SEMESTER – I

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC401	Constitution of India	2	-	20	30	50
CSC402	Research Methodology	2	-	10	40	50
CSC403	Programming 1	3	2	20	80	100
CSC404	Introduction to Algorithms	3	2	20	80	100
CSC405	Relational Databases Management Systems	3	2	20	80	100
CSC406	Mathematical foundations and Statistical methods	3	2	20	80	100
CSC407	Modern Operating System	3	2	20	80	100
		19	10			

Practical Code

CSC461 Practical based on CSC403,

CSC462 Practical based on CSC404,

CSC463 Practical based on CSC405

CSC464 Practical based on CSC406,

CSC465 Practical based on CSC407

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University, Aurangabad

Detailed Syllabus of Courses

Course Code	CSC401	Course title	Constitution of India
Number of Credits	2	Internal / External	20/30
Total Contact Hours (Th)	2 Hrs/week	Total Contact Hours (Pr)	-

Prerequisites: There is no prerequisite for the course

Course Objectives

- Student will be able to understand the constitution of India

- Student will be able to know the constitutional and fundamental rights.

Course Outline

Unit I: History of Making of the Indian Constitution: History & Drafting committee, (composition &Working)

Unit II: Philosophy of the Indian Constitution: Preamble, Salient Features

Unit III: contours of constitutional Rights & duties: Fundamental Rights - Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and educational rights, Right To Constitutional Remedies,

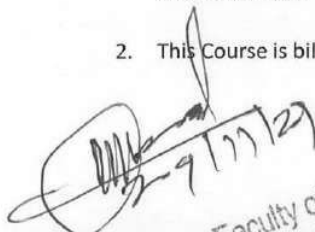Directive Principles of State Policy, Fundamental duties

Unit IV: Organs of Governance: Parliament – Composition, Qualification and disqualification, Power and function, Executive – President, Governor, Council of Ministers, Judiciary - Appointment and Transfer of Judges, Qualifications, Power and Function

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian constitution, 1st Edition, 2015.

3. M. P. Jain, Indian constitution Law, 7th Edn, Lexis Nexis, 2014.

4. D. D. Basu, Introduction to India, Lexis Nexis, 2014.

5. M. P. Jain , outline of Indian Legal and Constitutional history , Lexis Nexis , 2014.

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Note:

1. All latest volumes of above mentioned books must be preferred. The above list of Books is not an exhaustive one.

2. This Course is bilingual (English & Marathi), The Examination Will also be bilingual

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2. Research Methodology (Sem-I)

Course Code	CSC402	Course title	Research Methodology
Number of Credits	2	Internal / External	10/40
Total Contact Hours (Th)	2 Hrs/week	Total Contact Hours (Pr)	-

Prerequisite: There are no perquisites required for attending this course.

Course Objectives: following are the objectives of the course

- Foundations and principles behind engaging research are inculcated.
- Student will be able to understand various methods/mechanism involved in problem solving, reviewing and testing of hypothesis
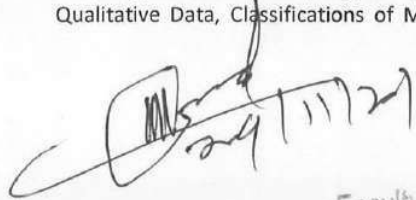
Course Outcomes:

- Critically analyze research methodologies identified in existing literature.
- Choose appropriate quantitative or qualitative method to collect data.
- Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.
- Develop a comprehensive research methodology for a research question.
- Apply the understanding of feasibility and practicality of research methodology for a proposed project.

Course Outline:

Unit 1: **Research Methodology:** Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research. **Defining the research problem:** What is a Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem

Unit 2: **Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Dependent and Independent Variables, Extraneous Variable, Control, Confounded Relationship, Research Hypothesis, Experimental and Non-Experimental Hypothesis-Testing Research, Experimental and Control Groups, Treatments, Experiment, Experimental Unit(s), Different Research Designs, Research Design in Case of Exploratory Research Studies, Research Design in Case of Descriptive and Diagnostic Research Studies, Research Design in Case of Hypothesis-Testing Research, Basic Principles of Experimental Designs.

Unit 3: **Design of Sample Surveys:** Introduction, Sample Design, Sampling and Non-Sampling Errors, Sampling Errors, Non-sampling Errors, Sample Survey Vs. Census Survey, Types of Sampling Designs, Non-probability Sampling, Probability Sampling, Complex Random Sampling Designs, **Measurement and Scaling,** Quantitative and Qualitative Data, Classifications of Measurement Scales Goodness of Measurement Scales, Sources of Error in

Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Techniques, Comparative Scaling Techniques, Non-comparative Scaling Techniques.

Unit 4: Data Collection: Introduction, Experiments and Surveys, Collection of Primary Data, Difference between Questionnaire and Schedule, Guidelines for Constructing Questionnaire/Schedule, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Unit 5: Data Preparation Process: Questionnaire Checking, Editing, Coding, Classification, Tabulation, Graphical Representation, Data Cleaning, Data Adjusting, Some Problems in Preparation Process, Missing Values and Outliers, Types of Analysis, Statistics in Research

Text Book:

1. Kothari C. R. & Garg Gaurav, (2019), Research Methodology Methods & Techniques (fourth Edition), New Age International Publishers, New Delhi.

Reference Books

1. Chawla Deepak &, Sondhi Neena, (2016), Research Methodology: Concepts and Cases (Second Edition), Vikas Publishing House, India.
2. Briony J. Oates., (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.

E-References:

1. https://www.slideshare.net/annakittystefen/researchmethodologymethodsandtechniquesbycrkothari
2. https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355.html

Course Code	CSC403	Course title	Programming 1
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: The student (s) should holds good skills on functional programming concepts, fundamental object oriented concepts. Student(s) should select wither group prior so that there are of expertise nurtured by the department by providing them training on the selected platform.

