram, Duffy, Friedrichsen, and Reding: "Microsoft Office 2003 --Illustrated Series, Premium Edition, Introductory", (Lab Textbook),

Programming for Problem Solving

Code: CSAUGPC02

Contacts: 3L

Credits: 3

Course Objectives:

- To provide a comprehensive study of the C programming language, stressing upon the strengths of C.
- To provide the students with the means of writing modular, efficient, maintainable, and portable code.

Course Outcomes:

CO 1: Students should be able to write, compile and debug programs in C language.
CO 2: They should be able to use different data types in a computer program.
CO 3: They should be able to design programs involving decision structures, loops and functions.
CO 4: Students should be able to explain the difference between call by value and call by reference.

CO 5: Students should be able to understand the dynamics of memory by the use of pointers.
CO 6: Students should be able to use different data structures and create/update basic data files.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√				
CO2		√	√			√	
CO3	√	√	√	√	√		√
CO4		√	√	√		√	
CO5		√	√		√		
CO6	√			√	√		√

Module - 1 [14 Hrs]

Introduction: History of Computing, Evolution of Programming Languages, Compilers, Interpreters.[2L]

Problem Solving Method: Algorithms and Flowcharts.**[2L]**

Overview of C: Brief History of C, C Standards, Structure of a C Program, C Libraries and Linking, Compiling a C Program.**[2L]**

Expressions: Basic Data Types, Variables, Type Qualifiers, Storage Class Specifiers, Variable Scopes, Constants, Operators, Operator Precedence, Expression Evaluation, Type Conversion in Expressions, Type Casting**[6L]**

Module - 2 [15 Hrs]

Statements: Selection Statements (if, switch-case), Iteration Statements (for loop, while loop, dowhile loop), Jump Statements (return, goto, break, exit, continue).**[4L]**

Arrays and Strings: Single Dimension Arrays, Double Dimension Arrays, Strings, Arrays of Strings, String LibraryFunctions.**[4L]**

Functions: General Form, Function Prototypes, Parameter Passing Mechanisms, Command Line Arguments,Recursion.**[4L]**

Module - 3 [15 Hrs]

Pointers: Pointer Variables, Pointer Operators, Pointer Expressions, Pointers and Arrays, Functions and Pointers, Pointers to Functions, Dynamic Memory Allocation. **[3L]**

Structures, Unions, Enumerations and Typedef: Structures, Arrays of Structures, Structure, Pointers, Unions, Bit Fields, Enumerations, Typedef **[4L]**

Console I/O: Reading and Writing Characters, Reading and Writing Strings, Formatted ConsoleI/O. **[1L]**

File I/O: Data Organization, File Operations, Text Files and Binary Files, Random Access.**[2L]**
The Preprocessor: Preprocessor Directives, Macros, Macro vs. Function, File Inclusion, Conditional Compilation.**[2L]**

Suggested Books:

1. Herbert Schildt: "C: The Complete Reference", 4th Edition, Tata McGraw Hill, 2000.
2. Stephen Prata: "C Primer Plus", 5th Edition, SAMS Publishing, 2005.
3. Brian W. Kernighan and Dennis M. Ritchi: "C Programming Language", 2nd Edition, Pearson Education, 2006.
4. Samuel P. Harbison and Guy L. Steele: "C: A Reference Manual", 5th Edition, Prentice Hall, 2003.
5. Yashwant Kanetkar: "Let Us C", BPB Publications, 9th Edition, 2008.
6. K. N. King: "C Programming: A Modern Approach", 2nd Edition, W. W. Norton and Company, 2008.
7. Andrew Koenig: "C Traps and Pitfalls", Addison Wesley Professional, 1989.

Digital Logic

Code: CSAUGPC03
Contacts: 3L

Credits: 3

Course objectives:
The objectives of this course are to:

1. Introduce the concept of digital and binary systems.
2. To understand the concept of Boolean algebra and various logic gates.
3. Design and analyze combinational logic circuits.
4. Design and analyze sequential logic circuits.
5. To provide knowledge about digital integrated circuits.

Course outcomes:

CO 1: Explain the principles and methodology of digital logic design at the gate and switch level.
CO 2: Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.
CO 3: Understand Boolean algebra and basic properties of Boolean algebra; able to simplify simple Boolean functions by using the basic Boolean properties.

CO 4: Familiar with basic combinational logic circuits: Adder, subtractor, encoder, decoder, comparator etc.

CO 5: Familiar with basic sequential logic components: flip-flops, registers and counters.

CO 6: Understands the concepts of Diodes, transistors, MOS, CMOS etc.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2	√	√	√	√			
CO3	√	√		√			
CO4		√		√			
CO5		√		√			
CO6	√	√	√				

Module - 1: [10 Hrs]

Number Systems, Boolean Algebra & Logic Gates: Binary numbers & Boolean algebra, Venn diagram, Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, Quine- Mcclusky method; BCD, ASCII, EBDIC, Gray codes and their conversions, Signed binary number representation with 1"s and 2"s complement methods, Maxterm, Minterm, Representation in SOP and POS forms ; Realization of Boolean functions using NAND/NOR gates, two-level and multilevel logic circuit synthesis.

Module - 2: [10 Hrs]

Combinational circuits: Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and checker; ROM, PLA .

Module - 3: [12 Hrs]

Sequential Circuits: Latch, Flip-flop. Design of Flip-flops with logic gates. Counters, Registers. Design and analysis of sequential circuits -Moore and Mealy model description, state diagram and state table – Minimization methods. Memory unit. Racing and Logic hazards. Implementation of hazard free logic circuit. asynchronous sequential circuit synthesis.

Module – 4: [10 Hrs]

Digital Integrated Circuits: Diode as switch. Use of diodes in AND, OR Circuits . Transistor as a switch. RTL, DTL, TTL logic gate circuits. MOS as a switch. Basic MOS inverter. MOS and CMOS logic gates. Fan -in and Fan-out of logic gates, propagation delay, Tristate logic.

Suggested Books:

1. Floyed and Jain: "Digital Fundamentals", Pearson Education.
2. Morries Mano: "Digital Logic Design", PHI.

3. Leach & Malvino: “Digital Principles & Application”, 5/e, Tata McGraw Hill.
4. Kharate: “Digital Electronics”, Oxford.
5. Bigmell and R.Donovan: “Digital Electronics - Logic & Systems”, Cambridge Learning.
6. D.J.Comer: “Digital Logic and State Machine Design”, 3/e. OUP.
7. P.Raja: “Digital Electronics”, Scitech Publications.
8. R.P.Jain: “Modern Digital Electronics”, 2/e , Tata McGraw Hill.
9. H.Taub and D.Shilling: “Digital Integrated Electronics”, Tata McGraw Hill.
10. D. Ray Chaudhuri: “Digital Circuits”, vol I & II, 2/e, Platinum Publishers.
11. Tocci and Widmer: “Moss-Digital Systems”, 9/e, Pearson Education.
12. J. Bignell and R. Donovan: “Digital Electronics”, 5/e, Cenage Learning.

Elementary Arabic and Islamic Studies

Code: UCCUGAU01
Contacts: 4L
Credits: 4

Mathematics-I

Code: MATUGBS01
Contacts: 4L
Credits: 4

Programming for Problem Solving Lab

Code: CSAUGPC04
Contacts: 3P
Credits: 1.5

Module no	Content of the module	Allotted hour
1	**Introduction to computing:** block architecture of a computer, bit, bytes, memory, and representation of numbers in memory.	1
2	**Introduction to problem solving:** Basic concepts of an algorithm, program design methods, flowcharts.[1]	1
3	**Introduction to C programming:** A Brief History of C, C is middle-level Language, is a Structured Language, Complier Vs Interpreters, The Form of a C Program, Library & Linking, Compilation & Execution process of C Program . [2]	2
4	**Variables, Data Types, Operator & Expression:** Character Set, Token,	3

	Identifier & Keyword, Constant, Integer, Floating Point, Character, String, Enumeration, Data Types in C, Data Declaration & Definition Operator & Expression, Arithmetic, Relational, Logical, Increment & Decrement, Bit wise, Assignment, Conditional, Precedence & Associability of Operators.	
5	**Console I/O:** Introduction, Character input & Output, String Input & Output, Formatted Input/Output (scanf/printf), sprintf&sscanf.	2
6	**Control Statement:** Introduction, Selection Statements, Nested if, if-else-if, The "?" Alternative, The Conditional Expression, switch, Nested switch, Iteration Statements, for loop, while loop, do-while loop, Jump Statements, Goto& label, break & continue, exit() function.	4
7	**Array & String:** Single Dimension Arrays, Accessing array elements, Initializing an array, Multidimensional Arrays, Initializing the arrays, Memory Representation, Accessing array elements, String Manipulation Functions, searching, sorting an array.	6
8	**Function:** Introduction, advantages of modular design, prototype declaration, Arguments & local variables, Returning Function Results by reference & Call by value, passing arrays to a function, Recursion.	4
9	**Storage Class & Scope:** Meaning of Terms, Scope - Block scope & file scope, Storage Classes Automatic Storage, Extern Storage, Static, Storage, Register Storage.	2
10	**Pointers:** Introduction, Memory Organization, The basics of Pointer, The Pointer operator Application of Pointer, Pointer Expression, Declaration of Pointer, Initializing Pointer, De-referencing Pointer,Void Pointer, Pointer Arithmetic, Precedence of &, * operators Pointer to Pointer, Constant Pointer, Dynamic memory allocation, passing pointer to a function, array of pointers, accessing arrays using pointers, handling strings using pointers.	4
11	**Structure, Union, Enumeration & typedef:** Structures, Declaration and Initializing Structure, Accessing Structure members, Structure, Assignments, Arrays of Structure, Passing, Structure to function, Structure Pointer, Unions.	2
12	**C Preprocessor:** Introduction, Preprocessor Directive, Macro Substitution, File Inclusion directive, Conditional Compilation.	2
13	**File handling:** Introduction, File Pointer, Defining & Opening a File, Closing a File, Input/Output Operations on Files, Operations on Text mode files and binary mode files, Error Handling During I/O Operation, Random Access To Files, Command Line Arguments	3

Suggested Books:

1. B.S. Gottfried: "Programming in C", TMH.
2. B.W. Kernighan and D.M. Ritchie: "The C Programming Language", PHI.
3. H. Schildt: C++: "The Complete Reference", TMH, 4e.
4. B. Stroustrup: "The C++ Programming Language", Addison-Wesley.
5. E. Balagurusamy: "Programming in ANSI C", TMH.
6. Yashwant Kanetkar: "Let Us C", BPB Publications.
7. K. N. King: "C Programming: A Modern Approach", W. W. Norton and Company.
8. Pradip Dey and Manas Ghosh: "Programming in C", Oxford University Press

Digital Logic Lab

Code: CSAUGPC05

Contacts: 3P

Credits: 1.5

1. **Logic family:** Implementation of OR and AND gates using diodes, Study on characteristics of DTL and TTL inverters using discrete components, Study on characteristics of TTL and CMOS gates.

2. **Combinational logic circuits:** Design and implementation of combinational circuits such as, Adders, comparators, parity generator and checker. Implementation of Boolean functions using multiplexer and decoder/de-multiplexer.

3. **Sequential circuits:** Study of latch and flip-flop, design of counters.

Suggested Books:

1. Floyed and Jain: “Digital Fundamentals”, Pearson Education.

2. Morries Mano: “Digital Logic Design”, PHI.

3. Leach & Malvino: “Digital Principles & Application”, 5/e, Tata McGraw Hill.

4. Kharate: “Digital Electronics”, Oxford.

5. Bigmell and R.Donovan: “Digital Electronics - Logic & Systems”, Cambridge Learning.

PC Software Lab

Code: CSAUGPC06

Contacts: 3P

Credits: 1.5

Operating System: Familiarization (Keyboard, Memory, I/O Port), Windows, Linux.
Word Processor: Introduction to word, Editing a document, Move and Copy text, Formatting text and Paragraph, Enhancing document, Columns, Tables and Other features.

Introduction to worksheet and shell: Getting started with Excel, Editing cell & using Commands and functions, Moving & Copying , Inserting & Deleting Rows & Columns, Printing work sheet.

Overview of Power point: Basics operation, Animation and Sounds, Presenting shows for

corporate and commercial using Power point, Creating charts, Naming ranges and using statistical, math and financial functions, database in a worksheet, Additional formatting commands and drawing toolbar, other commands & functions, multiple worksheet and macros.

Overview of MS Access: Table, Relation, Queries, Reports.

E-mail: Basic Operation, Address Book, Spam and Filtering.

Browsing and Discussion Forum: Browsing and Search, Discussion Forum, Wiki and Google Doc.

Suggested Books:

1. Computer Fundamentals – Raja Raman – Prentice Hall of India 2004.
2. PC Software for Windows 98‟ made simple – R.K.Taxali – Tata McGraw Hill Publishers, 2005.

Semester II

Semester II

Data Structures and Algorithms

Code: CSAUGPC07
Contacts: 3L
Credits: 3

Course Objectives:

- Identify and use appropriate data structure for a given problem with effective utilization of space and time.
- Describe the linear and nonlinear data structures.
- Analyze the complexities of different sorting techniques.
- Identify trees, recursive functions and Graphs.

Course Outcomes:

CO 1: Get concept of Data Structure and different data types.
CO 2: Understand the time and space complexities of Algorithms.
CO 3: Design a solution to a given problem using arrays.
CO 4: Understand different applications of stacks, queues and linked lists.
CO 5: Choose the appropriate nonlinear data structure and perform operations on them.
CO 6: Understand different sorting techniques and their performances.
CO 7: Develop operations on Binary Search Trees and Graphs.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√				
CO2		√	√	√			
CO3		√	√	√			
CO4		√	√	√			
CO5		√	√	√			
CO6	√	√		√			
CO7		√	√				

Module - 1 [14 Hrs]

Introduction: Data and Information, Program Structures, Abstract Data Type, Data Structure - Static and Dynamic Data Structures. [3L]
Arrays: Representation of Polynomials and Sparse Matrix, Linear List.

[3L] **Linked List:** Single Linked Lists, Doubly Linked Lists, Circularly Linked Lists, Linked List Representation of Polynomial and Applications.

[6L]

Module - 2 [15Hrs]

Sorting and Searching Algorithms: Bubble sort, Insertion sort, Selection sort, Merge, Quick, Heap, Radix, Bucket sort, Linear and Binary Search.[6L]
Stack and Queue: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions.[4L]
Recursion: Basic concept, Design of recursive algorithms, Tail recursion.[2L]

Module - 3 [12 Hrs]

Trees: Binary Trees, Binary Search Trees, Height-Balanced And Weight-Balanced Trees, 2-3 Tree, B-Trees, B+ -Trees. Applications of Trees. [6L]
Graphs: Adjacency Matrix and List, Graph Search Algorithms, Spanning Tree Algorithms, Shortest Path Algorithms. [4L]
Hashing: Terminologies, Hashing Functions, Collision Resolution Techniques, Types of Hashing. [2L]

Suggested Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed: “Fundamentals of Data Structures in C”, Second Edition, Universal Press. 2007.
2. M. A. Weiss: “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 2002.
3. A. V. Aho, J. E. Hopcroft and J. D. Ullman: “Data Structues and Algorithms”, First Edition, Pearson Education, 2002.
4. R. K. Kruse, Bruce P. Leung: “Data Structures and Program Design”, Prentice Hall, 2006.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein: “Introduction to Algorithms”, Third Edition, PHI Learning Pvt. Ltd, 2010.
6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum: “Data Structures using C and C++”, Second Edition, Pearson Education. 2015.

Computer Organization

Code: CSAUGPC08
Contacts: 3L
Credits: 3

Course Objectives:

- To familiar with Basic Structure of Computer Systems.
- To differentiate hardware and software.
- To learn the fundamentals of pipelining.
- To learn memory and data storage mechanism.
- To acquire knowledge about peripherals.

Course Outcomes:

CO 1: Knowledge about the fundamental organization of a computer system.
CO 2: Understand how integer and real numbers are represented and instruction is getting executed.
CO 3: Explain addressing modes, instruction formats and program control statements.
CO 4: Understand memory organization and their operation principles.
CO 5: Familiarity with peripheral devices and different data transfer techniques.
CO 6: Knowledge about fundamentals concepts of pipelining and its hurdles.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√		√		
CO2	√		√				
CO3	√		√	√	√		
CO4	√	√		√	√		
CO5	√		√				
CO6	√		√				

Unit I [12 Hrs]

Functional units-Basic operational concepts-Bus structure-Performance and metrics- Instruction and its sequence -Hardware and software interface-Instruction set architecture - Addressing modes-RISC - CISC -ALU design-Fixed point and Floating point operation.

Unit II [10Hrs]

Fundamental Concepts – Execution of complete instruction – Multiple bus organization – Hardwired control – Microprogrammed control – Nano programming.

Unit III [10 Hrs]

Pipelining Basic concepts – Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Performance considerations – Exception handling.

Unit IV [10 Hrs]

Memory, Basic concepts – Semiconductor RAM – ROM – Speed – Size and Cost – Cache memories

– Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices

Unit V [6 Hrs]

Accessing I/O Devices – Programmed I/O– Interrupts – Direct memory access – Buses – Interface circuits – Standard I/O interfaces (PCI, SCSI, USB) – I/O devices and processors.

Suggested Books:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky: "Computer Organization", 5th Edition, Tata Mc-Graw Hill, 2002.
2. Heuring, V.P. and Jordan, H.F.: "Computer Systems Design and Architecture", 2nd Edition, Pearson Education, 2004.
3. Patterson, D. A., and Hennessy, J.L.: "Computer Organization and Design: The Hardware/Software Interface", 3rd Edition, Elsevier, 2005.
4. William Stallings: "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003.
5. Hayes, J.P.: "Computer Architecture and Organization", 3rd Edition, Tata Mc-Graw Hill, 1998.

Object Oriented Programming

Code: CSAUGPC09
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the fundamental concepts of object oriented programming paradigm.
- To learn the benefits of object oriented programming technique.
- To understand of writing object oriented programming using Java language.
- To learn the fundamental concept about packages, multithreading etc.