Objective: the objective of this paper is to

- Provide student an opportunity to learn and develop basic skills required in writing programs
- Student will be provided horizontal learning path where they will be able to select the technology trends such as Java Group, Microsoft Group, and Open System Group.
- Programming 1 will help to develop the foundation for programming 2 and programming 3 course ⬚ Student will be able to write programs for generating solutions.

A)Course Outline: Java Group (Core Java)

Unit 1: Java Basics: Introduction to Java, Features & Properties, Program Structure, IDE platforms available for writing & Compiling java programs, Define the scope of variable, Define structure of Java Classes, executing java program from command line, Writing classes, declaring members and behaviors of class. Variable Scope. Working with Java Data types.

Unit 2: Working with Data Types : Declare and Initialize Java variables, Primitive Data types, Number Classes, Operators – classification of operators, type of operators, arithmetic, assignment, unary Operators, equality, relational, conditional operators, bitwise, bit shift operators, expressions, statements and blocks.

Creating and using arrays, vectors. Conditional and Looping Constructs – *if, if-else, switch, for, while, dowhile, foreach* and branching statements (*break, continue*). Creating and using packages.

Unit 3:Object Oriented Principals in java - **Encapsulation** – create methods with arguments and return values, including overloaded methods, use of static keyword to members and methods, **Polymorphism** - create overloaded methods, define constructor, default and user defined constructors, constructor overloading, inner classes, nested classes, passing information to method or constructor. **Inheritance** – Hiding methods, controlling access to members of class, method overriding, use of *super* and *this* keyword to access object and constructors, defining and using abstract class, abstract methods and interfaces, *final* and *finalize*.

Unit 4: Exception Handling – defining exception, exceptions and errors, advantages of exceptions, using try-catch block, nesting of try-catch, catching and handling exception, recognizing common exception and categories (such as NullPointerException, ArithmaticException, ArrayIndexOutofBoundsExceptions, ClassCastException), **Java Files I/O** – File operations, checking file or directory, performing operations (copy, delete, rename), managing metadata, walking with file tree, finding files, watching directory for changes.

Unit 5: Working with AWT – Applet, AWT class hierarchy, applet life cycle, Event and Listeners, Event Hierarchy, Listener Hierarchy. Working with all AWT components, Graphics – drawing and using fonts.

Web Resource https://docs.oracle.com/javase/tutorial/tutorialLearningPaths.html

Books:

1. Core Java, Vol I & II, Sun Press
2. Java 2 Complete Reference by Herbert Schildt, McGraw Hill Publications
3. Java How to Program by Dietal & Dietal
4. Java Certification Guide - Symon Roberts
5. Java Programming Language – James Gosling

B)Course outline: Microsoft Group (Advanced C++)

Unit 1: Fundamentals, types, constants, and Variables, using functions, input, output streams, Operators and fundamental types, control flow – while, for, do-while, if-else, conditional expressions, selecting switch, jumps, breaks, continue and goto, Symbolic constant and Macros – Macros, Macros with parameters, working with #define directive, conditional inclusions, standard macros for character manipulations.

Unit 2: Writing Functions and Classes: Functions – Significance, defining function, return value of function, passing arguments. Writing classes – defining classes, defining methods, defining objects, using objects, pointers to objects, constructors, constructor calls, destructors, this pointer, passing objects as arguments, structs, unions, Inline functions, overloading functions, Storage classes and namespaces – static, extern, auto and register, using keyword. Abstract Classes – pure virtual methods, abstract and concrete classes, virtual assignment,

Unit 3: Arrays and Pointers : Arrays – Defining, initializing, Class array, multidimensional array, Member arrays, Arrays and Pointers, Pointer Arithmetic, Arrays as arguments, pointer version of function, read-only pointers, returning pointers, pointers and reference to abstract classes, .

Unit 4: Overloading & Dynamic memory Allocations : Generals, operator functions, using overloaded operators, global operator function, friend function, friend classes, overloading script operators, overloading shift operators for I/O, type conversion for classes, Dynamic Memory allocation – new

Operator, delete operator, dynamic storage allocation for classes, dynamic storage allocation for arrays, Inheritance – Member access, redefining members, constructing and destroying derived classes, objects of derived classes, Protected Members, Multiple Inheritance.

Unit 5: Exception handling, Templates : Traditional Error Handling, exception handling, exception handlers, throwing and catching exception, nesting exception, defining you own error classes, standard exception classes, Templates – function and class templates, defining templates, template parameter, template argument, specialization, default arguments of templates, explicit instantiation, containers – container types, sequences, declaring sequences, inserting – deleting in sequence, iterators, accessing objects, length and capacity, list operations, associative containers, sets and multisets, maps and multi-maps **Books**

1. A complete guide to programming in C++ by Ulla Kirch-Prinz, Peter Prinz
2. C++ by Dissection by Ira Pohl
3. C++ Complete Reference by Herbert Schieldt

Practical's: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

C)Course Outline : Open Group (Python)

Unit-1:

Getting started with python: Python features, python environment, configuration and installation, python interpreter, interactive mode. **Data types and Operations:** Core data types, Numbers, Strings, Lists, Dictionaries, Tuples, files and others.

Unit-2:

Statement and Syntax: python statements, assignments, expression and prints, conditional statements if, multiway branching, **Looping Controls:** while, for, loop coding techniques, **Iterations and Comprehension.** Iterators, Lists Comprehension, Range iterators, the map, zip and filter iterators, multiple vs single iterator, generators, timing iterators. **Functions:** scope, arguments, types of functions, recursion, function objects, anonymous function, Modules

Unit-3:

Exception Handling: exceptions, default exception handler, catching exception, raising exception, user defined exceptions, termination action. **Exception coding details:** try/except/else statement, try statement, try else clause, try/finally statement, unified try/except/finally statement, raise statement, assert statement. **Exception Objects:** exception hierarchy, built-in exceptions, nesting exceptions, designing exceptions.

Unit-4:

Classes and OOP: class statement, constructors and expressions, methods, Inheritance, Multiple inheritance (Is-a, Has-a), static, decorators, metaclasses, Namespaces. **Operator overloading:** indexing and slicing, memberships, attribute reference. Delegation, Extending Built-in types, User Defined Modules.

Unit-5:

Wrappers in Python: Reflections, Isinstance, Duck typing, callable, Dir, Getattr, **Regular expression:** overview, matching and searching, replacing, splitting, escaping, flags, pattern objects.

Reference Books:

* Learning Python, 5th Edition, powerful Object-Oriented Programming, By Mark Lutz, and Publisher: O'Reilly Media, Final Release Date: June 2013

E-books:

1.Python Book(http://upload.wikimedia.org/wikipedia/commons/9/91/Python_Programming.pdf)http://pythonbooks.revolunet.com/

Practical's: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

Course Code	CSC404	Course title	Introduction to Algorithms
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites

- Student should know the conventions and significance of writing algorithm, its contribution towards writing effective algorithms
- Student should be aware with algorithm testing mechanism
- Student should be able to write algorithms as well as exposed with foundation of data structures.

Course Objectives: the course objectives includes

- To offer current and comprehensive introduction to the study of computer algorithms
- Study and implement simple as well as complex data representation system
- Estimate the performance of algorithms for selection of best suitable structures.

Course Outline

Unit 1: Data structures: Elementary data structures – Stacks, Stacks and Recursion, Queues, Queue Types, , Linked List, Types of List, List Representations, Trees, Binary search Tree, Red black tree, Graphs, types of graphs, graph property & its representation using lists, Hash tables

Unit 2: Role of Algorithm in computing, Growth of function & Asymptotic notations, recurrences, recursion-tree method, random variables and randomized algorithms

Unit 3: Sorting and Order statistics: Heaps – maintaining, building heap, heap sort, priority queues, Quicksort – building quick sort, performance evaluation, analysis of quicksort, sorting in linear times – radix sort, bucket sort, lower bounds of sorting, order statistics – maximum and minimum, selection expected in linear time , selection expected in worst-case linear time.

Unit 4: Advance Design & Analysis Techniques – B-trees, Binomial heap, Fibonacci heap, Minimum spanning tree Dynamic Programming, greedy algorithms, amortized analysis,

Unit 5: Graph Algorithms: Elementary graph algorithms (BFS, DFS), Single source shortest path algorithm – Bellman Ford, Dijkstra algorithms, all pair shortest path – Shortest path & Matrix multiplication, Floyd - Warshall algorithm, Maximum Flow networks – ford Fulkerson algorithm, String matching algorithms

Reference Book:

1.Introduction to Algorithms by Thomas Corman, PHI publications

E-Books

1. Design & Analysis of computer Algorithms by Alfred Aho, John Hopcroft and Jeffery Ullman (Link)
2. Introduction to Algorithms by Thomas Corman et.al (Link)

Lab Exercise:

- Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

Course Code	CSC405	Course title	Relational Database Management System
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites: Student must have basic foundations of database management system, various databases tools and exposed with the mechanism of retrieving information from the databases.

Course Objectives

- Student will be able to understand the basic difference between databases and relational databases
- Student will be trained on using SQL queries for retrieving information from the databases. The student will pursue for comprehensive database certification program on the foundation of course
- Student will be provided mechanism for representation of database in to XML for data mining studies.

Course Contents:

Unit 1: Introduction to Databases, Relational Databases, and Data Models – Relational Data Models, Design of Relational Databases, Structured Query Language -

Unit 2: SQL : - Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language commands, working with database objects like vies, indexes, sequences, synonyms and data dictionary.

Unit 3: Data normalization: E-R Diagrams and their transformations, relational data design, normalizations – 1 NF, 2NF, 3 NF, BCNF and 4NF, Limitations of BCNF and 4NF.

Unit 4: Object Based Databases and XML: Complex Data types and Object Orientations, Structured data types and inheritance in SQL, Table Inheritance, Array and multi set types in SQL, Object Identity and reference types in SQL Implementing O-R features, Persistent Programming Language, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interface to XML, Storage of XML Data and XML Applications.

Unit 5: Data Storage and Querying: Storage and File structures, Indexing & Hashing, Query Processing and Query optimization, Transaction Management: Transaction, Concurrency control and Recovery systems **Reference Books**

1. Database System Concepts by Avi Silberschatz, Henry F Korth and S Sudarshan

Additional Reference: http://codex.cs.yale.edu/avi/db-book/db5/slide-dir/index.html

Practical's: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

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6. Mathematical Foundation and Statistical Method (Sem-1)

Course Code	CSC406	Course title	Mathematical Foundation and Statistical Method
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: Some basic foundations of Matrices and set theory is required to be known to the student before attending this course.

Course Objectives:

- To create the basic foundation of mathematical techniques largely used in Computer Science and Information technology.
- This course covers possibly required mathematics for application development.

Course Outcome:

- Students are able to perform Mathematical operations based on Sets theory and statistical analysis.
- The theoretical component of the course treats fundamental concepts, as well as some necessary topics in set theory and statistical analysis. The practical component of the course addresses the computer implementation of these methods.
- In this way, students can develop a solid foundation for employment or further study in a wide range of scientific and engineering fields that rely on set theory and statistical modelling.

Course Outline:

Unit 1: Sets- Elements of a set, methods of describing a set, types of sets, Operations on sets-- union, intersection and difference of sets, Venn diagrams, statement problems, Associative Laws, Distributive laws, DeMorgans laws, duality, partitioning of a set. Relation -Basic definition of relation and types of relations, graphs of relations, properties of relations, recurrence relations, Matrix representation of a relation.