- To learn designing applications for solving real life problems using object oriented programming.

Course Outcomes:

CO 1: Learning object oriented programming paradigm in designing application software.
CO 2: Learn the difference among structured and object oriented programming paradigm to design a solution for real life problems.
CO 3: Understanding basic object oriented principles like inheritance, encapsulation and polymorphism to solve real life computing problems using Java language.
CO 4: Learn code reusability through inheritance, packages and interface.
CO 5: Learn to develop multithreaded programs, packages, exception handling in Java.
CO 6: Learn to write Applet programs.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√	√	√		
CO2	√	√	√	√	√		
CO3		√	√	√	√	√	
CO4			√	√		√	
CO5		√	√	√	√		
CO6			√	√		√	
CO7	√	√	√	√	√		

UNIT I: Object Oriented Thinking [3 Hrs]

Need for OOP Paradigm, Principles of Object Oriented Languages, Benefits of OOP, Applications of OOP.

UNIT II: Java Basics [8 Hrs]

History of Java, Java Buzzwords, Java Virtual Machine, Platform Independence, Data Types, Variables, Scope and Life time of variables, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program.

UNIT III: Classes and Objects [8 Hrs]

Concepts of Classes, Objects, methods, constructors, this keyword, garbage collection, Compile time polymorphism: overloading methods and constructors, parameter passing, command line arguments, Recursion, nested and inner classes, Exploring String, StringBuffer classes, Arrays.

UNIT III: Inheritance [6 Hrs]

Hierarchical abstractions, Base class object, subclass, subtype, forms of inheritance, benefits of inheritance, Member access rules, Usage of super, static and final with inheritance, Run time

polymorphism: method overriding, abstract classes, the Object class.

UNIT IV: Packages and Interfaces [5 Hrs]

Defining, Creating and Accessing a Package, Understanding CLASSPATH, access control, differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces. Exploring java.io.

UNIT V: Exception Handling [5 Hrs]

Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception classes: throw and throws.

UNIT VI: Multithreading [8 Hrs]

Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads.

UNIT VII: Applet Programming [5 Hrs]

Applet & Application, Applet Architecture, Parameters to Applet, Embedding Applets in Web page, Applet Security Policies.

Suggested Books:

1. E Balagurusamy: "Programming with Java", McGraw Hill Education.
2. Herbert Schildt: "Java: The Complete Reference", McGraw Hill Education.
3. Sachin Malhotra and Saurabh Choudhary: "Programming in Java", Oxford University Press.
4. Y. Daniel Liang: "Introduction to Java Programming, Brief Version", Pearson Education.
5. Y. Daniel Liang: "Introduction to Java Programming, Comprehensive Version", Pearson Education.
6. Cay S. Horstmann: "Core Java - Vol. I and Vol. II", Pearson Education.
7. E. Balagurusamy: "Object-Oriented Programming with C++", McGraw Hill Education.
8. Bjarne Stroustrup: "The C++ Programming Language", Pearson Education.
9. R. Lafore: "Object Oriented Programming in C++", Pearson Education.
10. Debasish Jana: "C++ and Object-Oriented Programming Paradigm", PHI Learning.

Mathematics II

Code: MATUGBS02
Contracts: 4L
Credits: 4

Environmental Science

Code: UCCUGMC02

Contacts: 2L

Credits: 0

UNIT I [4 Hrs]

Basic ideas of environment, basic concepts related to environmental perspective, man, society andenvironment, their inter relationship.

Mathematics of population growth and associated problems, definition of resource, types of resource: renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth,pollutant and contaminant. Environmental impact assessment.

Environmental degradation:Acid rain, toxic element, particulates, noise pollution, air pollution, effect of pollution on man.

Overall methods for pollution prevention, components of environment, environmental problems and sustainable development

UNIT II [3 Hrs]

Elements of Ecology:System, open system, closed system, definition of ecology, species, population, community, Ecosystem, biotic and abiotic components.

Ecological balance and consequence of change:Effect of abiotic factor on population, flow chart of different cycles with only elementary reaction [oxygen,nitrogen, phosphate, sulphur], food chain

UNIT III [10 Hrs]

Overview of Air Pollution and Control

Atmospheric Composition: Troposphere, stratosphere, mesosphere, thermosphere, tropopause, stratopauseand mesopause.

Energy Balance:Conductive and convective heat transfer, radiation heat transfer, simple global temperature model [Earth asa black body, earth albedo]), problems.

Green-house effects, Climate, weather:Difference between climate and weather, Global warming and its consequence, Atmospheric dispersion, Source and effect of pollutants, Primary and secondary pollutants:Emission standard, Depletion Ozone layer, Standards and control measures.

UNIT IV [7 Hrs]

Different Other Types of Pollutions and Way to their Control, Water Pollution: Natural water, Lake, Arsenic pollution.Land Pollution: Lithosphere, Waste and Waste management, Land filling. Noise Pollution: Causes and Effects.

Suggested Books:

1. Masters, G.M.: “Introduction to Enviromental Engineering”, Pearson Education India.
2. N NBasak: “Environmental Engineering”, McGraw Hill Education.
3. Richard T. Wright, Dorothy F. Boorse: “Environmental Science: Toward a Sustainable Future”, Pearson Education.
4. Eugene Odum.: “Fundamentals of Ecology”,Cengage Learning.
5. Smith:“Elements of Ecology”, Pearson Education India.
6. M. Dash, S. Dash: “Fundamentals Of Ecology”, McGraw Hill Education.

Data Structure Lab

Code: CSAUGPC10
Contacts: 3P
Credits: 1.5

Experiments should include but not limited to:

1. Implementation of various sorting algorithms such as Bubble sort, Insertion sort, Selection sort, Merge sort, Quick sort, Shell sort, Heap sort, Radix sort, Bucket sorting.
2. Implementation of Linear and Binary Search.
3. Implementation of stacks and queues using arrays.
4. Implementation of stacks and queues using linked lists.
5. Applications of linked lists: polynomial arithmetic, set operations, etc.
6. Sparse Matrices: Multiplication, addition.
7. Implementation of Binary Trees, Binary Search Trees, B-Trees, B+-Trees.
8. Implementation of Hash tables.

Python Programming Lab

Code: CSAUGPC11
Contacts: 3P
Credits: 1.5

1. Write a program to demonstrate basic data type in python
2. Create a list and perform the following methods
insert() ,remove() , append()
len() ,pop() ,clear()
3. Create a tuple and perform the following methods
Add items ,len() ,check for item in tuple ,Access items
4. Create a dictionary and apply the following methods
Print the dictionary items , access items , use get()
change values ,use len()
5. Write a program to create a menu with the following options
1. TO PERFORM ADDITITON 2. TO PERFORM SUBTRACTION
3. TO PERFORM MULTIPICATION 4. TO PERFORM DIVISION
Accepts users input and perform the operation accordingly. Use functions with arguments.
6. Write a python program to print a number is positive/negative using if-else.
7. Write a program for filter() to filter only even numbers from a given list.

8. Write a python program to print date, time for today and now

9. Write a python program to add some days to your present date and print the date added.

10. Write a program to count the numbers of characters in the string and store them in a dictionary data
structure

11. Write a program to count frequency of characters in a given file.

12. Using a numpy module create an array and check the following: 1. Type of array 2. Axes of array 3. Shape
of array 4. Type of elements in array

13. Write a python program to concatenate the dataframes with two different objects

14. Write a python code to read a csv file using pandas module and print the first and last five lines of a file.

15. Write a python program which accepts the radius of a circle from user and computes the area (use math
module)

OOPS LAB

Code: CSEUGPC07
Contacts: 3P
Credits: 1.5

1. Assignments on class, constructor, overloading, inheritance, overriding,
2. Assignments on abstract classes, String handling
3. Assignments on wrapper class, arrays
4. Assignments on developing interfaces- multiple inheritance, extending interfaces
5. Assignments on creating and accessing packages
6. Assignments on Exception handling
7. Assignments on multithreaded programming
8. Assignments on applet programming

Semester III

Semester -III

Operating Systems

Code: CSAUGPC13
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the main components and different functions of an operating system.
- To understand about process and its states, synchronized and different scheduling methods.
- To compare and illustrate various process scheduling algorithms.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC
- To understand different approaches to memory management.
- To summarize the principles of Virtual memory as applied to paging & caching techniques.
- To demonstrate internal file system structure with device drivers and file operations using system calls.
- To study the need for special purpose operating system with the advent of new emerging technologies

Course Outcomes:

CO 1: Understand the working procedure of an operating system and its components.
CO 2: Describe process management techniques and analyze the synchronization methods.
CO 3: Identify the working methodology of multithreaded applications and distinguish different scheduling algorithms.
CO 4: Evaluate the requirement for process synchronization and coordination handled by operating system.
CO 5: Identify the reasons of deadlocks, and their remedial measures in an operating system.
CO 6: Understand different memory management techniques used in operating systems.
CO 7: Get overview of different file systems.

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√					
CO2		√	√				
CO3		√		√			
CO4			√				√

CO5				√			
CO6		√	√				
CO7			√	√			

Module 1: [12 Hrs]

Introduction to Operating Systems.

Concept of batch-processing, multi-programming, time sharing, real time operations.

Process Management: Concept of process, state diagram, process control block; scheduling of processes – criteria, types of scheduling, non-preemptive and preemptive scheduling algorithms like: FCFS, Shortest Job First/Next (SJF/N), Shortest Remaining Time Next (SRTN), Round Robin (RR), Highest Response ratio Next (HRN), Priority based scheduling, different Multilevel queue scheduling etc.

Threads – concept, process vs thread, kernel and user threads, multithreading models.

Inter-process Communication (IPC) – Shared memory, message, FIFO, concept of semaphore, critical region, monitor.

Module 2: [12 Hrs]

Process Synchronization: concepts, race condition, critical section problem and its solutions; synchronization tools- semaphore, monitor etc., discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber etc.

Deadlock – conditions, resource allocation graph, prevention techniques, avoidance technique

– Banker‟s algorithm and related algorithms.

Module 3: [12 Hrs]

Memory management: Address space and address translation; static partitioning, dynamic partitioning, different types of fragmentation, paging, segmentation, swapping, virtual memory, demand paging, page size, page table, page replacement algorithms – FIFO, LRU, Optimal page replacement, Variants of LRU, etc; thrashing, working set strategy.

Module 4: [12 Hrs]

File Management: File and operations on it, file organization and access; file allocation; directory structures, file sharing, file protection

Device management: Magnetic disks, disk scheduling- criteria, algorithms – FCFS, SSTF, SCAN, C-SCAN, LOOK, etc, disk management – formatting, boot block, disk free space management techniques, concept of RAID etc.

Protection and Security: Concepts of domain, Access matrix and its implementation,

access control, Security of systems- concepts, threats- Trojan horse, virus, worms etc, introduction to cryptography as security tool, user authentication.

Suggested Books:

1. A. Silberschatz, P. Galvin and G. Gagne: "Operating Systems Concepts", Wiley India.
2. Gary Nutt, N. Chaki and S. Neogy: "Operating Systems Concepts", Pearson Education.
3. W. Stallings: "Operating Systems", Pearson Education.
4. D. M. Dhamdhere: "Operating Systems: A Concept-based Approach", Tata McGraw-Hill.

Database Management System

Code: CSAUGPC14
Contacts: 3L
Credits: 3

Course Objectives:

- The objective of this course is
- Students should be exposed to the fundamental concepts of Data Base Management Systems
- Students should be able to model, design and implement Data Base Management Systems
- Students should be able to manipulate a database using Structured Query Language (SQL)
- Students should be able to master techniques for Database Normalization, Transaction Management and database security and recovery management.

Course Outcomes:

CO 1: Understanding functional components and architecture of DBMS and its role in Information System
CO 2: Mastering SQL queries with background understanding of Relational Algebra
CO 3: Applying E-R model and Relational model for designing and implementation of DBMS
CO 4: Understanding Integrity Constraint, Functional Dependency and Normalization Rules
CO 5: Understanding Transaction Processing & Concurrency control
CO 6: Understanding Query Optimization, indexing, storage and recovery management

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√					
CO2		√	√		√		
CO3		√		√	√	√	
CO4	√	√		√			
CO5				√	√	√	
CO6	√	√					

Introduction [6 Hrs]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema Architecture of DBMS.

Entity-Relationship Model [5 Hrs]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [7 Hrs]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

SQL and Integrity Constraints [6 Hrs]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, Views, Nested Subqueries, Database security application development using SQL, Stored Procedures and Triggers.

Relational Database Design [9 Hrs]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, 2NF, 3NF, Boyce-Codd Normal Form, Normalization using multi- valued dependencies, 4NF, 5NF, Lossless Decomposition

Internals of RDBMS [8 Hrs]

Physical data structures, Query optimization: join algorithm, statistics and cost based optimization. Transaction Processing, Concurrency Control and Recovery Management, Serializability, Lock based protocols, Two Phase Locking.

File Organization & Index Structures [7 Hrs]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Suggested Books:

1. Abraham Silberschatz, Henry F. Korth and S Sudarshan: “Database System Concepts”, McGraw Hill Education.
2. Elmasri Ramez and Novathe Shamkant: “Fundamentals of Database Systems”, Pearson Education.
3. Raghu Ramakrishnan and Johannes Gehrke: “Database Management Systems”, McGraw Hill Education.
4. Jim Gray and Andreas Reuter: “Transaction Processing: Concepts and Techniques”, Moragan Kauffman Publishers.
5. C.J. Date: “An Introduction to Database Systems”, Pearson Education.
6. R. Panneerselvam: “Database Management Systems”, PHI Learning.
7. Alexis Leon and Mathews Leon: “Fundamentals of Database Management Systems”, McGraw Hill Education.
8. Ullman JD.: “Principles of Database Systems”, Galgotia Publications.

Numerical Methods and Programming (Open Elective I)

Code: CSAUGOE01
Contacts: 3L
Credits: 3

Course Objectives:

- The purpose of this course is to provide basic understanding of the derivation and integration.
- The purpose of this course use of the numerical methods along with the knowledge of finite precision arithmetic.
- To give the knowledge of few interpolation formulas.
- To give some knowledge of linear equations, differential equations etc.

Course Outcomes:

CO 1: Recall the distinctive characteristics of various numerical techniques and the associated error measures.
CO 2: Understand the theoretical workings of various numerical techniques to solve the engineering problems and demonstrate error.
CO 3: Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.
CO 4: Familiar with numerical solutions of nonlinear equations in a single variable.
CO 5: Apply the principles of various numerical techniques to solve various problems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2		√		√			
CO3				√			
CO4		√		√			
CO5				√			

Module-1 (14 hours)

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. Interpolation: Newton forward & backward interpolation,
Lagrange‟s and Newton‟s divided difference Interpolation.

Module-2 (15 hours)

Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Jacobi and GaussSeidel iterative methods. Numerical solution of Algebraic equation: Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method.

Module-3 (14 hours)

Numerical solution of ordinary differential equation: Taylor‟s series method, Euler‟s method, Runge Kutta methods, Predictor-Corrector methods and Finite Difference method. Numerical integration: Trapezoidal rule, SimPOn‟s 1/3 rule, Weddle‟s rule.

Suggested Readings:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

Open Elective II (Microprocessor and Applications)

Code: ECEUGOE02
Contacts: 3L
Credits: 3

Course Objectives:

- To learn the basics of a particular microprocessor.
- To learn the basics of a particular microcontroller.
- To learn the interfacing of microprocessor.

Course Outcomes:

CO 1: To acquire the knowledge of hardware details of 8085 and 8086 microprocessor with the related signals and their implications.

CO 2: To develop skill in assembly Language programming of 8085.

CO 3: To understand the concept and techniques of designing and implementing interfacing of microprocessor with memory and peripheral chips involving system design.

CO 4: To acquire the knowledge of the 8086 architecture and its programming.

CO 5: To analyze the performance of computers and its architecture to real-life applications

CO – PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√				
CO2	√		√	√			√
CO3	√		√	√		√	
CO4	√		√				√

Module I: [6 Hrs]

Introduction to Microprocessors and their features. Demultiplexing of Address & Data Bus, Generation of Read Write Control Signal for Memory & I/O. Uses of Decoder & Latch, Changes of Memory Map.

Module II: [10 Hrs]

8085 Microprocessor: Architecture, Register Organization, Control Signals, Hardware & Software Interrupts, Instruction Set, Addressing Modes & Assembly Language Programming.
Instruction Cycle, Machine Cycle, T-State, Timing Diagram [**03**L]
Interfacing of Memory Chips with Microprocessor, I/O Mapped I/O & Memory Mapped I/O.
[**06L**]

Module III: [14 Hrs]

Working of DMA Controller, Microprocessor based A/D Conversion using ADC0804.
[**03**L] Peripherals: 8255, 8253, 8259, 8237 [**09**L]
Industrial Applications of Microprocessor. [**02**L]

Module IV: [12 Hrs]

8086 Microprocessor: Architecture, Memory Segmentation, Minimum Mode & Maxamimum Mode, Addressing Modes, brief description of Instruction Set and Assembly Language Programming. [9**L**] Brief overview of some other Microprocessors [**02L**]

Suggested Books:

1. Ramesh Gaonkar: "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publishing (India) Private Limited.
2. B. Ram: "Fundamentals of Microprocessors and Microcomputers", Dhanpat Rai Publications.
3. N. Senthil Kumar, M. Saravanan and S. Jeevananthan: "Microprocessors and Microcontrollers", Oxford University Press.
4. A.K. Ray and K M Bhurchandi: "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing", Tata McGraw-Hill Publishing Company Limited.
5. M. A Mazidi, J .G. Mazidi and R. D. McKinlay: "The 8051 Microcontroller and Embedded Systems:Using Assembly and C", Pearson.
6. Kenneth Ayala: "The 8051 Microcontroller", Cenage Learning India Private Limited.
7. http://nptel.ac.in/.