Unit 2: Descriptive Statistics: Measures of Central Tendency, Mean, Median, Mode, Other Averages, Measures of Dispersion, Range, Mean Deviation, Standard Deviation, Measures of Skewness, Kurtosis, Measures of Relationship, Covariance, Karl Pearson's Coefficient of Correlation, Rank Correlation, Association in Case of Attributes, Other Measures, Index Numbers, Time Series.

Unit 3: Sampling and Statistical Inference: Parameter and Statistic, Sampling and Non-sampling Errors, Sampling Distribution, Sampling Distribution of Mean, Sampling Distribution of Proportion, Student's t-Distribution, Statistical Inference, Point Estimation, Interval Estimation, Sample Size and its Determination, Tests of Significance (Hypothesis Testing). **Analysis of Variance**: The ANOVA Technique, The Basic Principle of ANOVA, One Way ANOVA, Analysis of Variance Table

Unit 4: Linear Regression Analysis: Dependent and Independent Variables, Simple Linear Regression Model, Least Squares Estimation, Coefficient of Determination, Standard Error, Assumptions or Conditions Required, Testing the Hypothesis about the Slope and Correlation Coefficient (t-test for slope, f-test for ANOVA, t-test for correlation coefficient), Multiple Linear Regression Model, Least Squares Estimation

Unit 5: Discriminant Analysis: Introduction, Two Group Discriminant Analysis, Methodology, Assumptions, Predicting Group Membership, Multiple Discriminant Analysis, Methodology, **Cluster Analysis**: Introduction, Distance Measures, Clustering Algorithms, Non-hierarchical Clustering, Hierarchical Clustering.

Text Book:
1. Kenneth H Rosen (Indian Adaptation ByKamala Krithivasan), DiscreteMathematicsAnd Its ApplicationsWith Combinatorics And Graph Theory, seventh edition, McGrawHillEducation. (Unit 1)
2. C L Liu, D P Mohapatra, " Elements of Discrete Mathematics" 3rd edition, McGraw Hill, 2008. (Unit 1)
3. Kothari C. R. & Garg Gaurav, (2019), Research Methodology Methods & Techniques (fourth Edition), New Age International Publishers, New Delhi. (Unit 2-5)

Reference Books:

1. Alan Doerr, Applied Discrete Structures for Computer Science, Galgotia Publications.

2. Kolman and Busby —Discrete Mathematical structures for Computer Sciences PHI.

E-Reference:

https://web.stanford.edu/class/cs103/notes/Mathematical%20Foundations%20of%20Computing.pdf

Lab Experiment:
Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

Course Code	CSC407	Course title	Modern Operating System
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites: student must possess fundamental skills of operating systems, computer organizations and threading programming.

Course Objectives

This course introduces basic issues in operating systems. Topics include Threads, processes, concurrency, memory management, I/O Control and case studies.

- To make students able to learn different types of operating systems along with concept of file systems and CPU scheduling algorithms used in operating system.
- To provide students' knowledge of memory management and deadlock handling algorithms.
- To provide Hands-on study of Linux operating system design and kernel internals, Thread Programming.

Learning Outcomes:

Students who complete this course successfully are expected to:

- Gain extensive knowledge on principles and modules of operating systems.
- Understand key mechanisms in design of operating systems modules.
- Understand process management, concurrent processes and threads, memory management, virtual memory concepts, deadlocks.
- Compare performance of processor scheduling algorithms.
- Produce algorithmic solutions to process synchronization problems.
- Use modern operating system calls such as Linux process and synchronization libraries.
- Learn thread and multicore programming.

Course Outline

UNIT -I: Overview: Introduction, history of operating system, Memory Management: Processes in memory, Logical addresses, Partitions: static versus dynamic, free space management, external fragmentation, Segmented memory, Paged memory: concepts, internal fragmentation, page tables, Demand paging/segmentation, page replacement strategies: FIFO, LRU (and approximations), NRU, LFU/MFU, MRU, cache Management: Allocation and de-allocation techniques, coherence technique,

UNIT -II: Processes and Scheduling: Job/process concepts, Scheduling basics: CPU-I/O interleaving, (non)preemption, context switching, Scheduling algorithms: FCFS, SJF, SRTF, priority scheduling, round robin, Combined schemes Process details like creation PCB, process view, Thread and inter-process Communication,

UNIT -III: Lower Process Management:

Synchronization Primitives: Atomic instructions, locks, spinlocks, mutex semaphores, counting semaphores, and their use in solutions to Producer Consumer synchronization. **Classic Synchronization Problems**: Classic synchronization problems: Producer Consumer, Dining Philosophers, Readers and Writers, Sleeping Barber. **Monitors and Message Passing**: Monitors, condition variables, message passing, and their use in solutions to classic synchronization problems: Producer Consumer, Dining Philosophers, Readers and Writers, Sleeping Barber. **Deadlock**: Definition, Characteristics A resource Allocation graph, live-lock, Deadlock prevention, Deadlock avoidance: Banker's Algorithm, Deadlock Detection and Recovery. **Threads**: Overview of threads, thread basics and its advantages, **Multicore Programming**: Introduction, Amdhal's law, multicore programming challenges, types of parallelism, Multithreading Models, **Thread Libraries**: OpenMP:- shared memory architecture, fork-join model,

OpenMP directives ,schedule and programming constructs. **Pthread**: introduction, basic programming constructs of Pthreads, Aspect of implicit and explicit threading and threading issues.

UNIT -IV: I/O Management: I/O buffering, single and Double Buffer schemes, Disk Organization. **File Management:** File Concepts, File descriptor, Access methods: Sequential, indexed and direct, File sharing, Protection, Access rights, File System structure, Byte Sequence, Record sequence and Tree-based, Recovery and Disk formatting. **Secondary Storage Management:** File allocation methods: Contiguous Allocation and Non Contiguous allocation, Chained, Indexed allocation, free space management, **Disk Scheduling**: FCFS, SSTF, SCAN and C- SCAN, Disk Cache. Protection and Security: System performance, protection and security, policies and methods, Access Matrix.