Indian Constitution

Code: UCCUGAU03
Contacts: 2L
Credits: 2

Unit 1: Indian Constitution: Making and basic premise 10 Hours

1.1 Meaning and Significance of Constitution.
1.2 Constituent Assembly- Composition, Objectives
1.3 Preamble and Salient features of the Indian Constitution.
1.4 Fundamental Rights, Fundamental Duties. Directive Principles

Unit 2: Union and State Government 11 Hours

2.1 President of India- Election, Powers and functions
2.2 Prime Minister and Cabinet – Structure and functions
2.3 Governor- Powers and functions
2.4 Chief Minister and Council of Ministers – Functions.

Unit 3: Legislature and Judiciary 12 Hours

3.1 Parliament – Lok Sabha and Rajya Sabha – Composition and powers

3.2 State Legislative Assembly and Legislative Council – Composition and powers
3.3 Judicial System in India – Structure and features
3.4 Supreme Court and High Court: Composition, Jurisdiction.

Unit 4: Governance and Constitution 12 Hours

4.1 Federalism in India - Features
3.2 Local Government -Panchayats –Powers and functions; 73rd and 74th amendments
3.3 Election Commission – Composition, Powers and Functions; Electoral Reforms
3.4 Citizen oriented measures – RTI and PIL – Provisions and significance.

Suggested Readings:

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, (23rd edn.) 2018.
2. M.V. Pylee, India's Constitution, New Delhi; S.Chand Pub., (16th edn.) 2017.
3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency,(55th edn.) 2018.
4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf
5. K B Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015.
6. K.Sharma, Introduction to the Constitution of India, Prentice Hall of India, NewDelhi, 2002.

Operating System Lab

Code: CSAUGPC15
Contacts: 3P
Credits: 1.5

1. **Shell programming:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads:** programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication:** pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

Database Management System Lab

Code: CSEUGPC15
Contacts: 3P
Credits: 1.5

Overview of Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes

2. **Table and Record Handling**
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements

3. **Retrieving Data from a Database**
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

4. **Clauses**
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries

5. **Database Management**
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE

6. **Cursors in Oracle PL / SQL**

7. **Writing Oracle PL / SQL Stored Procedures**

Numerical Methods and Programming Lab (Open Elective I)

Code: CSAUGOE02
Contacts: 3P
Credits: 1.5

Android Development Lab

Code: CSAUGPC17
Contacts: 3P
Credits: 1.5

COURSE OBJECTIVES:

1. To facilitate students to understand android SDK
2. To help students to gain a basic understanding of Android application development
3. To inculcate working knowledge of Android Studio development tool

COURSE OUTCOMES:

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

CO 1: Identify various concepts of android programming that make it unique from programming for other platforms.

CO2: Critique mobile applications on their design pros and cons.

CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.

CO4: Program mobile applications for the Android operating system that use basic and advanced phone features.

CO5: Deploy applications to the Android marketplace for distribution.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√	√	√		
CO2				√		√	
CO3				√		√	
CO4		√	√	√			
CO5				√	√	√	

UNIT – I [8 Hrs]

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT – II [8 Hrs]

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT – III [8 Hrs]

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT – IV [8 Hrs]

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT – V [8 Hrs]

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TEXT BOOKS:

1. T1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Dawn Griffiths and David Griffiths "Head First Android Development-A Brain-Friendly Guide" O'REILLY, 2nd ed (2017)

REFERENCE BOOKS:

1. R1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. R2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. R3. Android Application Development All in one for Dummies by Barry Burd, Edition:I

Semester IV

Semester IV

Computer Networks

Code: **CSAUGPC18**

Contacts: 3L

Credits: 3

Course Objectives:

- Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.
- Read the fundamentals and basics of Physical layer, and will apply them in real time applications
- Study data link layer concepts, design issues, and protocols.
- Gain core knowledge of Network layer routing protocols and IP addressing.
- Study Transport layer services and protocols.
- Acquire knowledge of Application layer and Presentation layer paradigms and protocols.

Course Outcomes:

CO 1: Understand basic concepts of computer network and its components.
CO 2: Describe the functions of each layer in OSI and TCP/IP model.
CO 3: Explain the types of transmission media.
CO 4: Describe the functions of data link layer and explain the protocols.
CO 5: Classify the routing protocols and analyze how to assign the IP addresses for the given network
CO 6: Describe the functions of Transport layer and explain the protocols.
CO 7: Explain the functions of Application layer.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√		√			
CO2		√	√	√			
CO3		√		√			
CO4		√	√	√			
CO5		√	√	√			
CO6		√	√				
CO7		√	√	√			

Module 1: [12 Hrs]

Introduction: Uses of Computer Networks, Types of Computer Networks, OSI Reference Model, Example Networks

Physical Layer: Data and signal fundamentals, Transmission impairments, Attenuation, Distortion, Noise, Data rate limits for noisy and noiseless channels, Performance

Digital Transmission – Problems with digital transmission, Different line coding schemes, Block coding schemes, Scrambling techniques, Analog to digital encoding, Analog Transmission.

Transmission Media - Guided (wired) media – Twisted pair cable, Coaxial cable and Fibre optic

cable, Unguided (wireless) media – Different propagation modes, Radio waves, Terrestrial microwaves, Satellite communication. Concept of multiplexing, Frequency division multiplexing, Time division multiplexing – Synchronous and Statistical time division multiplexing, Handling variable length data, Pulse stuffing. Concept of spreading spectrum, Frequency hopping spread spectrum and Direct sequence spread spectrum.

Module 2: [12 Hrs]

Data Link Layer: Link Layer Services, Error detection and Correction Techniques, Multi Access Protocols, Link Layer Addressing, Ethernet, Hubs, Switches and Switches, Point to Point Protocol, Asynchronous Transfer Mode, Multiprotocol Label Switching

Module 3: [12 Hrs]

Network Layer: Introduction, Virtual Circuit and Datagram Networks, IP Addressing, Subnetting, Routing Algorithms (Link State, Distance Vector, Hierarchical), Routing in the Internet (RIP, OSPF, BGP), Broadcast and Multicast Routing Algorithms, Routers, ICMP, IPv6

Module 4: [12 Hrs]

Transport Layer: Introduction to Transport Layer Services, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control, Sockets, Quality of services (QOS)
Application Layer: Web and HTTP, Domain Name Space (DNS), Electronic Mail (SMTP, MIME, IMAP, POP3), File Transfer Protocol, Cryptography.

Suggested Books:

1. James F. Kurose and Keith W. Ross: “Computer Networking: A Top-Down Approach Featuring the Internet”, 5th Edition, Pearson Education, 2010.
2. Behrouz A. Forouzan: “Data communication and Networking”, 4th Edition, Tata McGraw-Hill, 2007.
3. Andrew S. Tanenbaum: “Computer Networks”, 4th Edition, Prentice Hall India, 2003.
4. Larry L. Peterson and Peter S. Davie: “Computer Networks: A Systems Approach”, 4th Edition, Morgan Kauffman Publishers, 2007.
5. William Stallings: “Data and Computer Communication”, 9th Edition, Pearson Education, 2011.

Web Technology

Code: **CSAUGPC19**

Contacts: 3L

Credits: 3

Course Objectives:

- To impart the basics of web page design.
- To understand important components of HTML5 documents and use HTML5 to create web pages.
- To learn to use JavaScript in Webpages to enhance the functionality and appearance of web pages.
- To know XML schema and transformation.
- To design dynamic web pages using PHP.

Course Outcomes:

CO 1: Student will be able to summarize the basic tags and properties in HTML and CSS.
CO 2: Student will be able to select HTML tags and CSS properties to design web pages.
CO 3: Student will be able to prepare XML documents to store and transport data.
CO 4: Student will be able to write programs in PHP.
CO 5: Student will be able to develop web applications using JavaScript and PHP.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√	√				
CO2		√	√		√		
CO3			√	√			
CO4			√		√		
CO5		√	√		√		

Static Web Pages [5 Hrs]

HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout,

Dynamic Web Pages [4 Hrs]

The need of dynamic web pages; an overview of DHTML, Cascading Style Sheet (CSS), comparative studies of different technologies of dynamic page creation

Active Web Pages [5 Hrs]

Need of active web pages; Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing Applet, Applications.

Java Script [6 Hrs]

Data types, variables, operators, conditional statements, Array object, Date object, String object, Function, Errors, Validation.

Extensible Markup Language (XML) [5 Hrs]

Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.

Cookies & Sessions [4 Hrs]
Definition of cookies; Create and Store a cookie with example; Sessions.

Java Servlet [5 Hrs]
Servlet environment and role, HTML support, Servlet API, The Servlet life cycle, Servlet Programs.

JSP [15 Hrs]
JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

PHP & MySQL [10 Hrs]
Overview of PHP, Basics web programming using PHP, Introducing MySQL, Database connectivity using PHP.

Suggested Books:

1. Uttam K. Roy: "Web Technologies", Oxford University Press.
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: "Java Server Programming for Professionals", Shroff Publishers and Distributors.
3. C. Xavier: "Web Technology and Design", New Age.
4. Kogent Learning Solutions Inc.: "Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press.
5. N.P. Gopalan and J. Akilandeswari: "Web Technology: A Developer's Perspective", PHI.
6. Luke Welling, Laura Thomson: "PHP and MySQL Web Development", Pearson Education.
7. Mike McGrath: "PHP and MySQL", McGraw Hill Education.
8. Meloni J C: "Sams Teach Yourself PHP MY SQL and Apache", Pearson Education.
9. Jain & Siddiqui with NIIT: "J2EE Professional Projects", PHI.
10. Uttam K. Roy: "Advanced Java Programming", Oxford University Press.

Formal Language & Automata Theory

Code: **CSAUGPC20**
Contracts: 3L
Credits: 3

Course Objectives:

- Course should provide a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical (and less magical) view towards algorithmic design and in general computation itself.
- The course should in addition clarify the practical view towards the applications of these ideas in computer science.

Course Outcomes:

CO 1: Understand different models and compare them.
CO 2: Analyse different computational models using combinatorial methods.
CO 3: Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO 4: Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.
CO 5: Understand limitations of some computational models and possible methods of proving them.
CO 6: Have an overview of how the theoretical study in this course is applicable to and application like designing the compilers.

CO – PO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO 11	PSO 12
CO1	√	√	√		√							
CO2	√	√			√							
CO3			√	√		√	√				√	
CO4			√	√	√	√	√				√	
CO5			√	√	√							
CO6		√		√	√							

Module-1 [14 Hrs]

Introduction: Alphabet, Languages, Grammars, Productions, Derivation, Chomsky hierarchy of languages, Regular Expressions and Languages. [3L]

Finite Automata (FA): Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), Deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, Minimization of Finite Automata. [6L]

Regular Languages: Regular Sets and Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages. [3L]

Module-2 [14 Hrs]

Context-Free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. [8L]

Context-Sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. [4L]

Module-3 [16 Hrs]

Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, Variants of Turing machines, Nondeterministic TMs and equivalence with deterministic TMs, Universal TMs, Halting Problem, Recursive Functions and Sets, Recursively Enumerable Sets, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. [8L]

Undecidability: Church-Turing Thesis, Universal Turing Machine, The Universal And Diagonalization Languages, Reduction Between Languages And Rice's Theorem, Undecidable Problems AboutLanguages. [4L]

Suggested Books:

1. John Martin: "Introduction to Languages and Theory of Computation",Tata McGraw Hill.
2. J. E. Hopcroft and J. D. Ullman:"Introduction to Automata Theory, Languages and Computation", Pearson Education.
3. H. R. Lewis and C. H. Papadimitriou:"Elements of the Theory of Computation", Second Edition, Pearson Education.
4. Peter Linz:"An Introduction to Formal Languages and Automata", Narosa.
5. Michael Sipser:"Introduction to the Theory of Computation", Thomson Press.
6. Dexter C. Kozenm:"Automata and Computability", Springer.

Probability and Statistics

Code: MATUGBS05
Contacts: 3L
Credits: 3

UNIT-I: [5 Hrs]

Mathematical Theory of Probability: Basic concepts, Classical and axiomatic approaches, Sample space and events, Properties of probability functions, Conditional probability and independent events.

UNIT-II: [8 Hrs]

Single Random variables & probability distributions: Random variables - Discrete and continuous. Probability distributions, mass function/ density function of probability distribution. Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution. Binomial, Poisson & normal distributions and their properties. Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-III: [7 Hrs]

Multiple Random variables, Correlation & Regression: Joint probability distributions-Joint probability mass/ density function, Marginal probability mass & density functions, Covariance of two random variables, Correlation Coefficient of correlation, Regression Coefficient, Central limit theorem.

UNIT-IV: [7 Hrs]

Sampling Distributions & Parameter estimation: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of mean and sampling distribution of variance, likelihood estimate, interval estimations.

UNIT-V: [6 Hrs]

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors - critical region, confidence interval, Level of significance, Once sided test, Two sided test, Student t-distribution, F-distribution, Chi-square test of goodness of fit.

UNIT-VI: [7 Hrs]

Queuing Theory&Stochastic processes: Structure of a queuing system, Operating characteristics of queuing system, Introduction to Stochastic Processes - Classification of Random processes, Methods of description of random processes, Stationary and non-stationary random process, Markov process, Markov chain.

Suggested Books:

1. Seymour Lipschutz and John J. Schiller: "Introduction to Probability and Statistics",
2. S. K. Mapa: "Higher Algebra (Abstract & Linear)",
3. A. Banerjee, S. K. De and S. Sen: "Mathematical Probability",
4. C.W.Helstrom: "Probability and Stochastic Processes for Engineers",
5. K.B.Datta and M.S.Sriniva: "Mathematics for Engineers", Cengage Publications.
6. T.K.V.lyengar&B.Krishna Gandhi Et: "Probability and Statistics",
7. S C Gupta and V.K.Kapoor: "Fundamentals of Mathematical Statistics",
8. Jay I.Devore: "Probability and Statistics for Engineers and Scientists",

Open Elective III (Principles of Communication)

Code: CSAUGOE03
Contacts: 3L
Credits: 3

Communicative English

Code: ENGUGHU01
Contacts: 3L

Credit: 3

Objectives of the Course: To impart basic Communication skills to the first year UG students in the English language through rigorous practice and use of various categories of common words and their application in sentences; to enable them to achieve effective language proficiency for their social, professional & inter personal communication both in speaking & writing.

Module no	Content of the module	Allotted hour
1	**Fundamentals of Communication:** Communication: Meaning, Nature, Process, Importance and Function of Communication; Levels of Communication: Intra-personal, Interpersonal, Organizational, Mass Communications; The Flow of Communication: Downward, Upward, Lateral or Horizontal, Diagonal, Grapevine Communication; Network in an Organization; Principles for Effective Communication; Verbal and Non-Verbal Communication; Barriers to Communication, Gateways to Communication.	
2	**Listening and Speaking Skills** The Process of Listening; Barriers to Listening; Types of Listening: Active and Passive Listening; Methods for improving listening skills, Benefits of Effective Listening. Presentation Strategies: Defining Purpose; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech – Accent, Pitch, Rhythm, Intonation, Strong and Weak Forms, Connected Speech- Assimilation and Elision, Paralinguistic Features of Voice; Articulation of Speech Sounds- Vowels and Consonants; Spelling and Pronunciation; Problems of Indian speakers of English and their remedial measures.	
3	**Reading and Writing Skills** **Reading Skills:** Purpose, Process, Methodologies, and Strategies; Special Reading Situations – Skimming and Scanning, Intensive and Extensive Reading, Critical Reading, Drawing Inferences, Reading Technical Reports, etc. **Writing Skills:** Words and Phrases: Word Formation, Synonyms and Antonyms, Homophones, One Word Substitutes, Words Often Confused, Word Choice - Right Words, Appropriate Words, Idioms and Phrases; Correct Usage: Parts of Speech, Modals, Concord, Articles, Infinitives, Requisites of Sentence Construction. Elements of Effective Writing, Main Forms of Written Communication: Paragraph - Techniques and Methods (Inductive, Deductive, Linear, Spatial, Chronological etc.), The Art of Condensation- various types (Précis, Summary and Abstract, etc.), Description, Agenda, Minutes, Notices, Circulars, Memo, Advertisements, Drafting an E-mail, Press Release.	
4	**Business Communication** Business Letters: Principles; Sales & Credit letters; Claim and Adjustment Letters; Job application and Résumés. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal. Negotiation & Business Presentation skills.	

Suggested Books:

1. Sethi, J & et al.:"A Practice Course in English Pronunciation", Prentice Hall of India, New Delhi.
2. Berry Cicely: "Your Voice and How to Use it Successfully", George Harp & Co. Ltd, London

3. Bansal, R.K. and J.B. Harrison:“Spoken English”, Orient Longman.
4. Hornby's, A.S.:“Oxford Advanced Learners Dictionary of Current English”, 7th Edition, Oxford University Press.
5. Pillai, Sabina &Agna Fernandez: “Soft Skills & Employability Skills”,Cambridge Univ. Press.
6. Sudharshana, N.P. & C. Savitha: “English for Technical Communication”, Cambridge Univ. Press.
7. Raman, Meenakshi & Sangeeta Sharma: “Technical Communication: Principles and Practice”,Oxford Univ. Press.
8. Prasad, P.:“The Functional Aspects of Communication Skills”, Delhi.
9. McCarthy, Michael:“English Vocabulary in Use”, Cambridge University Press, Cambridge.
10. Leech, G &Svartvik, J. A: “Communicative Grammar of English”, Pearson Education. New Delhi.
11. Narayanaswamy V.R.:“Strengthen your Writing”, Orient Longman, London.
12. Dean, Michael:“Write it”, Cambridge University Press, Cambridge.
13. Sen, Leena:“Communication Skills”, Prentice Hall of India, New Delhi.
14. Bown, G.:“Listening and Spoken English”, Longman, London

Computer Networks lab

Code: CSAUGPC21
Contacts: 3P
Credits: 1.5

1. **Familiarization with**
   - Networking cables (CAT5, UTP)
   - Connectors (RJ45, T-connector)
   - NIC Installation & Configuration (Windows/Linux)
   - Hubs, Switches
2. **TCP/UDP Socket Programming**
3. **Implementation/Simulation of**
   - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
   - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
   - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Web Technologies Lab

Code: CSAUGPC22
Contacts: 3P
Credits: 1.5

1. Web Page Design using HTML
2. Use of CSS in Designing Web Pages
3. Applet Design
4. Application of JavaScript in Web Page Development
5. Usage of Cookies & XML
6. Server Side Programming through Servlets
7. Application of Java Server Pages in Server Side programming
8. Application of Java Database Connectivity
9. Web design using PHP and MySQL

Semester V

Semester V

Design and Analysis of Algorithms

Code: **CSAUGPC23**

Contacts: 3L

Credits: 3

Course Objectives:

- Define the basic concepts of algorithms and analyze the performance of algorithms.
- Discuss various algorithm design techniques for developing algorithms.
- Discuss various searching, sorting and graph traversal algorithms.
- Understand NP completeness and identify different NP complete problems.
- Discuss various advanced topics on algorithms.

Course Outcomes:

Course Outcomes:

CO 1: Student will be able to get idea of algorithms and its running time complexity.

CO 2: Describe the divide-and-conquer paradigm and explain when an algorithmic design situation Student will be able to solve explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.

CO 3: Student will be able to solve explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.

CO 4: Student will learn about computational complexity of problems & can use this in practical problem solving.

CO – PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1		√	√				
CO2	√			√			
CO3		√		√			
CO4			√	√			

Module - 1 [14 Hrs]

Models of computation: RAM, TM etc. time and space complexity.

Asymptotic Notation: Big-O, omega, theta etc.; finding time complexity of well known algorithms like heap sort, search algorithm etc.

Algorithm design techniques: Recursion: use, limitations, examples.

Divide and Conquer: basic concept, use, examples (Merge sort, Quick Sort, Binary Search).

Module - 2 [14 Hrs]

Dynamic Programming: basic concept, use, examples (matrix-chain multiplication, all-pair shortest paths, single-source shortest path, travelling salesman problem).

Branch and Bound: basic concept, use, examples (15-puzzle problem).

Backtracking: basic concept, use, examples (Eight queens problem, graph coloring problem, Hamiltonian problem).

Greedy Method: basic concept, use, examples (Knapsack problem, Job sequencing with deadlines, minimum spanning tree).

Lower Bound Theory: Bounds on sorting and sorting techniques using partial and total orders.

Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank, Path compression.

Module - 3 (14 hours)

Properties of graphs and graph traversal algorithms: BFS and DFS.

Matrix manipulation algorithms: Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes.

Notion of NP-completeness: P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.

Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem.

Suggested Books:

1. T.H. Cormen, C.E. Leiserson., R.L. Rivest, C. Stein: “Introduction to Algorithms”,.
2. E. Horowitz, S. Sahni, S. Rajasekaran: “Fundamentals to Computer Algorithms”,.
3. C.H. Papadimitriou, E. Steiglitz: “Combinatorial Optimization Algorithms and Complexity”,.

Computer Graphics

Code: CSAUGPC24

Contacts: 3L

Credits: 3

Course Objectives:

- To introduce computer graphics concepts, display systems, algorithm design, elemental algorithms and transformations.
- To make students familiar with techniques of object representation and viewing in two dimensional and three dimensional space.
- To learn about elemental concepts of modeling, rendering and shading and their applications.

Course Outcomes:

CO 1: Knowledge about fundamentals of computer graphics.
CO 2: Concepts of algorithm design and geometric/mathematical transforms.
CO 3: Understanding of two dimensional object representation and viewing in display devices.
CO 4: Knowledge about representation, transformation and viewing objects in three dimensional space.
CO 5: Familiarity with different aspects and components about recent applications of computer graphics and insights into upcoming prospective graphics-powered applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√		√	√		√
CO2	√	√		√	√		√
CO3	√	√		√	√	√	√
CO4	√	√		√	√	√	√
CO5	√	√		√	√	√	

Unit I. Introduction to Computer Graphics & Graphics Systems (10L)

Overview of computer graphics, graphical display devices, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics softwares; Character generation

Unit II. Scan Conversion (8L)

Points and lines, Line drawing algorithms; DDA algorithm, Bresenham‟s line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit III. 2D Transformation (8L)

Basic transformations - translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection, shear, Transformation of points, lines, parallel lines, intersecting lines.

Unit IV. Viewing in 2D (6L)

Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, Cohen Sutherland Algorithm, clipping circles, polygons & ellipse, Sutherland Hodgeman algorithm.

Unit V. 3D Transformation and Viewing (6L)

Translation, rotation, scaling & other transformations, Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Unit VI. Curves and Surfaces (6L)

Object representation; Curve and surface designs, Bezier curves, Continuity conditions; B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Suggested Books:

1. Computer Graphics C version, by D. Hearn and M.P. Baker, Pearson Education.
2. Computer Graphics bySamit Bhattacharya, Oxford University Press.
3. Procedural Elements for Computer Graphics by David F.Rogers, TMHpublication.
4. Mathematical Elements for Computer Graphics by David F. Rogers and J. A.Adams, TMH publication.
5. Computer Graphics Principles &Practice in C by J.D. Foley, A. van Dam, S.K.Feiner and F. H. John, Pearson.
6. Computer Graphics – A Programming Approach by S. Harrington, TMHpublication.
7. Computer Graphics by A.N. Sinha and A.D. Udai, TMH publication

Artificial Intelligence & Soft Computing

Code: CSAUGPC25

Contacts: 3P

Credits: 3

Module-1 [12 Hrs]:

Fuzzy Logic and Approximate Reasoning: Conventional and fuzzy sets, Basic concepts of fuzzy logic, Fuzzy expressions: Basic principles of fuzzy logic and fuzzy inference rules, fuzzy relations, fuzzy operators, realization of fuzzy systems using fuzzy relations , application of fuzzy logic in vision, pattern recognition, robotics and linguistics.

Approximate reasoning in Experts Systems, Fuzzy sets in approximate reasoning, Fuzzy propositions in approximate reasoning. Transition Modifier rules, Basic principles of approximate reasoning and rules of inference.

Module-2 [12 Hrs]

Genetic Algorithms (GAs) : Introduction to GAs, Binary encodings of candidate solutions, Schema Theorem and Building Block Hypothesis, Genetic operators – crossover and mutation, parameters for GAs, Reproduction mechanism for producing Offspring, Darwinian Principle in evaluating objective function. Convergence Analysis: Simple GA schemes, Stochastic models: GA approaches to optimization problems

Module-3 [12 Hrs]

Machine learning foundations – probabilistic framework, algorithms.

Classification and Predictions:What is Classification & Prediction, Issues regarding Classification and prediction, k-NN, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm.

Suggested Books:

1. J. S. R. Jang C. T. Sun and E. Mizutani: "Neuro- Fuzzy and Soft Computing : A Computational Approach to Learning and Machine Intelligence", Pearson.
2. T. J. Ross:"Fuzzy Logic with Engineering Applications", Wiley.
3. B. Kosko:"Neural Network and Fuzzy Systems : A Dynamical Systems Approach to Machine Intelligence", PHI, 1992.
4. G. J. Klir, B. Yuan: "Fuzzy sets and Fuzzy logic: Theory and Applications", PHI, 1995.
5. David E. Goldberg: "Genetic Algorithms in Search, Optimization and Machine Learning", Addision Wesley, MA, 1989.

Software Engineering

Code: **CSAUGPC26**
Contracts: 3L
Credits: 3

Course Objectives:

- To acquire the generic software development skill through various stages of software life cycle.
- To ensure the quality of software through software development with various protocol based environment.

Course Outcomes:

CO 1: Basic knowledge and understanding of the analysis and design of complex systems.
CO 2: Ability to apply software engineering principles and techniques.
CO 3: Ability to develop, maintain and evaluate large-scale software systems.
CO 4: To produce efficient, reliable, robust and cost-effective software solutions.
CO 5: Ability to perform independent research and analysis.
CO 6: Ability to work as an effective member or leader of software engineering teams.
CO 7: Ability to understand and meet ethical standards and legal responsibilities

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2		√	√				
CO3	√		√				
CO4			√	√		√	
CO5		√	√				√
CO6					√	√	
CO7							√

Module 1: **[14 Hrs]**

Overview: System Analysis & Design, Business System Concept, System Development Life Cycle,

Waterfall Model, Spiral Model, Prototype Model, Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, COCOMO model.

System Requirement Specification: DFD, Data Dictionary, ER diagram,

System Design: Problem Partitioning, Top-Down and Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

Module 2: **[12 Hrs]**

Coding & Documentation: Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation.

Testing: Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.

Module 3: **[14 Hrs]**

Software Project Management: Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.

CASE tools: Concepts, use and application.

UML diagrams: Fundamentals of Object Oriented design in UML.

References:

1. Roger Pressman: "Software Engineering, A practitioner‟s approach",
2. Rajib Mall: "Software Engineering",
3. Pankaj Jalote: "Software Engineering",

Multimedia (Professional Elective I)

Code: CSAUGPE01

Contracts: 3L

Credits: 3

Multimedia

Introduction:

Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications

Text and Audio:

Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI

Image and Video:

Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.

Synchronization:

Temporal relationships, synchronization accuracy specification factors, quality of service

Storage models and Access Techniques:

Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, and CCD

Image and Video Database:

Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing

Document Architecture and Content Management:

Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications

Suggested Books:

1. Charles Petzold: "Windows Programming", Microsoft Press, 1998.
2. David J. Kruglinski, George Shepherd, Scot Wingo: "Programming Microsoft
3. Visual C++", Microsoft Press, 2006.
4. Kate Gregory: 'Using Visual C++", Prentice Hall of India Pvt., Ltd., 1999.
5. Buford J. K.: "Multimedia Systems" – Pearson Education.
6. Andleigh&Thakrar: "Multimedia", PHI
7. Balagurusamy E: "Programming in C#", Tata McGraw Hill, 2010.

Animation Techniques (Professional Elective I)

Code: CSAUGPE02

Contracts: 3L

Credits: 3

COURSE OUTCOMES (CO)

CO1: To define viewpoint and common rollouts-editing Splines.

CO2: To understand different concepts of light.

CO3: To make use of VRay in animation and create animation by using rendering technique.

CO4: To learn texturing the objects; light the scene, etc. to create a short-animated movie.

CO5: To have complete understanding of AR and VR System.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√		√		
CO2			√		√		
CO3	√	√		√			
CO4		√	√	√			
CO5	√			√	√		√

Module 1 (Contact hours: 10) – 2D and 3D: View, Viewports, Standard primitives, Transformations, File formats and operations, Selection, Cloning, Group, Ungroup, Alignment, Splines: common, Rollouts-editing splines, Architectural tools, Max scene files, Modifiers, World space modifiers, Object space modifiers, Modifier stack, Instanced modifier.

Module 2 (Contact hours: 12) - Compound objects and types, Modeling- mesh modeling, converting objects to editable mesh, sub objects: vertex, edge, face, polygon, element, Edit mesh modifier, Editable poly modeling, Material Editor, Assigning materials to objects, Material editor options, Material properties, Material types, Concepts of Light, omni lights, Spotlight, target lights, free lights, directional light, area lights, Mental ray, Skylight, Creating max basic lights, lights parameters, Positioning lights, Creating max light in exterior environment, Creating max light in interior environment.

Module 3 (Contact hours: 8) - Rendering, rendering techniques, Photorealistic rendering, Shading, VRaySun, VRay Light, Ray Tracing, Creating Animations: particles and dynamics, rendering the animation, automating the output of multiple still images, rendering a shadow study, creating a walkthrough, output options, particle systems: creating hierarchies.

Module 4 (Contact hours: 8) - Animating modifiers, animating elements, animation helpers, using dummy objects, dynamics and reaction, Dynamic Objects: damper, Spring, simulation mass FX.

TEXTBOOKS/LEARNING RESOURCES:

a) Alan H. Watt and Mark Watt, Advanced Animation and Rendering Techniques Theory and Practice (1 ed.), ACM Press 1992, 1992. ISBN 9780201544121, 0201544121.

b) Tomas Akenine-Möller, Eric Haines and Naty Hoffman,, Real-Time Rendering (1 ed.), CRC Press, 2019. ISBN 9781315362007, 1315362007.

Audio Signal Processing (Professional Elective I)

Code: CSAUGPE03

Contracts: 3L

Credits: 3

Course Objective:

- To introduce the various aspects of acoustic and audio signal processing along with applications in audio algorithm design, and audio signal analysis.
- To develop Audio Signals Analysis and Synthesis scheme to get more detailed information from audio signals.
- To develop Audio Signals Feature Representation schemes to build verbal communication based real time artificial intelligence based systems.

Course Outcomes:

CO1. Understand different characteristics of Audio signals

CO2. Perform different processing techniques for audio and speech signals

CO3. Analyze different speech analysis and synthesis systems.

CO4. Execute different feature representation schemes from audio/speech signals

CO5. Design models and algorithms for audio and speech processing applications.

CO-PO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√	√	√	√	√	√
CO2	√	√	√	√	√		
CO3	√	√	√	√	√	√	
CO4	√	√	√	√	√	√	
CO5	√	√	√	√	√	√	√

Module I. Background and preview: (10 Hours)
Audio Signal Characteristics, Production model, Hearing and Auditory model, audio measurement, sound intensity, noise signal analysis and characterization, stationary and nonstationary signals, probabilistic signal processing techniques with applications for the acoustic & audio signal analysis.

Module II. Audio signal processing techniques: (6 Hours)
Audio signal acquisition, Representation and Modelling, Enhancement of audio signals: Spectral Subtraction, Weiner based filtering, Acoustic characteristic of speech, Speech production models

Module III. Audio Signals Analysis and Synthesis: (8 Hours)
Audio/ Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time

Module IV: Audio Signals Feature Representation: (8 Hours)
Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction., Linear Predictive Coding Analysis.

Module V. Applications: (8 Hours)
Principles of Automatic Speech Recognition (ASR), Speaker Recognition, Evolution of Speech APIs, Natural Language Processing, Sound source separation models.

Suggested Books and References:

1. D. Manolakis, M. Ingle, S. Kogon, Statistical and Adaptive Signal Processing, McGraw-Hill, Revised Edition 2014.

2. Jacob Benesty, Israel Cohen, Jingdong Chen, Fundamentals of Signal Enhancement and Array Signal Processing, Wiley & Sons, 2018

3. Udo Zolzer, Digital Audio Signal Processing, Wiley & Sons, 2008

4. Steven L. Gay, Jacob Benesty, Acoustic Signal Processing for Telecommunication, Springer, 2001.

5. T.F. Quartieri, Discrete-Time Speech Signal Processing: Principles and Practice, Prentice Hall

6. L.R.Rabiner, R.W.Schafer, Theory and Applications of Digital Speech Processing, Prentice Hall

B. Gold, N. Morgan, D. Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, Wiley-Blackwell

GIS and Remote Sensing (Professional Elective I)
Code: CSAUGPE04
Contracts: 3L
Credits: 3

Course Objectives:

- To understand the principles, applications, trends, and pertinent issues of geographical information systems and sciences.
- To develop technical skills and competence in data and information acquisition, extraction, management and analysis; spatial and statistical modeling; mapping and visualization.
- To perform image enhancement on remotely sensed imagery and extract information.
- To apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate remote sensing data and processing methods.

Course Outcomes:

CO 1: Retrieve the information content of remotely sensed data.
CO 2: Analyze the energy interactions in the atmosphere and earth surface features.
CO 3: Interpret the images for preparation of thematic maps.
CO 4: Apply problem specific remote sensing data for engineering applications.
CO 5: Analyze spatial and attribute data for solving spatial problems.
CO 6: Create GIS and cartographic outputs for presentation.

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1		√		√	√		√
CO2	√	√					
CO3	√					√	
CO4		√	√	√			
CO5	√	√		√			√
CO6			√			√	√

Module 1 [12 Hrs]

Fundamentals of remote sensing; Principles of electromagnetic radiation and EM spectrum. Sensors and platforms; remote sensing satellites, multispectral, hyper spectral and thermal sensors; RS data acquisition systems. Image processing; Image enhancement and visualization; Image interpretation and classification. Microwave thermal remote sensing; Radar & laser altimetry.

Module 2 [12 Hrs]
Applications of Remote Sensing; Integration of remote sensing and GIS. Basic concepts of GIS; cartographic principles, map projections and coordinate systems. Geographic information and spatial data types; Hardware and software; Steps of spatial data handling; Database management systems; Spatial referencing.

Module 3 [12 Hrs]
Data quality, measures of location errors on maps. Spatial data input, data preparation; Point data transformation.Analytical GIS capabilities, retrieval and classification, overlay functions. Neighbourhood operations, network analysis, error propagation; Data visualization.

Suggested Books:
1. Burrough PA:"Principles of Geographic Information System for Land Resources Assessment", Oxford Univ. Press. 2. Curran PJ:"Principles of Remote Sensing", Longman. 3. Jensen JR:"Introductory Digital Image Processing", Prentice Hall. 4. Lillesand TM & Kiefer RW:"Remote Sensing and Image", Wiley.

System Analysis and Design (Professional Elective I)
Code: CSAUGPE05
Contracts: 3L
Credits: 3

COURSE OBJECTIVES

- To make students understand the basic concepts of Systems.
- To familiarize with knowledge of Information system and system analyst.
- To understand the concepts of System Development Life Cycle.
- To study the system planning and Feasibility Study.
- To introduce the tools for System Analysis and System Design.
- To get knowledge about Input and Output requirements.
- To study the system maintenance, system security and audit.

COURSE OUTCOMES

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

CO1: Understand different types of systems and responsibilities of a system analyst
CO2: Understand the system development life cycle
CO3: Know the system planning and different types of feasibility study
CO4: Describe different tools used for system analysis and types of design approaches
CO5: Explain the concept of Input output requirements, maintenance of the system, system security and audit

Unit 1: Basic Concept of Systems
The System: Definition and Concepts; Elements of a System: Input, Output Processor, Control, Feedback, Environment, Boundaries and Interface; Characteristics of a System; Types of systems -Physical and Abstract System, Open and Closed Systems, Man-made Systems; Information and its categories

Unit 2: Information System and System Analyst
Information systems: TPS, OAS, MIS, DSS, ESS; System Analyst: Role and need of system analyst, System Analyst as an agent of change.