Unit - V: Introduction : History of Linux , Features of Linux, Drawbacks of Linux , Components of Linux, Memory Management Subsystems , Linux Process and Thread Management, File Management System, Device Drivers **Linux Commands and Utilities:***cat, tail, cmp, diff, wc, sort , mkdir, cd, rmdir, pwd, cp, more, passwd, who, whoami, mv, chmod, kill, write, wall, merge , mail, pipes, filters* and *redirection utilities.* **Shell Scripts:** Creating and executing simple shell programs, variables, special characters, comparison of expressions, iteration statements, and conditional statements functions. **System Administration:** Installing Linux, Booting the system, Maintaining user accounts, File systems and Special Files, Backups and Restoration.

Text Book

- Operating Systems Concepts, 8th edition, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne; Wiley, ISBN 0-470-12872-0,2010. **Reference books**

- Operating Systems: Internals and Design Principles, 6th edition, William Stallings; Prentice Hall, ISBN-10: 0136006329, Operating Systems, 3rd edition
- Modern Operating Systems, Andrew S. Tanenbaum; Prentice Hall, ISBN-10: 0-13-600663-9, 2008, 3rd edition.
- Using OpenMP,Portable Shared Memory Parallel Programming ,Barbara Chapman, Gabriele Jost and Ruud van der Pas, MIT Press,ISBN: 9780262533027 ,2007

Web/E- References:

- http://codex.cs.yale.edu/avi/os-book/OS8/os8c/slide-dir
- http://openmp.org/wp/resources/
- http://www.compunity.org/training/tutorials/3%20Overview_OpenMP.pdf

Practical's: Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

SEMESTER - II

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC408	Technical Report Writing	1	-	10	40	50
CSC409	Programming 2	3	2	20	80	100
CSC410	Data communication	3	2	20	80	100
CSC411	Software Engineering	3	2	20	80	100
CSC421 - 430	Elective 1	3	2	20	80	100
CSC431 - 440	Elective 2	3	2	20	80	100
		16	10			

Practical Code

CSC466 Practical based on CSC409,

CSC467 Practical based on CSC410,

CSC468 Practical based on CSC411

CSC426 - 430 Practical based on CSC421-425,

CSC431-435 Practical based on CSC436-440

Detailed Course Contents

Course Code	CSC408	Course title	Technical Report Writing
Number of Credits	1	Internal / External	10/40
Total Contact Hours (Th)	1 Hrs/week	Total Contact Hours (Pr)	-

Course outcomes

- Critically analyze research methodologies identified in existing literature.
- Choose appropriate quantitative or qualitative method to collect data.
- Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.
- Develop a comprehensive research methodology for a research question.
- Apply the understanding of feasibility and practicality of research methodology for a proposed project.

Contents

Unit-I: Introduction

Meaning, Concept, nature steps types and characteristics of research, Identification & formulation of Research Problem, Hypothesis, Research Design & Research Ethics.

Review of literature Need for Reviewing Literature, what to Review and for what purpose, Literature search Procedure, Sources of Literature, Planning of Review work, Note Taking.

Unit-II: Development of research proposal

Research proposal and its elements, Formulation of research problem - criteria of sources and definition, Development of objectives and characteristics of objectives, Development hypotheses and applications.

Unit-III: Methods & tools of data collection:

Concept of sampling and other concepts related to sampling. Probability and non - probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools - like questionnaire, opinnaere, observation, interviews, scales and tests etc.

Field Work The Nature of Field Work, Selection and Training of Investigators, Sampling Frame and Sample Selection, Field Operation, Field Administration.

Unit-IV: Methods of data analysis:

Editing, Classification and Coding, Transcription, Statistical Analysis, Measures of Central Tendency Measures of Dispersion, Measures of Association / Relationship, Regression and Correlation Analysis, Hypothesis Testing (For Proportion and Means), Test of Significance.

Report writing and evaluations: Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Documentation, Data and Data Analysis reporting in a Thesis, Writing of Report, Typing of Report, Briefing. Use of Anti-plagiarism software and its importance.

Unit-V: Case study formats of research proposal writing.

References:

- BrionyJ.Oates., (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.

- Kothari C.R., (2004), Research Methodology Methods & Techniques, New Age International Publishers, New Delhi.

- Bajpai S. R., (1975), Methods of Social Survey and Research, Kitabghar, Kanpur.

- Bhattacharya D. K., (2004), Research Methodology, New Delhi, Excel Books.

- Brymann Alan and Carmer D., (1995), Qualitative data analysis for social / scientist, New York, Routledge publication.

- Best J. W. and Khan J. V., (2005), Research in Education New Delhi, Prentice Hall India. Hans Raj (19gg) Theory and practice in Social Research, Surjeet publication, Kolhapur.

- Chandera A. and Saxena T. P., (2000), Style Manual, New Delhi, Metropolitan Book Comp. Ltd.

- Krishnaswami O. R., (1988), Methodology of Research in Social Science, Himalaya pub House.

- Kothari, C. R., (2005), Quantitative Technique, New Delhi, Vikas publication House.

- Gautam N. C., (2004), Development of Research tools, New Delhi, Shree Publishers.

- Gupta, Santosh, (2005) Research Methodology and statistical Techniques, Deep and Deep publications. ⬚ Shukla J. J., (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication **E-References:**

- https://www.slideshare.net/annakittystefen/researchmethodologymethodsandtechniquesbycrkothari
- https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355.html

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Course Code	CSC409	Course title	Programming 2
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: The student (s) should holds good skills on object oriented concepts. Student(s) should select the paper from program group in continuation of last semester.