Unit 3: System Development Life Cycle
Introduction to SDLC, Various phases: study, analysis, design, development, testing, implementation, maintenance; System documentation: Types of documentation and their importance.

Unit 4: System Planning and Information Gathering

Initial Investigations, Identification of user needs, Project Identification and Selection; Needs of Information Gathering, Determination of requirements, Information gathering tools: interviews, group communication, questionnaires, presentations and site visits.

Unit 5: Feasibility Study

Definition, Importance of feasibility study, Types of feasibility study, System selection plan and proposal, Prototyping, Cost-Benefit Analysis: Tools and Techniques.

Unit 6: Tools for System Analysis
Data Flow Diagram (DFD), Logical and Physical DFDs, Developing DFD; System Flowcharts and Structured charts, Structured English, Decision trees and Decision tables.

Unit 7: System Design
Module specifications, Module Coupling and cohesion, Top-down and bottom-up design; Logical and Physical design, Structured design.

Unit 8: Input and Output
Input design: Input data, Input media and devices; Output design; Form Design: Classification of forms,

Requirements of Form design.

Unit 9: System Implementation and Maintenance

Need of System Testing, Types of System Testing, Quality Assurance; System Conversion, Conversion methods, procedures and controls, System evaluation and performance, Maintenance activities and issues.

Unit 10: System Security and Audit
System Security, Security Threats, Risk Analysis, Control measures, System Audit, Disaster Recovery Planning

Suggested Readings:
1. Elias m. Awad: System Analysis and Design
2. Perry Edwards: System Analysis & design Mc Graw Hill

Design Analysis of Algorithms Lab

Code: CSAUGPC27

Contracts: 3P

Credits: 1.5

EXPERIMENTS

1. Write a program to perform operation count for a given pseudo code
2. Write a program to perform Bubble sort for any given list of numbers.
3. Write a program to perform Insertion sort for any given list of numbers.
4. Write a program to perform Quick Sort for the given list of integer values.
5. Write a program to find Maximum and Minimum of the given set of integer values.
6. Write a Program to perform Merge Sort on the given two lists of integer values.
7. Write a Program to perform Binary Search for a given set of integer values recursively and non recursively.
8. Write a program to find solution for knapsack problem using greedy method.
9. Write a program to find minimum cost spanning tree using Prim's Algorithm.
10. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
11. Write a program to perform Single source shortest path problem for a given graph.
12. Write a program to find solution for job sequencing with deadlines problem.
13. Write a program for all pairs shortest path problem.
14. Write a program to solve N-QUEENS problem.
15. Write a program to solve Sum of subsets problem for a given set of distinct numbers.

REFERENCES:

1. Data Structures and Algorithms by G.A.V. Pai, 2017, TMH.
2. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,2nd edition, University Press.

Computer Graphics Lab

Code: CSAUGPC28

Contracts: 3P

Credits: 1.5

1. Programs for designing objects in graphics by using Library functions.
2. Programs to draw the line, circle by using algorithms.
3. Programs to fill polygons by using algorithms.
4. Programs to implement line clipping.
5. Programs to implement 2-D transformation on objects.
6. Programs to do basic animation by using graphics.
7. Program to create simple geometric objects.
8. Program to implement the DDA technique to draw line.
9. Program to implement the Bresenham's technique to draw line.

10. Program to implement the DDA technique to draw Circle.
11. Program to implement the midpoint circle algorithm.
12. Program to implement 2 Dimensional basic transformations.
13. Program to implement various attributes of Graphics primitives.
14. Program to implement animation.

Artificial Intelligence & Soft Computing Lab

Code: CSAUGPC29
Contracts: 3P
Credits: 1.5

Demonstrating physical components of computer system
2. Demonstrating connecting peripherals to the computer system
3. Demonstrating the components of Windows Desktop
4. Demonstrating Recycle Bin
5. Demonstrating My Computer or Windows Explorer in Windows
6. State space search
7. Heuristic search
8. Toy problem

Semester VI

Semester-VI

Machine Learning

Code: CSAUGPC30
Contacts: 3L
Credits: 3

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To explain mathematical background of the Machine Learning Algorithms
- To develop skills for solving practical problems using Machine Learning

Course Outcomes:

Students will be able to:

CO 1: Recognize characteristics of machine learning that make it useful in certain types of real-world analysis problems.
CO 2: Understanding machine learning problems as supervised, semi-supervised, and unsupervised.
CO 3: Become familiar with feature engineering and Dimensionality reduction Techniques
CO 4: implementing regression, clustering, classification, and reinforcement task
CO 5: Using Python Machine Learning libraries

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2		√		√			
CO3	√	√		√			
CO4		√		√	√		
CO5				√	√		

Module 1 (18 hours)

Introduction: Overview of topics and applications

Supervised Learning: Linear Regression: gradient descent, Normal equations. Probabilistic Interpretation, Logistic Regression, Newton's method, Locally weighted Linear Regression, Nearest Neighbors, Exponential Families, Generalized Linear Models, Optimization: Convex functions, Convex problems, Generative Learning Algorithms, Gaussian Discriminant Analysis, Feature selection, Kernels, Support vector Machine.

Module 2 (18 hours)

*Unsupervised Learning:*Curse of Dimensionality, Dimensionality Reduction, PCA, Mixture of Gaussians, EM Algorithm. Examples of EM, clustering, spectral clustering. Multi-dimensional Scaling (MDS), Isomaps, Non Negative Matrix Factorization.

Module 3 (12 hours)

Probabilistic Graphical Models: Introduction, Representation, Markov Blanket, variable elimination, HMM, Inference on a chain (sum-product specific case), Kalman Filters, Directed / Undirected graphs, MRFs, Sum-product, Max-product,

Special Topic: Graphical Models, Deep Learning.

Reference Books:

- Machine Learning, Tom Mitchell, McGraw Hill
- The Elements of Statistical Learning Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Springer
- EthemAlpaydin, Introduction to Machine Learning, PHI
- Chris Bishop, Pattern Recognition and Machine Learning

Cryptography & Cyber Security

Code: CSAUGPC31

Contacts: 3L

Credits: 3

Course Objectives:

• To understand the mathematics behind Cryptography.
• To understand the security concerns and vulnerabilities
• To familiarize with different types of cryptosystems
• To create an awareness for the design of various cryptographic primitives
• To analyze different types of attacks on various cryptosystems.

Course Outcome:

CO1: The students will be able
CO2: To learn the importance of number theory in designing crypto systems;
CO3: To design public and private key cryptosystems;
CO4: To do cryptanalysis of various cryptosystems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√				
CO2	√		√		√		
CO3		√		√			
CO4		√		√		√	

Module 1: [14 Hrs]

Introduction and Mathematical Foundations: Introduction, Overview on Modern Cryptography, Number Theory Probability and Information Theory, Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.

Cryptography: Concepts & Techniques. Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size

Module 2 [14 hrs]

Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5 (Rivest Cipher 5) algorithm.

Asymmetric Key Algorithm: Digital Signature and RSA: Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).

Module 3 [5 hrs]

Internet Security Protocols, User Authentication: Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

Module 4 [5 hrs]

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods –Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

References:

1. William Stallings, "Cryptography and Network Security – Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.
3. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
4. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

Compiler Design

Code: CSAUGPC32

Contacts: 3L

Credits: 3

Module-1 [8 Hrs]

Introduction to Compiling [2L]

Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler.

Lexical Analysis [6L]

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of tokens, Recognition of tokens, Finite automata, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Module-2 [10 Hrs]

Syntax Analysis [6L]

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation [4L]

Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

Module-3 [8 Hrs]

Type checking [3L]

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Overloading of functions and operators.

Run time environments [5L]

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module-4 [10 Hrs]

Intermediate code generation [3L]

Intermediate languages - Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples), Declarations, Assignment statements, Boolean expressions.

Code generations [4L]

Issues in the design of code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, A simple code generator, Register allocation and assignment, The DAG representation of basic blocks, Peephole optimization.

Code optimization [3L]

Introduction, The principle sources of optimization, Optimization of basic blocks, Loops in flow graphs.

Suggested Books:

1. Aho, Sethi, Ullman: “Compiler Principles, Techniques and Tools”, Pearson Education.
2. K. V. N. Sunitha: “Compiler Construction”, Pearson Education.
3. O.G. Kakde: “Compiler Design”, Laxmi Publications.
4. Holub: “Compiler Design in C”, PHI.
5. Tremblay and Sorenson: “Compiler Writing”, McGrawHill International.
6. Chattopadhyay: “Compiler Design”, PHI.

Frontend Development with PHP and MySQL (Professional Elective II)

Code: CSAUGPE06

Contacts: 3L

Credits: 3

Course Outcomes (CO):

1. Basic knowledge of utilizing PHP for web development.
2. Integrating Database applications, File handling with PHP.
3. Mastering Session management in PHP
4. Design and Implement Interactive Web Site using PHP and JavaScript.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	3	-	2	2	-
CO2	-	2	2	1	2	3	-
CO3	1	-	2	-	3	-	2
CO4	2	2	-	2	3	-	-

1- Low
2- Medium
3- High

Unit- I [4L]

Web technology- HTML, MVC, HTTP, GET/POST, HTML basic tags and elements

Unit- II [8L]

PHP basics: Syntax, data types, variable, operators, assignments, conditional statements, loop, array, Form handling, String handling. Object Oriented Programming with PHP.

Unit- III [6L]

Session handling: Stateless protocol, Query string, hidden field, Session variable, Cookies management.

Unit – IV [4L]

File handling: Understanding file & directory, Opening and closing a file, Coping, renaming and deleting a file, File Uploading & Downloading

Unit- V [8L]

JavaScript: JavaScript Tokens-Identifiers, Keywords, Literals, Operators, Strings. Built-in and User-defined functions, Using Objects and Events from PHP, AJAX with PHP

Unit-VI [12L]

MySQL: Introduction to RDBMS, PHP Connection with MySql Database, Performing basic database operation-Insert, Delete, Update, Select, Performing advanced Query like Inner joins, Outer Joins, Aggregate, and Group-by.

Books-

Learning PHP & MySQL by Michele E. Davis, Jon A. Phillips , Publisher: SPD
Head First PHP & MySQL by Lynn Beighley, Michael Morrison Publisher: O'Reilly

Introduction to NoSQL (Professional Elective II)

Code: CSAUGPE07

Contacts: 3L

Credits: 3

Course Outcome:

CO1: Ability to compare and contrast RDBMS with different NoSQL databases.
CO2: Understanding of different types of NoSQL Databases
CO3: Understanding the detailed architecture and adaptation of NoSQL databases.
CO4: Mastering performance tuning of Key-Value Pair in NoSQL databases.
CO5: Applying NoSQL development tools on different types of NoSQL Databases.

1- Low
2- Medium
3- High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	-	1	-	-	-
CO2	-	-	2	2	-	-	-
CO3	-	2	3	3	2	2	1
CO4	1	2	3	3	3	1	-
CO5	2	-	2	3	3	2	-

Unit I: NoSQL- Definition and Introduction, Characteristics of NoSQL, Difference with RDBMS, Transaction Management. [4L]

Unit II: Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases. Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, CAP Theorem. Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, [10L]

Unit III: Distribution Models, Single Server, Sharding, Master-Slave Replication, Big Data, Map-Reduce Algorithm, Hadoop [8L]

Unit IV: Understanding the Storage Architecture, Working with Column-Oriented Databases, HBase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores in Redis,

Unit V: Performing CRUD Operations in NoSQL, Creating Records, Accessing Data, Updating and Deleting Data [8L]

Unit VI: Querying NoSQL Stores: Comparing Between SQL and MongoDB Query Features, Accessing Data from Column-Oriented Databases Like HBase [6L]

Unit VII: Indexing and Ordering Data Sets, Indexing and Ordering in MongoDB, Indexing and Ordering in CouchDB, Indexing in Apache Cassandra [6L]

Books –
NoSQL for Mere Mortals by Dan Sullivan Publisher: O'Reilly
NOSQL by Ganesh Chandra Deka Publisher: CRC Press

Advanced Java Programming (Professional Elective II)

Code: CSAUGPE08

Contacts: 3L

Credits: 3

Course Objectives:

- To understand the features and basic concepts of Object Oriented Programming.
- To be familiar with the features of JDBC.
- To understand the concepts of all the event handling methods as well as the AWT class.
- To understand the basic concepts of Java Server Pages and network programming.
- To understand the concepts of generating a client's request and tracking a userusing Java servlet.

Course Outcomes:

CO 1: Demonstrate terms and concepts of Object Oriented Programming.
CO 2: Create an application and connect it with databases.
CO 3: Create an application using AWT class and the event handling methods.
CO 4: To be able to demonstrate the concepts of Java Server Pages and network programming.
CO 5: Demonstrate the concepts of Java servlet and how to generate a client request as well as tracking it.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1							
CO2		√	√			√	
CO3	√	√	√			√	
CO4	√				√		√
CO5	√			√			

Introduction (6 Hours)

Basic Concepts in Java: Objects, Classes, Encapsulation, Inheritance, Polymorphism, Packages, Access Protection, interfaces, Arrays, String Handling, Exception Handling, Multithreading, Applets.

Networking (6 Hours)

Networking Basics, Introduction of Socket, Types of Socket, Socket API, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection, RMI Architecture, Client Server Application using RMI.

JDBC Programming (6 Hours)

JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, PreparedStatement, CallableStatement), Exploring ResultSet Operations, Batch Updates in JDBC.

Java Server Pages (6 Hours)

Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects.

Java Servlet (5 Hours)

Servlet as an improved CGI, Servlet Fundamentals / API, What is a Web-Container, Servlet Life Cycle / Architecture, HTTP GET and POST Request Method, Processing Html Forms, What is Name-Value pair, Content Types and MIME.

Event Handling (7 Hrs)

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

Suggested Books:

1. E Balagurusamy: ―Programming with Java‖, McGraw Hill Education.
2. Herbert Schildt:―Java: The Complete Reference,McGraw Hill Education.
3. Sachin Malhotra and SaurabhChoudhary:―Programming in Java, Oxford University Press.
4. Y. Daniel Liang:―Introduction to Java Programming, Brief Version, Pearson Education.
5. Y. Daniel Liang:―Introduction to Java Programming, Comprehensive Version‖, Pearson Education.
6. Cay S. Horstmann: ―Core Java - Vol. I, Vol. II and Vol. II, Pearson Education.
7. Paul J. Deitel and H. Deitel: ―Java 9 for Programmers, Pearson Education India.
8. Harold Elliotte Rusty: ―Java Network Programming, Shroff Publishers & Distributers.
9. George Reese: ―Java Database Best Practices: Persistence Models and Techniques for Java Database Programming, O'Reilly.
10. Uttam K. Roy: ―Advanced Java Programming, Oxford University Press.

React and Node JS (Professional Elective II)

Code: CSAUGPE09

Contacts: 3L

Credits: 3

Course Objective:

- To introduce the various aspects of client and server side application development with the application of JS
- To implement single page application using rect.
- To develop front end web application using React.
- To introduce with Node.js Basics.
- To explain and develop Node JS Modules
- To demonstrate Node Package Manager

Course Outcomes:

CO1. Understand different JavaScript application, different React features, components and forms and React library

CO2. Explore how to implement single page application using React and Execute Reactstrap to design responsive React application.

CO3. Design the architecture for a React-Redux application using Redux.

CO4. Understand Node JS and REPL terminal.

CO5. Experiment with Node JS Modules and Node Package Manager.

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√	√	√	√	√	√
CO2	√	√	√	√	√		
CO3	√	√	√	√	√	√	
CO4	√	√	√	√	√	√	
CO5	√	√	√	√	√	√	√

Unit I

Module I. Introduction to React: (2 Hours)
Introduction to front-end JavaScript frameworks and libraries, introduction to react. React components and JSX.

Module 2: React Router and Single Page Applications (4 Hours)
Various component types. React router and its use in designing single page applications. Single page applications and use React Router to design single page applications.

Module 3: React Forms, Flow Architecture and Introduction to Redux (4 Hours)
Controlled and uncontrolled forms, form validation in React applications. Overview of the Flux architecture, introduction to Redux as a way of realizing the flux architecture.

Module 4: More Redux and Client-Server Communication (4 Hours)
More Redux that includs Redux action, combining reducers, and Redux thunk, client-server communication using Fetch and the REST API. Animation in React. Testing, building and deploying React applications.

Unit II

Module 1. Introduction to Node JS: (4 Hours)
Features and advantages of Node JS, Traditional Web Server Model, Node.js Process Model, Asynchronous programming with Node.js, Types of applications that can be developed using Node.js

Module 2. Setup Development Environment: (2 Hours)
Install Node.js on Windows, working in REPL, Node JS Console, Creating a Node File with JavaScript, Accessing a Node.js File Through the Command Line Interface, Using Node.js in Net-Beans IDE**.**

Module 3 NODE.JS BASICS: (2 Hours)
Primitive Types, Object Literal, Functions, Buffer, Access Global Scope.

Module 4 NODE.JS MODULES: **(4 Hours)**

Module, Module Types: Core Modules, Local Modules, Third Party Modules, Module Exports. Using Modules in a Node.js File, Using the Built in HTTP, URL, Query String Module, Creating a Custom Module

Module 5. NODE PACKAGE MANAGER: **(4 Hours)**

NPM, Installing Packages Locally, Adding dependency in package.json, Installing packages globally, Updating packages.

Suggested Books and References:

1. Robin Wieruch, The Road to React: The React.js with Hooks in JavaScript Book
2. Mark Thomas, React in action
3. Dhruti Shah, "Node.JS Guidebook", BPB Publications, 2018.
4. Basarat Ali Syed, Beginning Node.js, A press, 2014.

Machine Learning Lab

Code: CSAUGPC33

Contacts: 3P

Credits: 1.5

1.The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)

2. Extract the data from database using python

3. Implement k-nearest neighbours classification using python

4.

Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of kmeans clustering with 3 means (i.e., 3 centroids) periments

VAR1 VAR2 CLASS

1.713 1.586 0

0.180 1.786 1

0.353 1.240 1

0.940 1.566 0

1.486 0.759 1

1.266 1.106 0

1.540 0.419 1

0.459 1.799 1

0.773 0.186 1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no -> highRisk
high golf trading married forties yes -> lowRisk
low speedway transport married thirties yes -> medRisk
medium football banking single thirties yes -> lowRisk
high flying media married fifties yes -> highRisk
low football security single twenties no -> medRisk
medium golf media single thirties yes -> medRisk
medium golf transport married forties yes -> lowRisk
high skiing banking single thirties yes -> highRisk
low golf unemployed married forties yes -> highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite word

Compiler Design Lab

Code: CSAUGPC34

Contacts: 3P

Credits: 1.5

S. No.	List of Experiments
1	Write a LEX Program to scan reserved word & Identifiers of C Language language.
2	Implement Predictive Parsing algorithm
3	Write a C program to generate three address code.
4	Implement SLR(1) Parsing algorithm
5	Design LALR bottom up parser for the given language
6	Write a C program for implementing the functionalities of predictive parser for the mini language specified in Note 1.

7	Write a C program for constructing of LL (1) parsing.
8.	Write a C program for constructing recursive descent parsing.
9	Write a C program to recognize strings under 'a', 'a*b+', 'abb'.
10	Write a C program to simulate lexical analyzer for validating operators.
11	Write a C program to implement LALR parsing.

Frontend Development with PHP and MySQL Lab (Professional Elective II Lab)

Code: CSAUGPE10

Contacts: 3P

Credits: 1.5

1. Write a program to compute the sum of the digits of a number. (Input get Using Form)

2. Write a program to inserts a new item in an array in any position. (Input get Using Form) Expected Output : Original array : 1 2 3 4 5 After inserting '$' the array is : 1 2 3 $ 4 5

3. Write a program to sort the following associative array :
array("Sophia"=>"31","Jacob"=>"41","William"=>"39","Ramesh"=>"40") in
a) ascending order sort by value
b) ascending order sort by Key
c) descending order sorting by Value
d) descending order sorting by Key
e) transform a string all uppercase letters.
f) transform a string all lowercase letters.
g) make a string's first character of all the words uppercase.

4. Write a program using nested for loop that display a chess board

5. Write a program to compute and return the square root of a given number (Without default array function) (Input get Using Form)

6. Write a program to print Fibonacci series using recursion.

7. Write a program to validate given input is date or not and create simple 'birthday countdown' script, the script will count the number of days between current day and birthday
8. Write a program to store current date-time in a COOKIE and display the „Last visited on“ date-time

on the web page upon reopening of the same page.

9. Upload and Display images in particular directory

10. To design an student details database using HTML Form and process using PHP(Add, Edit, delete, View records) with login option

11.To design an Employee details database using HTML Form and process using PHP(Add, Edit, delete, View records) with login option

Note: Use MySqli or PDO for database connectivity

Introduction to NoSQL Lab

Code: CSAUGPE11

Contacts: 3P

Credits: 1.5

1: Introduction, Overview, and History of NoSQL Databases – The Definition of the Four Types of NoSQL Database
2: Column-oriented NoSQL databases using Apache HBASE
3: Column-oriented NoSQL databases using Apache Cassandra
4: NoSQL Key/Value databases using MongoDB
5: NoSQL Key/Value databases using Riak
6: Graph NoSQL databases using Neo4J
7: NoSQL database development tools and programming languages
8: Course Summary and Future Trends for NoSQL databases

Books –

NoSQL for Mere Mortals by Dan Sullivan Publisher: O'Reilly
NOSQL by Ganesh Chandra Deka Publisher: CRC Press

Advanced Java Programming Lab

Code: CSAUGPE12

Contacts: 3P

Credits: 1.5

1. A) Write a Java Program to create an applet that show a simple message along with background and foreground colors?
B) Write a Java Program to create an applet that scrolls a message from left to right?

2. A) Write a Java Program to create an applet that receives an integer in one text field, and computes its factorial value and returns it in another text field, when the button named "Compute" is clicked.

B) Write a Java Program to create an applet that receives a string and returns either it Uppercase or Lowercase, Reverse of given string, and length of a given String.

3. A) Write a java program to draw Lines, ovals, filled ovals and arcs, filled arcs?
B) Write a java program to draw rectangle, filled rectangle and rounded rectangle and filled rounded rectangle with any two colors?
C) Write a java program to draw a smiley face?

4. A) Write a Java program to demonstrate the mouse event handlers.
B) Write a Java program to demonstrate the key event handlers.

5. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

6. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.

7. A) Write a Java Program to create 4 push Buttons bearing the names of 4 colors. When a button is licked that particular color is set as background color in a frame?

B. Write a Java Program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.

8. Write a Java Program a simple user form which reads the name of a user and mail id in Text fields, select gender with radio buttons, and selects some Known languages using checkboxes, and also enters an address in a text area. After filling details whenever a user press the “submit” button, then displays all the information about the user input.

9. Write a Java Program to create multiple frames, which create a Frame2 with a ‘back ‘button, such that when a user click ‘back’ button, Frame 2 is closed and we see the Frame1 only?

10. A) Write a Java Program to create an applet using Swings which contains two push buttons. If a user presses a particular button then display a message ‘selected’ button is pressed. B) Write a Java Program to create a frame using swing in which create a push button with a label and image. When the button is clicked an image is displayed in the Frame?

11. Write a Java Program to create a student table, which includes name, roll no, branch and age or DOB?

12. Write a Java Program to create a tabbed pane with two tabs. In the first tab sheet, display some push buttons with names of Branches. In second tab sheet, display checkboxes with names of subjects.

13. A) Write a java program to create a menu with several menu items by implementing JMenu. B) Write a java program to create a combo box with some name of some places. The user can select

any one name from the list and the selected country name is displayed in the frame? (Use JComboBox) C) Write a java program to select multiple places and displayed in Frame using JList?

REFERENCES:
1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.
3. An introduction to Java programming and object oriented application development, R.A. JohnsonThomson.
4. Core Servlets and Java Server pages volume1: Core Technologies By Marty Hall and Larry Brown Pearson.

React and Node JS Lab

Code: CSAUGPE13

Contacts: 3P
Credits: 1.5

List of experiments:

1. Build a responsive web application for shopping cart with registration, login, catalog and cart pages using CSS3 features, flex and grid.
2. Make the above web application responsive web application using Bootstrap framework.
3. Use JavaScript for doing client – side validation of the pages implemented in experiment1 andexperiment 2.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implementan application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.
5. Develop a java stand alone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.
6. Create an xml for the bookstore. Validate the same using both DTD and XSD.
7. Design a controller with servlet that provides the interaction with application developed inexperiment 1 and the database created in experiment 5.
8. Maintaining the transactional history of any user is very important. Explore the varioussessiontracking mechanism (Cookies, HTTP Session)
9. Create a custom server using http module and explore the other modules of Node JS like OS,path, event.
10. Develop an express web application that can interact with REST API to perform14CRUDoperations on student data. (Use Postman)
11. For the above application create authorized end points using JWT (JSON Web Token).
12. Create a react application for the student management system having registration, login,contact, about pages and implement routing to navigate through these pages.
13. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation usingchart.js

14. Create a TODO application in react with necessary components and deploy it intogithub.

REFERENCE BOOKS:
1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010
2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O Reilly "Media,2ndEdition, 2008.
3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development withMongo,Express, React, and Node, 2nd Edition

Research Methodology

Code: CSAUGPC35

Contacts: 2L
Credits: 2

Course outcomes:

CO1: Understand the fundamentals of research and its importance in computer applications.
CO2: Learn how to define and formulate research problems.
CO3: Gain proficiency in designing research studies and selecting appropriate research methodologies.
CO4: Develop skills for data collection, analysis, and interpretation.
CO5: Learn to write and present research reports effectively.

CO – PO Mapping:

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓	✓		✓			✓
CO2	✓	✓		✓			✓
CO3	✓	✓	✓	✓			✓
CO4	✓	✓	✓	✓	✓		
CO5	✓	✓		✓	✓	✓	

MODULE I (12 hours)

Research Methodology: An Introduction: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches,

Understanding Research Process: Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

Reviewing the literature: What is a literature review? Importance of Literature Review, Searching and Selecting Existing Literature, reviewing selected literature.

Module II (12 hours)

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Sampling Design: Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs.

Measurement and Scaling: Measurement in Research, Classifications of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Important Scaling Techniques.

Methods of Data Collection: Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Module III (12 hours)

Testing of Hypotheses: Hypothesis: Definition and Types, Basic Concepts Concerning Testing of Hypotheses, Procedure for Hypothesis Testing, Flow Diagram for Hypothesis Testing, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of Proportions, Hypothesis Testing for Difference between Proportions, Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance, Limitations of the Tests of Hypothesis.

Chi-square Test: Chi-square as a Test for Comparing Variance, Chi-square as a Non-parametric Test, Steps Involved in Applying Chi-square Test.

Analysis of Variance and Covariance: Analysis of Variance (ANOVA), What is ANOVA? The Basic Principle of ANOVA, ANOVA Technique.

Interpretation and Report Writing: Meaning of Interpretation in Research, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing a Research Report, Layout and Structure of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Research Ethics and Ethical Considerations.

Suggested Books and References:

1. C.R. Kothari, Gaurav Garg, “Research Methodology: Methods and Techniques”, New Age International, 4th Edition, 2018.
2. Ranjit Kumar, “Research Methodology a step-by-step guide for beginners”, SAGE Publications, 3rd Edition, 2011.
3. William M. K. Trochim, “Research Methods: the concise knowledge base”, Atomic Dog Publishing, 2005.
4. Arlene Fink, “Conducting Research Literature Reviews: From the Internet to Paper”, Sage Publications, 2005.

Semester VII

Semester-VII

Digital Image Processing

Code: CSAUGPC36
Contacts: 3L
Credits: 3

Course Objectives:

- To know about acquisition, representation and analysis of digital images.
- To learn about image enhancement in spatial domain.
- To comprehend the frequency domain and various image transformation in it.
- To learn the analytical tools and methods applied to image information for various aspects of practical applications.
- To learn image compression and segmentation techniques.

Course Outcomes:

CO 1: Knowledge of basic operators and preprocessing techniques in monochrome and gray images.
CO 2: Skills in image enhancement like linear and non-linear spatial and frequency domain filters using python libraries.
CO 3: Familiarity with concepts and operators of morphological techniques.
CO 4: Knowledge of elemental segmentation algorithms.
CO 5: Understanding about concepts and techniques for image processing projects using different methods.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√	√				
CO2	√	√	√	√	√		
CO3	√	√	√	√	√		
CO4	√	√	√	√	√		
CO5	√	√	√	√	√	√	√

Course Content:

Module 1 [8 Hrs]
Introduction: Image Formation, Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image, Color Models (RGB, YCbCr, HIS), Image File Format.

Module 2 [8Hrs]
Image Enhancement in Spatial Domain: linear and non-linear operators, Histogram Equalization, Spatial Domain Smoothing and Sharpening Filters, Correlation and Convolution.

Module 3 [8 Hrs]
Frequency Domain Image Enhancement: Fourier Transform (1-D and 2-D), Frequency Domain image, Image smoothing, Image sharpening, Correlation and Convolution, Discrete Cosine Transform.

Module 4 [6 Hrs]
Morphological Image Processing: Dilation and Erosion, Opening and Closing, Basic morphological

algorithms.

Module 5 [10 Hrs]

Image Segmentation, Feature Extraction & Object Recognition: Point Detection, Line Detection, Edge Detection**,** Thresholding, Region segmentation; Chain Codes, Polygonal Approximation, Skeletons, Component Labeling, Texture Analysis, Moments, Gray-level Co-occurrence Matrix, Template Matching, Object recognition methods.

Suggested Books and References:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing".
2. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis".
3. S. Sridhar, Digital Image Processing, Oxford University.

Natural Language Processing

Code: CSAUGPC37
Contacts: 3L
Credits: 3

Course Objectives:

- Student should understand the theoretical concepts of natural language processing in Linguistics and Formal Language theory
- Enable students to be capable to syntactic, semantic and pragmatic processing of Natural Languages
- Student should be able to analyze NLP models and algorithms using both the traditional and the statistical approaches

Course Outcome:

CO 1: Understanding fundamentals of syntax, semantics and rules in NLP and Automata Theory
CO 2: Basic Text Processing Operations
CO 3: Learning Language modeling techniques
CO 4: Understanding Information Retrieval Techniques
CO 5: Performing Text Classification using Machine Learning

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√	√				
CO2			√	√			
CO3	√	√	√	√			
CO4	√	√		√	√		
CO5	√		√				

Unit I. Regular Expressions and Automata (4 Hr.)

Introduction to NLP, Regular Expression, Finite State Automata

Unit II. Basic Text Processing (8 Hr.)

Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance; Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer

Unit III. Language Modeling (10 Hr.)

Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models; Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation

Unit IV. Text Classification (8 Hr.)

Text Classification, Naïve Bayes‟ Text Classification, Evaluation, Sentiment Analysis –Opinion Mining and Emotion Analysis, Resources and Techniques

Unit V. CFG and Lexical Semantics (8 Hr.)

Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing; Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus –WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity

Unit VI. Information Retrieval (8 Hr.)

Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback

Suggested Books:

1. Jurafsky and Martin: Speech and Language Processing, Pearson Education.
2. Manning and Schutze: Foundation of Statistical Natural Language Processing and interpretable summaries.
3. Visualization of data, performing clustering, classification using different packages of R.

Internet of Things

Code: CSAUGPC38

Contacts: 3L
Credits: 3

Course Objectives:

- Understand the concepts of IoT.
- Study IoT architecture
- Understand the technologies used to build IoT applications.

Course Outcomes:

CO 1: Understand the constraints and opportunities of wireless and mobile networks for Internet of Things.

CO 2: Analyze the IoT enabling technologies.
CO 3: Identify the use of IoT from a global context.

CO 4: Analyze, design and develop parts of an Internet of Things solution and map it toward selected IoT application.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√			√		√	
CO2	√	√	√	√			
CO3	√	√		√	√	√	√
CO4		√	√	√	√	√	√

Module 1: (14 hours)
Introduction to IoT, Sensing, Actuation, Basics of Networking.
Basics of Networking, Communication Protocols.

Module 2: (14 hours)
Sensor Networks: Machine-to-Machine Communications
Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.
Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

Module 3: (14 hours)
Fog Computing, Smart Cities and Smart Homes.
Connected Vehicles, Smart Grid, Industrial IoT.
Case Study: Agriculture, Healthcare, Activity Monitoring.

REFERENCES
1. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", Springer
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014.

Cyber Laws (Professional Elective III)

Code: CSAUGPE14

Contacts: 3L
Credits: 3

Course Objective

- Understand the legal framework governing digital transactions and cyber activities.

- Analyze and apply legal principles to cyber incidents and cases.
- Develop strategies for compliance with cyber laws and regulations in digital environments.
- Understanding about IPR and Copyright infringements

Course Outcomes:

CO1: Get an overview of the Indian Legal System
CO2: Familiar with the Information Technology Act, 2000 and its Amendments (till date)
CO3: understanding the outline of Electronic Governance
CO4: Familiar with Copyright infringements and IPR
CO5: Identify, Interpret and Evaluate Laws, Government Regulations and International Legal Systems Pertinent to E-commerce

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√				√		√
CO2		√		√		√	√
CO3	√		√		√		√
CO4					√	√	√
CO5		√			√		√

UNIT - 1: Cyber crimes and related offences and penalties: Introduction to Cybercrimes, Classification of cybercrimes, Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism etc. Provisions in Indian Laws in dealing with Cyber Crimes and its critical analysis, Information Technology Act, 2000, Penalties under IT Act, Offences under IT Act, Offences and Analysis related with Digital Signature and Electronic Signature under IT Act, Statutory Provisions, Establishment of Authorities under IT Act and their functions, powers. Cyber crimes under IPC.

UNIT - 2: Electronic Governance – Legal Recognition of Electronic Records and Electronic Evidence -Digital Signature Certificates - Securing Electronic records and secure digital signatures - Duties of Subscribers - Role of Certifying Authorities - Regulators under the IT Act -The Cyber
Regulations Appellate Tribunal - Internet Service Providers and their Liability– Powers of Police under the IT Act – Impact of the IT Act on other Laws . Authentication of electronic records (Section-3, IT ACT), legal recognition of electronic records and digital signature (Section-4 and 5, IT Act), Certifying Authorities and Controller, Offences as per IT Act (Section-65 to Section-78), Special provision in Indian Evidence Act regarding admissibility of electronic records (Section-65B of IEA, 1872).

UNIT - 3: Cr.P.C and Indian Evidence Act - Cyber crimes under the Information Technology Act,2000 - Cyber crimes under International Law - Hacking Child Pornography, Cyber Stalking, Denial of service Attack, Virus Dissemination, Software Piracy, Internet Relay Chat (IRC) Crime, Credit Card Fraud, Net Extortion, Phishing etc - Cyber Terrorism Violation of Privacy on Internet - Data Protection

and Privacy – Indian Court cases.

UNIT - 4: Intellectual Property Rights – Copyrights- Software – Copyrights vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Trademarks - Trademarks in Internet – Copyright and Trademark cases Patents - Understanding Patents - European Law on Computer related Patents, Legal process on Computer related Patents - Indian process Patents – Case Law, Domain names -registration - Domain Name Disputes-Cyber Squatting-IPR cases

UNIT - 5: E-commerce and related laws: History, Overview of developments in Information Technology and Defining E-Commerce, Understanding Ethical, Social and Political issues in ECommerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance. UNCITRAL model law in electronic commerce.

References:

1. The Information Technology Act, 2000 Bare Act with Short Notes, Universal Law
2. Publishing Co., New Delhi
3. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi
4. Farouq Ahmed, Cyber Law in India, New Era publications, New Delhi
5. S.R.Myneni: Information Technology Law(Cyber Laws), Asia Law House, Hyderabad.
6. Chris Reed, Internet Law-Text and Materials, Cambridge University Press.
7. Pawan Duggal: Cyber Law- the Indian perspective Universal Law Publishing Co., New Delhi Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.