Objective: the objective of this paper is to

- Provide student an opportunity to learn and develop basic skills required in writing programs
- Student will be provided horizontal learning path where they will be able to select the technology trends such as Java Group, Microsoft Group, and Open System Group.
- Programming 1 will help to develop the foundation for programming 2 and programming 3 course ▢ Student will be able to write programs for generating solutions.

A)Course Outline : Java Group (Advance Java)

Unit 1: Collections : Collection Interfaces, Concrete Collections, The Collections Framework **Multithreading** : Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread, **Networking** - Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagrams

Unit 2: Java Database Connectivity - Merging Data from Multiple Tables: Joining, Manipulating Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures C. **Remote Method Invocation:** Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client

Unit 3: Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with HttpSession

Unit 4: Java Server Pages (JSP): Introduction, JavaServer Pages Overview, A First JavaServer Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries

Unit 5: Introduction Smart Phone Application Development: Introduction to android platform, Creating application template, adding activity, intent, services to application, using Google map API

Reference Book:

1. "Advanced Java 2 Platform HOW TO PROGRAM" by H. M.Deitel, P. J. Deitel, S. E. Santry – Prentice Hall
2. "Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional" by Antonio Goncalves – Apress publications

B)Course Outline : Microsoft Group (VB.NET)

Unit-1:

Getting Started: Microsoft Visual Studio .NET Architecture, Application in Visual Basic .NET, Basic .NET Concepts, Exploring the Development Environment, Creating a Visual Basic .NET Projects. **Using Variables**

and Arrays: Introduction to Data Types, Using Variables, Variable Scope, Converting Data Types, Creating and Using Structures, Storing Data in Arrays

Unit-2:

Working with Procedures: Creating Procedures, Using Procedures, Using Predefined Functions, **Decision Structures and Loops:** Using Conditional Expressions, Using Decision Structures, Using Conditional Loop Structures. **Validating User Input:** Restricting User Input, Validating Field Data, Validating Form Data

Unit-3:

Object-oriented Programming in Visual Basic .NET: Understanding Classes, Working with Classes, Using Shared Members, Inheritance, Polymorphism, and Namespaces **Handling Errors and Exceptions:** Types of Errors, Using the Debugger and Handling Exceptions.

Unit-4:

Working with Forms and Controls: Understanding Programming Concepts, Working with Windows Forms Working with Controls, Styling Your Code. **Enhancing the User Interface:** Creating Menus, Creating Status Bars, Creating Toolbars.

Unit-5:

Using ADO.NET: Database Concepts, Overview of ADO.NET, Overview of MySQL, Working with Database using MySQL, Create Insert, delete Table commit etc. Deploying Applications: Introduction to Deployment, Deploying a Windows-based Application

Reference Books:
1. Steven holzner, Visual basic .net programming black book, Wiley publishing.
2. Heinrich Gantenbein, Microsoft Visual Basic .NET 2003 Unleashed

E-Books:

http://www.tutorialspoint.com/mysql/mysql_tutorial.pdf

C) Course Outline : Open Group (Advanced Python)

Unit-1:

Threads: Introduction to Threads, thread organization, thread architectures, starting new thread, thread modules, Creating thread using Threading module, Synchronising threads. Controlling access to resources,

Unit-2:

GUI Design using TkInter or jython: Introduction, Layout Management, Widgets, Menus and Toolbars, Dialog boxes, Drawings, Nibbles. Database Programming using python (MySql): Python Database Interfaces and APIs, Database Connections, Creating Table, Insert Operation, Read operation, Update and Delete Operation, Performing Transactions, Commit & Rollback Operations, Handling Errors.

Unit-3:

Web Framework using Web.py: Introduction, URL Handling, GET and POST method, difference between GET and POST, Configuring server, starting server, Templating, Forms, Databashing, development

Unit-4:

Web socket programming and Web services: Introduction, About Sockets, socket module, types of sockets, Server Socket Methods, Client Socket Method, Design of simple server and client, python internet modules, HTTP web services: features of HTTP, using web services, debugging web services, setting user agents, handling redirects, handling compressed data.

Unit-5:

FLASK framework: Introduction, Exploring FLASK, Coding Conventions, Environment, configuration, organizing project, handling templates, files, handling forms, deployments.

Reference Books:

1. Python 3 Web Development Guide, Michel Anders, Beginners guide, PACKT Publishing, open source.

E-books: -

➢ Python Threading:
- o http://www.tutorialspoint.com/python/python_multithreading.htm
  ohttp://pymotw.com/2/threading/ ohttp://www.python-course.eu/threads.php ➢GUI:
- o https://wiki.python.org/moin/TkInter https://wiki.python.org/jython/LearningJython
- o http://www.tutorialspoint.com/python/python_gui_programming.htm ➢Database:
- o Python MySQL API https://wiki.python.org/moin/DatabaseInterfaces ohttp://www.tutorialspoint.com/python/python_database_access.htm

➢ Web Framework: http://webpy.org/docs/0.3/tutorial
➢ Python webSocket:
- o http://www.tutorialspoint.com/python/python_networking.htm
  - o https://docs.python.org/2/howto/sockets.html o https://docs.python.org/3.0/library/socket.html
- o http://www.diveintopython.net/http_web_services/index.html

➢ FLASK framework, ohttp://www.fullstackpython.com/flask.html

Course Code	CSC410	Course title	Data Communication
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisites

- Student should have fundamental knowledge of operating system concepts, simple data communication principal, types of data communication.

Objectives

- To provide an introduction to the range of topics in data communication and networking, protocols, and protocol suites.
- Concerned with exchange of data between directly connected devices, aspects of transmission, interfacing, link control, multiplexing.
- To Explore architectural principals and mechanism required for exchange of data among computers, workstations, servers and data processing devices.