Wireless and Sensor Networks (Professional Elective III)

Code: CSAUGPE15

Contacts: 3L

Credits: 3

COURSE OBJECTIVES

- To make students understand the basics of Wireless sensor Networks.
- To familiarize with learning of the Architecture of WSN.
- To understand the concepts of Networking and Networking in WSN.
- To study the design consideration of topology control and solution to the various problems.
- To introduce the hardware and software platforms and tool in WSN.

COURSE OUTCOMES

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

CO1: Understand challenges and technologies for wireless networks

CO2: Understand architecture and sensors

CO3: Describe the communication, energy efficiency, computing, storage and transmission

CO4: Establishing infrastructure and simulations

CO5: Explain the concept of programming the in WSN environment

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√				
CO2				√	√		
CO3		√	√				
CO4		√		√		√	
CO5			√	√			

UNIT – I: OVERVIEW OF WIRELESS SENSOR NETWORKS [9 Hours]

Single-Node Architecture - Hardware Components - Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks - Types of wireless sensor networks.

UNIT – II: ARCHITECTURES [9 Hours]

Network Architecture - Sensor Networks-Scenarios - Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments - introduction to Tiny OS and nesC - Internet to WSN Communication.

UNIT – III: NETWORKING SENSORS [10 Hours]

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy- Efficient Routing, Geographic Routing.

UNIT – IV: INFRASTRUCTURE ESTABLISHMENT [8 Hours]

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT – V: SENSOR NETWORK PLATFORMS AND TOOLS [9 Hours]

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node- level Simulators, State-centric programming.

References:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

2. Feng Zhao & Leonidas J.Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

3. Waltenegus Dargie , Christian Poellabauer, “Fundamentals of Wireless Sensor Networks - Theory and Practice”, John Wiley & Sons Publications, 2011

4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols and Applications”, John Wiley, 2007.

5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

WEB LINKS FOR REFERENCE

1. https://nptel.ac.in/courses/106/105/106105160/

2.https://onlinecourses.swayam2.ac.in/arp19_ap52/preview

3. https://cse.iitkgp.ac.in/~smisra/course/wasn.html

Blockchain Technologies (Professional Elective III)

Code: CSAUGPE16

Contacts: 3L
Credits: 3

Course Objectives:

1. To provide a concept and know the importance of blockchain technology.
2. To introduce the basic cryptographic principles that are used in blockchain technology as well as the architecture and design principles of blockchain.
3. To familiarize with major blockchain platforms like Bitcoin, Ethereum, and Hyperledger.
4. To explore various real-world applications of blockchain, including its potential uses in governance.
5. To encourage critical thinking about the advantages, disadvantages, and potential impacts of blockchain technology.

Course Outcomes:

CO1: Students will be able to explain the concept, history, and importance of blockchain technology.

CO2: Students will understand the role of cryptography in blockchain and will be able to explain concepts like public and private keys, digital signatures, and hash functions.

CO3: Students will gain knowledge about the architecture and design of blockchain, including the structure of a block, network architecture, consensus mechanisms, and smart contracts.

CO4: Students will be able to identify and describe the features of major blockchain platforms like Bitcoin, Ethereum, and Hyperledger.

CO5: Students will be able to discuss various real-world applications of blockchain and understand its potential uses in governance.

CO6: Students will be able to evaluate the advantages, disadvantages, and potential impacts of

blockchain technology.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓						
CO2		✓	✓				
CO3		✓	✓	✓			
CO4			✓	✓	✓		
CO5				✓	✓	✓	
CO6				✓	✓	✓	✓

Module 1: [9 hours]
Introduction to Blockchain
Definition and Overview of Blockchain, History and Evolution of Blockchain, Blockchain 1.0: Introduction to Bitcoin, Blockchain 2.0: Introduction to Ethereum and Smart Contracts, Importance and Necessity of Decentralization, Advantages and Disadvantages of Blockchain, Understanding Distributed Ledger Technology (DLT), Comparison of Blockchain with Traditional Technologies.

Module 2: [9 hours]
Basics of Cryptography in Blockchain
Introduction to Cryptography, Role and Importance of Cryptography in Blockchain, Understanding Symmetric and Asymmetric Cryptography, Public and Private Keys: Generation, Role and Use, Digital Signatures: Creation, Role and Use, Understanding Hash Functions and their Role in Blockchain.

Module 3: [9 hours]
Blockchain Architecture and Design
Understanding the Structure of a Block, Blockchain as a Chain of Blocks, Understanding Nodes and Network Architecture in Blockchain, Consensus Mechanisms: Proof of Work, Proof of Stake, Delegated Proof of Stake, Practical Byzantine Fault Tolerance (PBFT), and others, Design Principles of Blockchain: Transparency, Immutability, Security, Smart Contracts: Definition, Creation, Deployment, and Use Cases, Web 3.0 and its relation to Blockchain.

Module 4: [9 hours]
Blockchain Platforms and Use Cases
Introduction to Major Blockchain Platforms: Bitcoin, Ethereum, Hyperledger, etc., Comparison of Different Blockchain Platforms, Understanding Ethereum: Ether, Gas, Smart Contracts, DApps, Understanding Hyperledger: Fabric, Sawtooth, Composer, Real-world Use Cases of Blockchain: Finance, Supply Chain, Healthcare, Voting Systems, Real Estate, Energy, Media, Education, Insurance , Blockchain Applications in Governance: Registration of movable and immovable assets, Digital currency/payments, Land registration, Identity management, Supply chain traceability, Health care, Corporate registration, Taxation, Voting etc.

Textbooks:

1. "Mastering Bitcoin: Programming the Open Blockchain, Third Edition" by Andreas M. Antonopoulos and David A. Harding, Published by O'Reilly Media.
2. "Blockchain Technology" by Kumar Saurabh and Ashutosh Saxena, Published by Wiley India Pvt Ltd.

Reference Books:

1. "Mastering Blockchain - Fourth Edition" by Imran Bashir, Published by Packt Publishing.
2. "Blockchain Quick Reference" by Brenn Hill, Samanyu Chopra, Paul Valencourt, Published by Packt Publishing.

Green Computing (Professional Elective III)

Code: CSAUGPE17

Contacts: 3L

Credits: 3

Course Objectives:

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.

CO2: Enhance the skill in energy saving practices in their use of hardware.

CO3: Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.

CO4: Understand the ways to minimize equipment disposal requirements.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√				
CO2		√	√			√	
CO3	√	√	√	√	√		√
CO4		√	√	√		√	

UNIT I FUNDAMENTALS 9 hours

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT II GREEN ASSETS AND MODELING 9 hours

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT III GRID FRAMEWORK 9 hours

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

UNIT IV GREEN COMPLIANCE 9 hours

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

UNIT V CASE STUDIES 9 hours

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TEXT BOOKS:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012

Ethical Hacking (Professional Elective III)

Code: CSAUGPE18

Contacts: 3L

Credits: 3

Course Objectives

1. Understanding Ethical Hacking: To provide a comprehensive understanding of ethical hacking, its purpose, and its role in protecting information systems.
2. Security Threats and Vulnerabilities: To familiarize students with various types of security threats, vulnerabilities, and the corresponding protective measures.
3. Penetration Testing: To teach the methodologies and tools used for penetration testing and vulnerability assessment.
4. Legal and Ethical Aspects: To introduce students to the legal and ethical considerations in hacking and information security.
5. Countermeasures and Defenses: To equip students with knowledge about various defense mechanisms and countermeasures against hacking.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1: Explain the basic concepts and principles of ethical hacking and its importance in information security.

CO2: Identify and classify different types of security threats, vulnerabilities, and attacks.

CO3: Demonstrate the use of various tools and techniques for penetration testing.

CO4: Analyze legal and ethical issues related to hacking and information security.

CO5: Implement and recommend security measures to defend against hacking attempts.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√				
CO2		√	√			√	
CO3	√	√	√	√	√		√
CO4		√	√	√		√	
CO5		√	√		√		
CO6	√			√	√		√

Syllabus

Unit 1: Introduction to Ethical Hacking

- Definition and types of hacking, - Ethical vs. Unethical hacking ,- The need for ethical hacking, - Information security overview ,- Hacker motivations and mindset

Unit 2: Security Threats and Vulnerabilities

- Types of security threats: viruses, worms, Trojans, ransomware, etc. - Vulnerabilities in software and hardware - Network security threats - Case studies on security breaches

Unit 3: Penetration Testing

- Penetration testing methodologies ,- Planning and reconnaissance, - Scanning and enumeration
- Exploitation techniques, - Reporting and documentation

Unit 4: Tools for Ethical Hacking

- Overview of hacking tools (Nmap, Metasploit, Wireshark, etc.), - Hands-on with key tools
- Vulnerability scanning tools, - Network sniffing and packet analysis tools

Unit 5: Legal and Ethical Issues

- Cyber laws and regulations, - Ethical guidelines for ethical hackers ,- Privacy concerns
- Intellectual property rights, - Case studies on ethical and unethical hacking

Unit 6: Countermeasures and Defenses

- Intrusion detection systems (IDS), - Firewalls and antivirus software, - Security policies and best practices ,- Incident response and management, - Future trends in cybersecurity

Recommended Textbooks and References

- Textbook:

"The Basics of Hacking and Penetration Testing" by Patrick Engebretson

- Reference Books:
  - "Hacking: The Art of Exploitation" by Jon Erickson
  - "Ethical Hacking and Penetration Testing Guide" by Rafay Baloch
  - "CEH Certified Ethical Hacker All-in-One Exam Guide" by Matt Walker

Cyber Forensics (Professional Elective III)

Code: CSAUGPE19

Contacts: 3L

Credits: 3

Course Objectives

1. Acquire skills in digital evidence collection, preservation, and analysis for investigative purposes.
2. Understand techniques and tools used to investigate cybercrimes and digital incidents.
3. Learn to apply forensic methodologies to reconstruct digital events and support legal proceedings.

Course Outcomes:

CO1: Proficiency in conducting thorough digital investigations, including evidence acquisition and preservation.

CO2: Ability to analyze digital evidence using forensic tools and techniques to support legal proceedings.

CO3: Understanding of ethical and legal considerations in handling digital evidence and conducting forensic investigations.

CO4: Competence in documenting findings and presenting forensic evidence effectively in court or administrative proceedings.

CO5: Capability to contribute to cybersecurity incident response teams by applying forensic skills to mitigate and prevent cyber threats.

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√			√	√		√
CO2			√			√	√
CO3		√		√	√		√
CO4	√			√	√	√	√
CO5		√	√	√	√	√	√

Unit 1: Digital Investigation - Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process -Investigative Reconstruction - Modus Operandi, Motive and Technology -Digital Evidence in the courtroom.

Unit 2 : Understanding information - Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers - Extraction of forensic artifacts– understanding the dimensions of other latest storage devices – SSD Devices.

Unit 3: Computer Basics for Digital Investigators - Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer forensic specialists.

Unit 4: Standards, Guidelines and Best Practices- Handling the Digital Crime Scene - Digital Evidence Examination Guidelines –ACPO – IOCE – SWGDE -DFRWS – IACIS – HTCIA - ISO 27037

Unit 5: Types of Computer Forensics Tools and Technology -Tools and Types of Military Computer Forensics Technology -Tools and Types of Law Enforcement Computer Forensic Technology -Tools and Types of Business Computer Forensic Technology.

Reference:

1. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.

2. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw-Hill, New Delhi, 2006.
3. Robert M Slade," Software Forensics", Tata McGraw-Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
5. " Understanding Forensics in IT ", NIIT Ltd, 2005.

Cloud Computing (Professional Elective III)

Code: CSAUGPE20

Contacts: 3L

Credits: 3

Course Objectives:

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

Course Outcomes:

CO 1: Understand the fundamental principles of distributed computing.
CO 2: Understand how the distributed computing environments known as Grids can be built from lower level services.
CO 3: Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO 4: Analyze the performance of Cloud Computing.
CO 5: Understand the concept of Cloud Security.
CO 6: Learn the Concept of Cloud Infrastructure Model.

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1		√			√		
CO2		√	√		√	√	√
CO3	√	√	√				
CO4		√				√	√
CO5		√			√		
CO6		√		√	√		

Module-1: [12 Hrs]

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ 102 service providers, Cloud Reference model, Characteristics of Cloud Computing – Benefits and advantages of Cloud Computing.

Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients.

Services and Applications by Type: IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations; PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Module-2: [12 Hrs]
Concepts of Abstraction and Virtualization: Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D);

Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Mention of The Google Cloud as an example of use of load balancing; Hypervisors: Virtual machine technology and types.
Use of Google Web Services: Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service. Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

Module-3: [12 Hrs] Use of Microsoft Cloud Services: Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services.

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs.

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service, attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs.
Cloud-based Storage: Cloud storage definition – Manned and Unmanned. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.

Digital Image Processing Lab
Code: CSAUGPC39
Contacts: 3P
Credits: 1.5

1. Write a program to display frequency of each pixel occurring in a row of an image.
2. Write a program to convert color images to Gray scale Images.
3. Write a program to perform Rotation of images using different methods.
4. Write a program to perform resizing of images using different methods.

5. Write a program to implement Contrast stretching
6. Write a program to demonstrate smoothening of an image
7. Write a program to perform non-linear filtering of an image(Median)
8. Write a program to implement of Edge detection
9. Write a program to extract the three color components in the images 10. Write a program to perform bit plane slicing.

Industrial Management

Code: MBAUGHU01

Contacts: 3L
Credits: 3

Module no	Content of the module	Allotted hours
1	**Economics:** Introduction and Basic Economics Terms: Nature and Significance of Economics, Role of Economics in Engineering and Technology, Basic Economic: Utility, Saving, Investment, Equilibrium, Micro and Macro Economics, Liberalization, Privatization, Globalisation. Demand Analysis, Elasticity of Demand, Demand Forecasting, Factors of Production. Money Banking and Trade: Functions of money, supply & demand for money, money price level & inflation, black money, meaning, magnitude & consequences. Banking system in India, Functions of Commercial banks, Function of RBI, Sources of public revenue, principles of taxation, direct and indirect taxes, balance of trade and payment.	10
2	**Organizational Behavior:** Basic concepts of management, objectives, classification and hierarchy, Different Schools of Management Thought, Motivation: Concept, Different Theories (Maslow, ERG, Herzberg) Communication: Purpose, process, Barriers to effective communication, Guidelines to make communication effective. Perception: Process, Importance, Factors influencing perception, Shortcuts for judging people- Halo effect, Stereotyping, Projection.	5
3	**Human Resource Management:** Recruitment and selection, Training, Performance appraisal, Industrial Relations, Trade Union, Collective Bargaining	5
4	**Quality Management**: Concept, Dimensions for goods and services, Cost of Quality, Statistical Quality Control, Control Charts, Acceptance Sampling (single). Quality circle. Total Quality Management: Concept, benefits, Criticism. New Quality Tools: Kaizen, Six Sigma, Quality Circles.	5
5	**Productions Management:** Concept, Difference from Operations Management, Types of Production (Mass, Batch, Project), Functions of Production Management.	6

	Productivity: Concept, Different Inputs and Productivity Measures, Efficiency and Effectiveness, Measures to increase Productivity.	
6	**Marketing Management:** Basic Concepts of Marketing, Difference between Selling and Marketing, Elements of Marketing Mix- the 4 P's., STP. Marketing Research: Definition, Process, Importance, SWOT Analysis, BCG Matrix, GE Matrix.	6
7	**Financial Management:** Use of management science for the efficient administration of economic units, cost benefit analysis, present work and breakeven analysis, budgetary control.	6
8	**Materials Management:** Concept, Functions, EOQ Models, Selective Inventory Control—ABC, VED, FSN analysis	5

Suggested Books:

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1. L. C. Jhamb:"A Text Book of Industrial Engineering (Vol.1)",Publisher: Everest Publishing House.
2. Anil Bhat & Arya Kumar: "Management: Principles, Processes and Practices", Publisher: OUP.
3. Martand T. Telsang: "Industrial & Business Management", Publisher: S. Chand.
4. RajanMisra: " (2009) Engineering Economics", University Science Press, An imprint of Laxmi PubliactionsPvt. Ltd., New Delhi.

Project Dissertation - I

Code: CSAUGPC40

Contacts: 8P

Credits: 4

Summer Internship

Code: CSAUGPC41

Contacts: 0

Credits: 2

Semester VIII

Semester-VIII

Mobile Computing

Code: CSAUGPC42

Contacts: 3L

Credits: 3

Module-1: [12 Hrs]

Introduction to wireless networking and characteristics of mobile computing; Fundamentals of wireless transmission - Medium Access Control Protocols FDMA, TDMA, CDMA; Overview of Wireless LAN (IEEE 802.11); Overview of Bluetooth architecture

Module-2: [12 Hrs]

Introduction to Mobile Adhoc Network and routing protocols- DSDV, WRP, CGSR, FSR, AODV, DSR, ABR, TORA etc.; Mobile Networking protocol (Mobile IP); Mobile transport layer - Effects of mobility on Reliable Transport Protocols; Mechanisms for improving TCP performances on wireless links

Module-3: [12 Hrs]

Energy / Power Management; Wireless application Environments Wireless Application Protocol, WML, Push Architecture, Push/Pull Services; Overview of Security in mobile environments; Overview of fault tolerance in mobile computing systems.

Suggested Books:

1. C. Siva Ram Murthy and B. S. Manoj: “Ad Hoc Wireless Networks: Architectures and Protocols”, Pearson.
2. Charles Perkins: “Adhoc Networking”, Pearson Education.
3. W. Stallings:“Wireless Communication”, Pearson.

Professional Values and Ethics

Code: MBAUGHU02

Contacts: 4L
Credits: 4

Course Introduction – Need, Content and Process for Value Education

- Understanding the need, content and process for Value Education. (Students should be aware of the difference among skills, values and ethics and their respective needsin life.)
- Classification of Value Education: understanding Personal Values, Social Values,
- Moral Values & Spiritual Values; Understanding the difference between ideology and values.
- Understanding Harmony with self, Society and Nature.
- Practical: Debate and discussion on the need and nature of value education;
- Students should be encouraged to find and analyze suitable case studies to
- Understand various types of values.