Course Contents

Unit 1: Overview

Data communications, components, data representations, data flows. Networks: Distributed processing, network criteria, physical structures, network models, interconnection of networks. Protocol and standards: Protocol, standards, standard organization, internet standards.

Unit 2

Layered tasks: sender, receiver, carrier and hierarchy. Models: OSI, Layer in OSI Model, TCP/IP protocol suite, addressing. Data and Signals: Analog and Digital Signal, Periodic analog signal, Digital Signal, Data rate limits, performance: bandwidth, throughputs, latency (delay), bandwidth-delay, Jitter. *Digital Transmission*: digital to digital conversion - Line coding scheme, block coding, analog-to-digital conversion – pulse code modulation, delta modulation. Transmission mode – parallel and serial transmission. *Analog Transmission*: digital to analog conversion – amplitude shift keying, frequency shift keying, phase shift keying. Analog to analog conversion – Amplitude modulation, frequency modulation, phase modulation,

Unit 3

Transmission media: guided media – twisted pair, coaxial cable, fiber optic cable, un-guided media – radio waves, microwaves, infrared. Switching – circuit switched networks, datagram networks, virtual circuit networks. Error detection and correction: type of errors, redundancy, detection versus correction, forward error correction versus retransmission. Block coding, linear block coding, cyclic codes, checksum. Data link controls – framing, flow and error control, protocols – noisy channel, HDLC, point-to-point protocol. Random Access – ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access – reservation, polling, token passing. Channelization – FDMA, TDMA, CDMA

Unit 4

Network Layer : Logical addressing, IPV4 Addressing, IPV6 Addressing, Internet Protocol – transition from IPv4, IPv6, Address mapping, Error reporting and multicasting – ICMP, IGMP, ICMPv6. Delivery Forwarding and routing – delivery, forwarding, Unicast routing protocol, multicast routing protocol. Transport Layer – Process to process delivery, User datagram protocol, Congestion control and quality of service – open and closed loop congestion.

Unit 5

Application layer – Domain Name system - Name space, domain name space, Distribution of name space, DNS messages, types of records, Remote login, Electronic mail and File transfer protocol – Telnet, Email Architecture – agents, SMTP, POP and IMAP. WWW and HTTP – architecture, web documents. Security in the internet – IPSec, SSL/TLS, PGP, VPN and Firewalls.

Text Books

- Data Communication and networking by Behrouz A Forouzan, McGrawHill Publications ⯀
  Data and Computer Communications by William Stallings, LPE Publications.

Practical's:

Students are required to implement programs for data transmission (Chat) applications using socket programming, file transfer application, error detection and correction

Course Code	CSC411	Course title	Software Engineering
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisite:

- The student must possess good knowledge of writing good programs, algorithms, processes etc.
- Student must have good skills towards requirement gathering and process identifications
  - ⬚ Student must have good skills for defining process flows and process interactions

Course outcome:

- Student be able to analyze processing, draw actor interactions and optimization processes
  - ⬚ Student decides process models, ensure proper software testing, versioning of software ⬚ Student able to identify the cost of designed software products and services etc. Course contents

Unit 1:

Product Metrics: Software Quality, Framework for product metrics, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance

Unit 2:

Web Engineering: Engineering Layers, Engineering Process, Formulating web based systems, Planning, Team, Project Management, Metrics for Web Engineering and WebApps, Analysis model for WebApps, Content Model, Interaction Model, Functional model, Configuration model, Navigation analysis, WebApp Design and Testing. Cleanroom software engineering: Clean Room approach, functional specification, Cleanroom design, Cleanroom testing

Component based Development: The CBSE Process, Domain engineering, Component based development, Classifying and Retrieving

Unit 3: Components, Economics of CBSE Formal Methods: Basics, Mathematics in Software Development, mathematical preliminaries, applying mathematical notations for formal specification, Object Constraint language, Formal Specification: Formal Specification in the Software process, Sub-system interface specification, Behavioral Specification

Unit 4: Agile Development: Agile practices, extreme programming, planning, testing, refactoring, Agile design basics. Software process models and metrics for evolving technologies

Unit 5: Design patterns: introduction to design patterns, behavioral design patterns, Working with design pattern and anti-patterns

Text and Reference Book

- Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India.
- Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa.
- Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill.
- Ian Sommerville, Software Engineering, Addison-Wesley.

- Heineman, G.T., and Councill, W.T., "Component-Based Software Engineering: Putting the Pieces Together", Pearson Higher Education/Addison Wesley
- Pressman, R. S. and Lowe, D., "Web Engineering: A Practitioner's Approach", Special Indian Edition, Tata McGraw-Hill.
- Martin, R.C., Agile Software Development: Principles, Patterns, and Practics, Pearson Education Publisher.

Practical's: Student is required to complete mini-project implementing the learning objectives of the course through one mini projects.

Course Code	CSC421-430	Course title	Elective -1
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Course Prerequisite

- Student must have fundamental knowledge data representation, data structure, and open source programming skills using pythons.
- Student must have good foundations of numerical methods, discrete mathematical structures and basic statistical functions.

Course Objective:

- The course offers excellent learning opportunity for the student select research verticals ranging from Pattern analysis and machine intelligence, Data Science, Remote Sensing and Geospatial technology and sensor technology.
- Student should get expertise in the area of elective – 1
- Student will be able to apply the concepts for implementation of concepts for innovative products.

A)Course Outline : CSC 421 - Image Processing

Unit 1: Introduction, Fundamentals, Digital Image Representation, Image Types, Converting between Classes, Array Indexing.

Unit 2: Intensity Transformations and Spatial Filtering, Intensity Transformation Functions, Histogram Processing and Function Plotting, Spatial Filtering, Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering.

Unit 3: Filtering in the Frequency Domain, The 2-D Discrete Fourier Transform, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Highpass (Sharpening) Frequency Domain Filters, Selective Filtering.