Human Values and Ethics

- Meaning and nature of human values; Significance of human values in life;
- Relation between values and ethics.
- Relevance of Human values: Integrity Empathy, Loksangrah, Brahmvihara.
- Theory of Naya (Jainism), Deontology, Virtue Ethics, Utilitarianism

Integrated Personality and Well-being

- Understanding the relationship among: Self, Identity and Personality.
- Understanding Integrated Personality – with the three gunas theory of Sankhya, thefour
- Antah-karanas (inner instruments) in Yoga, and Panchkosha (five sheaths) in Upanishad.

· Approaching comprehensive understanding of well-being and its relation to Happiness.

Professional Ethics and Global Citizenship

· Nature, characteristics and scope of professional ethics; Types of Professional Ethics

· Professional Values: Trusteeship, Inclusiveness, Commitment, Sustainability, Accountability, Transparency, Impartiality.

· Values for Global Citizenship: Equality, Justice, and Human Dignity.

· Nature and need of competency based education; Types of Competencies, Core

· Competencies: communication, teamwork, planing and achieving goals, Functional

· Competencies: analytical thinking, knowledge sharing and learning, decision making, partnership building.

Recommended Books/e-resources/LMS:

1. R. R. Gaur R Sangal G P Bagaria (2009): A Foundation Course in Human Values and Professional Ethics,Excel Books.

2. D.R. Kiran (2014) Professional Ethics and Human Values, McGraw Hill Education (India).

3. Happiness and Well-Being, NIOS Module V (Health and well-being)

4. Kiran Kumar K. Salagame (2016): Meaning and Well-Being: Indian Perspectives, Journal of Constructivist Psychology

5. Dan P. McAdams, Kali Trzesniewski, Jennifer Lilgendahl, Veronica Benet-Martinez, Richard W. Robins (2021) Self and Identity in Personality Psychology, Personality Science, 2021, Vol. 2, Article e6035, https://doi.org/10.5964/ps.603

6. S. K. Kiran Kumar (2003): An Indian conception of well being, in Henry, J. (Ed) European PositivePsychology Proceedings 2002. Leicester, UK: British Psychological Society.

Data warehousing & Data Mining (Professional Elective IV)

Code: CSAUGPE21

Contacts: 3L

Credits: 3

Course Objectives:

- To identify the scope and essentiality of Data Warehousing and Mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To study spatial and web data mining.
- To develop research interest towards advances in data mining.

Course Outcomes:

CO 1: Understand Data mining and warehouse fundamentals.

CO 2: Design data warehouse with dimensional modelling and apply OLAP operations.

CO 3: To get familiar with different data mining algorithms to solve real world problems

CO 4: Compare and evaluate different data mining algorithms and techniques like classification, prediction, clustering and association rule mining.

CO 5: Describe complex data types with respect to spatial and web mining.

CO 6: Benefit the user experiences towards research, innovation and integration.

CO PSO MAPPING:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1		√			√		
CO2		√	√		√	√	√
CO3	√	√	√				
CO4		√				√	√
CO5		√			√		
CO6		√		√	√		

Module-1 [12 Hrs]

Introduction to Data Mining Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction

Association Rule Mining: Mining Association Rules in Large Databases, Association rule mining, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining Multilevel 104 Association rules from Transaction Databases and Mining MultiDimensionalAssociation rules from Relational Databases

Module-2 [12 Hrs]

Classification and Predictions: What is Classification & Prediction, Issues regarding Classification and prediction, Decisiontree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forwardNeural Network, Back propagation Algorithm, Classification methods K-nearest neighbour classifiers, Genetic Algorithm.

Dimensionality Reduction Introduction Principal Components Analysis, Singular Value

Decomposition, Multidimensional Scaling

Module-3 [12 Hrs]

Cluster Analysis: Data types in cluster analysis, Categories of clustering methods, Partitioning methods. Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting. Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

Suggested Books:

1. P. Tan, M. Steinbach and V. Kumar: "Introduction to Data Mining", Addison Wesley, 2006.
2. J. Han and M. Kamber: "Data Mining: Concepts and Techniques", 2nd Edition, Morgan Kaufmann, 2006.
3. Arun K. Pujari: "Data Mining Techniques", Universities Press.

Pattern Recognition (Professional Elective IV)

Code: CSAUGPE22

Contacts: 3L
Credits: 3

Course Objectives:

- To learn advanced concepts, issues and approaches to development of pattern recognition and machine intelligence systems.
- To know about various feature extraction techniques, and develop insights into feature fitness, feature selection and dimensionality reduction.
- To understand and apply both supervised and unsupervised approaches to analyze patterns in real-world data.
- To develop prototype pattern recognition systems that can be used to study algorithm behavior and performance against real-world multivariate data.

Course Outcomes:

CO 1: Knowledge about advanced aspects of pattern recognition and approaches to solutions.
CO 2: Ability to analyze different classification and clustering problems of practical relevance and solve using pattern recognition techniques.
CO 3: Knowledge of quantitative performance evaluation methods for pattern recognition algorithms and insights into their significance and scope of applicability.
CO 4: Comparative view of different methods in regard to real-world problems such as document analysis, image classification, etc.

CO 5: Skills for implementation of pattern classifiers, classifier combinations, and structural pattern recognizers.

CO – PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√	√			√	√
CO2	√	√	√		√	√	
CO3	√	√	√	√		√	√
CO4	√	√	√	√	√	√	
CO5	√	√	√	√	√	√	√

UNIT I (4 Hours)

Introduction and Mathematical Preliminaries: Pattern Recognition? Clustering vs. Classification; Applications; Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors; Vector Spaces, Probability Theory, Estimation Techniques.

UNIT II (8 Hours)

Bayes Decision Theory: Minimum-error-rate classification; Classifiers, Discriminant functions, Decision surfaces; Normal density and discriminant functions;Discrete features.

Parameter Estimation Methods: Maximum-Likelihood estimation:Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Sequential Pattern Recognition: Hidden Markov Models (HMMs), Discrete HMMs. Continuous HMMs.

UNIT III (4 Hours)

Dimensionality reduction: Principal component analysis - its relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods.Non negative matrix factorisation - a dictionary learning method.

UNITIV (10 Hours)

Classification: Error Probability, Error Rate, Minimum Distance Classifier, Mahalanobis Distance; K-NN Classifier, Linear Discriminant Functions and Non-Linear Decision Boundaries. Fisher's LDA,Training Set and Test Sets, Standardization and Normalization;

Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).

Artificial neural networks: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

UNIT V (6Hours)

Clustering: Different Distance Functions and Similarity Measures, Minimum Within Cluster Distance Criterion, K-Means Clustering, Single Linkage and Complete Linkage Clustering, K-Medoids, DBSCAN, Visualization of Datasets, Existence of Unique Clusters or No Clusters.

UNIT VI (4Hours)

Feature Selection: Problem Statement and Uses, Probabilistic Separability based Criterion Functions, Interclass Distance based Criterion Functions, Branch and Bound Algorithm, Sequential Forward/Backward Selection Algorithms, (l,r) Algorithm.

Feature Extraction: PCA, Kernel PCA.

Suggested Books and References:

1. K. Fukunaga, Statistical pattern Recognition, Academic Press, 2000.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. V.S. Devi, M.N. Murty, Pattern Recognition: An Introduction, Universities Press, Hyderabad.
4. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.

Deep Learning (Professional Elective IV)

Code: CSAUGPE23

Contacts: 3L
Credits: 3

Course Objective:

- To introduce major deep learning algorithms, problem setups, and their applications to solve real world problems.
- To apply deep learning algorithms for various learning tasks.
- To develop insights, considerations and evaluation of deep learning systems

Course Outcomes:

CO1. Familiarity to the idea of deep learning and application areas.
CO2. Ability to comprehend major deep learning algorithms and their variants.
CO3. Identify appropriate deep learning algorithms for various types of learning tasks.
CO4. Implement deep learning algorithms and solve real-world problems.
CO5. Knowledge and insights about evaluation of such models.

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√	√	√	√	√	√
CO2	√	√	√	√	√		
CO3	√	√	√	√	√	√	
CO4	√	√	√	√	√	√	
CO5	√	√	√	√	√	√	√

Course Content:

Module I. Introduction (4 Hours)
Norms, Matrices and Tensors, Eigen decomposition, Learning Algorithms, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Supervised & Unsupervised Learning Algorithms, Optimization, Softmax Regression, Image Classification Dataset

Module II. Deep Feedforward and Convolutional Networks (12 Hours)
MLP, Hidden Units, Back-Propagation, Differentiation Algorithms, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Early

Stopping, Bagging, Model Selection, Dropout, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Convolution Operation, Pooling, Variants of the Basic Convolution Function, Structured Outputs, Efficient Convolution Algorithms, Random or Unsupervised Features, Neuroscientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning, CNN Architectures: LeNet, AlexNet, VGG Network, GoogLeNet, ResNet, DenseNet, MobileNet

Module III. Recurrent and Recursive Nets (10 Hours)
Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Challenge of Long-Term Dependencies, Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Denoising Autoencoders

Module IV. Deep Generative Models (10 Hours)
Deep Belief Networks, Convolutional Boltzmann Machines, Boltzmann Machines for Structured or Sequential Outputs, Back Propagation through Random operations, Directed Generative Nets, Generative Stochastic Networks, Other Generation Schemes, Evaluating Generative Models, Applications in Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications

Suggested Books and References:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press.
2. P. K. Sree, P. Raju, P. Archana, R. Rao, "Fundamentals Of Deep Learning: Theory And Applications", AG Publishing House
3. M. Arif Wani, Farooq Ahmad Bhat, Saduf Afzal, Asif Iqbal Khan, "Advances in Deep Learning", Springer Nature.
4. Valentino Zocca, Gianmario Spacagna, Daniel Slater, Peter Roelants, "Python Deep Learning", Packt.

Bigdata Analytics (Professional Elective IV)

Code: CSAUGPE24

Contacts: 3L
Credits: 3

Course Objectives:

- To introduce fundamental concepts of Big Data and its use cases
- To explore tools and practices for working with big data
- Provide an overview of Apache Hadoop, HDFS concepts and interfacing
- Understand Map Reduce Jobs
- Provide hands on Hadoop Eco System
- Apply analytics on Structured, Unstructured Data and Semi-structured data
- To learn about stream computing.

Course Outcomes:

CO1. Identify Big Data and its business implications.
CO2. List the components of Hadoop and Hadoop Eco-System.
CO3. Access and process data (such as clustering and classification) on Distributed File System, and manage job execution in Hadoop environment.
CO4. Develop Big Data solutions using Hadoop eco system.
CO5. Knowledge and insights about performance analysis and evaluation of big data systems.

CO-PSO Mapping:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√		√	√	√	√
CO2	√	√			√		
CO3	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√	
CO5	√	√	√	√	√	√	√

Course Content:

Module I. Introduction (6 Hours)
Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications; Basic statistical concepts with a brief review of R and Python.

Module II. Data Analytics Recapitulation (8 Hours)
Introduction and Concepts Differentiating algorithmic and model based frameworks, Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K-NN, Regression & Classification, Supervised Learning with Regression and Classification techniques, Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, SVM, Ensemble Methods: Random Forest, Neural Networks, Deep learning, Unsupervised Learning and Challenges for Big Data Analytics Clustering, Associative Rule Mining, Challenges for big data analytics.

Module III. Data Analytics with R/Python (6 Hours)
Introduction, Classification, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with Big R.

Module IV. Big Data with Hadoop (12 Hours)
Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data Predictive Analytics, Big Data with Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics - Information Management, Integrating disparate data stores - Mapping data to the programming framework - Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop, Map Reduce. Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce jobs - Distributing data processing across server farms -Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully

distributed.

Module V. Big Data with Hive (4 Hours)
Introduction to HIVE & e-HIVEQL - Using Hive to query Hadoop files.

Suggested Books and References:

1. Walpole, Myers, Myers, Ye, "Probability & Statistics for Engineers & Scientists", Prentice Hall
2. B. Furht, F. Villanustre, "Big Data Technologies and Applications", Springer
3. J. A. Shamsi, "Big Data Systems: A 360-degree Approach", CRC Press
4. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", Wiely CIO Series, 2013.
5. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.

Computational Biology (Professional Elective IV)

Code: CSAUGPE25

Contacts: 3L
Credits: 3

Course Objectives:

- Knowledge learned without implementation (content covered in the lecture component of contact sessions).
- The basic objective is to introduce students to the basic practical bioinformatics techniques. Emphasis will be given to applying bioinformatics and biological databases to problem-solving in real research problems.

Course Outcomes:

CO 1: To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
CO 2: Describe the history, scope, and importance of Bioinformatics.
CO 3: Explain about the methods to characterize and manage the different types of Biological data.
CO 4: Classify different types of Biological Databases.
CO 5: Introduction to the basics of sequence alignment and analysis.
CO 6: Overview of biological macromolecular structures and structure prediction methods.

CO –PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√					
CO2		√	√				
CO3	√		√				
CO4			√	√			
CO5		√	√				√
CO6					√	√	

Module - I (12 hours)

Background: Why computational biology, biological information, challenges in computational biology.

Sequence Assembly: Fragment assembly, Sequencing by hybridization, Overlap-layout-consensus

Sequence Alignment: Introduction to biological sequences, DNA sequence, dynamic programming methods for global and local alignment, gap penalty functions, heuristics in alignment, BLAST, pairwise sequence alignment, multiple sequence alignment

Module - II (12 hours)

Phylogenetic Trees: Distance, parsimony, and probabilistic methods of phylogenetic tree construction, models of sequence evolution

Annotating genomes: Markov chains, high-order Markov models, Forward/Backward/Viterbi algorithms, applications to genome segmentation and annotation.

Module - III (12 hours)

Clustering approaches to biological datasets: High-throughput technologies, clustering algorithms, evaluation of clusters

Analysis of gene expression data

Modeling and analysis of biological networks: Biological networks, computational problems in network biology, Bayesian networks, module networks, parameter and structure learning, regression-based network inference, and network applications.

Machine Learning algorithms and their usage in modeling biological data

Suggested Books:

1. JIN XIONG: Essential Bioinformatics, Cambridge University Press
2. Joachim Selbig and Stefanie Hartmann: Introductory Bioinformatics: Fourth Edition
3. Jonathan Pevsner: Bioinformatics and Functional Genomics, Wiley- Blackwell
4. S.C. Rastogi, N Mendiratta, P Rastogi: Bioinformatics: Methods & Applications, PHI
5. Stanley I. Letovsky: Bioinformatics: Databases and Systems.
6. Sorin Draghici: Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical Biology & Medicine).
7. Arthur M.Lesk: Data base annotation in molecular biology, Principles and Practices.
8. Tao, Jiang, Ying Xu, Michael Q. Zang: Current topics in computational molecular biology.

Data warehousing & Data Mining Lab (Professional Elective IV Lab)

Code: CSAUGPE21

Contacts: 3P
Credits: 1.5

1. Introduction to R and Python language.
2. Data collection - data wrangling, cleaning, and sampling to get a suitable data set;
3. Data management - accessing data quickly and reliably;
4. Exploratory data analysis – generating hypotheses and building intuition, prediction or statistical learning; and communication – summarizing results through visualization, stories, and interpretable summaries.
5. Visualization of data, performing clustering, classification using different packages of R.

Pattern Recognition Lab (Professional Elective IV Lab)

Code: CSAUGPE27

Contacts: 3P
Credits: 1.5

1. Practice and assignments on Classification: Bayes Decision Rule, Error Probability, Error Rate, Minimum Distance Classifier, Mahalanobis Distance, K-NN Classifier
2. Practice and assignments on Linear Discriminant Functions and Non-Linear Decision Boundaries. Fisher's LDA, PCA, Single and Multilayer Perceptron, Training Set and Test Sets, Standardization and Normalization.
3. Exercises and assignments on Clustering: Different Distance Functions and Similarity Measures, Minimum Within Cluster Distance Criterion, K-Means Clustering, Single Linkage and Complete Linkage Clustering, K- Medoids, DBSCAN, Visualization of Datasets, Existence Of Unique Clusters or No Clusters.

Deep Learning Lab (Professional Elective IV Lab)

Code: CSAUGPE28

Contacts: 3P
Credits: 1.5

1. Build a deep neural network model start with linear regression using a single variable.
2. Build a deep neural network model start with linear regression using multiple variables.
3. Write a program to convert speech into text.
4. Write a program to convert text into speech.

5. Write a program to convert video into frames.
6. Write a program for Time-Series Forecasting with the LSTM Model.
7. Build a feed forward neural network for prediction of logic gates.
8. Write a program to implement deep learning Techniques for image segmentation.
9. Write a program for object detection using image labeling tools.
10. Write a program to predict a caption for a sample image using LSTM.
11. Write a program for character recognition using CNN.
12. Write a program to predict a caption for a sample image using CNN.
13. Write a program for character recognition using RNN and compare it with CNN.
14. Write a program to detect Dog image using YOLO Algorithm.
15. Write a program to develop Autoencoders using MNIST Handwritten Digits.
16. Write a program to develop a GAN for Generating MNIST Handwritten Digits

Bigdata Analytics Lab (Professional Elective IV Lab)

Code: CSAUGPE29

Contacts: 3P

Credits: 1.5

1. Practice and assignments on elementary operations on data, statistical measures, distributions, hypothesis testing, correlation analysis, etc.
2. Practice and assignments on relation analysis, regression, data classification and clustering techniques, association rules analysis, etc.
3. Exercise and assignments on big data processing exercises in Hadoop, Sparc or related platform(s).

Computational Biology Lab (Professional Elective IV Lab)

Code: CSAUGPE30

Contacts: 3P

Credits: 1.5

Primary goal of this course is to make acquaint the students to know different bioinformatics tools available and how to use them to perform biological data analysis.

All the programming will be performed in R or MATLAB.

The syllabus includes but not limited to-

1. Introduction to R programming language

2. Sequence Alignment

3. Phylogenetic Analysis

4. Performing Clustering in biological datasets

5. Classification analysis in biological datasets

6. Gene Expression analysis

7. Modelling and analysis of biological networks

Project Dissertation - II

Code: CSAUGPC43

Contacts: 16P

Credits: 8

Comprehensive Viva-Voce

Code: CSAUGPC44

Contacts: 0

Credits: 2