Unit 4: Image Restoration and Reconstruction, A Model of the Image Degradation/Restoration Process,

Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Modeling the Degradation Function, Direct Inverse Filtering, Wiener Filtering, Constrained Least Squares (Regularized) Filtering, Iterative Nonlinear Restoration Using the LucyRichardson Algorithm, Blind Deconvolution, Image Reconstruction from Projections.

Unit 5: Geometric Transformations and Image Registration, Transforming Points, Affine Transformations, Projective Transformations, Applying Geometric Transformations to Images, Image Coordinate Systems, Image Interpolation, Image Registration.

References:

⬚ Digital Image Processing Using MATLAB®, Second Edition, Rafael C. Gonzalez, Richard E. Woods, Steven

L. Eddins, The MathWorks, Inc. ISBN number 9780982085400, Publisher: Gatesmark Publishing, 2009.

Web Link:

http://imageprocessingplace.com/DIPUM-2E/dipum2e_main_page.htm

Practical: Students are required to implement at least two practical on each unit. Similarly, students are required to complete small mini project on Image Processing and application covering all units.

B)Course Outline: CSC 422 - Data Mining

Unit-1: Introduction to Data Mining, Related technologies - Machine Learning, DBMS, OLAP, Statistics, Data Mining Goals, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications, Example: weather data.

Unit-2: Data Warehouse and OLAP, Data Warehouse and DBMS, Multidimensional data model, OLAP operations, Example: loan data set, Data preprocessing, Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization

Unit-3: Data mining knowledge representation, Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge, Visualization techniques, Experiments with Weka – visualization.

Unit-4: Attribute-oriented analysis, Attribute generalization, Attribute relevance, Class comparison, Statistical measures, Experiments with Weka - using filters and statistics

Unit-5: Data mining algorithms: Association rules, Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis, Experiments with Weka - mining association rules.

Textbook / Reference Book:
- Han, J. and Kamber, M., Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann, 2006

Other Materials:
- P. Tan, M. Steinbach and V. Kumar, Introduction to Data Mining, Addison Wesley, 2006.
- Related papers from various conferences and journals will be provided by the instructor.

Web Link:
- http://academic.csuohio.edu/fuy/EEC%20525/syllabus.html
- http://academic.csuohio.edu/fuy/ECE 525
- http://www.cs.ccsu.edu/~markov/ccsu_courses/580Syllabus.html
- http://academic.csuohio.edu/fuy/EEC%20525/syllabus.html

C)Course Outline : CSC423 Fundamentals of Satellite Remote Sensing

Unit 1 Introduction:

Definition and Objectives, Historical Background, International Space Law, Advantages of Space Based Observations, Sources of Information on Remote Sensing. Fundamentals of Remote Sensing Signals, the Electromagnetic Spectrum, Terms and Units of Measurement, Electromagnetic Radiation Laws, Atmospheric Interactions.

Unit 2 Sensors and Remote Sensing Satellites:

Types of Sensors, Resolutions of a Sensor System, Passive Sensors, Active Sensors, Satellite Remote Sensing Missions.

Unit 3 Basics for Interpretation of Remote Sensing Images:

Constraints in Using Remote Sensing Data, Types of Interpretation, Interpretation Phase.

Unit 4 Visual Interpretation:

Characteristics of Photographic Images, Feature Identification, Criteria for Visual Interpretation, Elements of Visual Analysis.

Unit 5 Remote Sensing Image Enhancements and Corrections:

Structure of Digital Image, Media and Data Organization, Digital Image Processing Equipment, Visual Enhancements, Image Corrections.

Practical:

Demonstration, Illustration and implementation of various algorithms for remotely sensed data through ENVI/ Erdas / Open-Source Technologies. : Unit I to Unit IV

Reference Material:

*   Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, and Alfredo Huete.
*   Remote sensing models & methods for image processing, third edition, Robert's A. Schowengerdt.

Online Resources:

*   http://www.nrsc.co.uk/
*   http://earthobservatory.nasa.gov/Library/RemoteSensing/
*   http://noaasis.noaa.gov/NOAASIS/ml/education.html
*   http://www.colorado.edu/geography/gcraft/notes/remote/remote_f.html
*   http://www.crisp.nus.edu.sg/~research/tutorial/rsmain.htm
*   http://www.nrcan.gc.ca/node/9309

D)Course Outline : CSC 424 - Foundation of Electronics

Unit 1

Introduction to Electronics: Signals, frequency Spectrum of Signals, Analog and Digital Signals, Linear Wave

Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator. Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors, Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes

Unit 2

Bipolar junction Transistor (BJTs): Physical Structures & Modes of Operation, Transistor Characteristics, DC analysis, Introduction to Small Signal Analysis, Transistor as an amplifier, The RC coupled amplifier, Introduction to Power Amplifiers, Transistor as switch.

Unit 3

Field Effect Transistors (FETs): Physical Structures & Modes of Operation of MOSFETs, MOSFET Characteristics, DC Analysis. Feedback Amplifiers & Oscillators: General Principles, Different types of feedback amplifier (block diagram only), Properties of Negative Feedback, Barkhausen criteria for Oscillation. Operational Amplifiers (OP-Amps): Ideal OP-AMP, Inverting Amplifier, Non-Inverting Amplifier. Adder, Subtractor, Integrator, Differentiator.

Unit 4

Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-toDecimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, Basics of Flip flops, Shift Resistors, Counters.

Unit 5

Introduction to Electronic Instruments: CRO, Multimeter, Signal Generators. Principles of Communication: Fundamentals of AM & FM, Transmitters & Receivers

TEXT BOOKS:

- Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press.
- Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications.

REFERENCE BOOKS:

- Integrated Electronics, Millman and Halkias, Mc.Graw Hill Publications.
- Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education

Course Code	CSC431-440	Course title	Elective -2
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Course Prerequisite

- Student must have fundamental knowledge required for understanding of the subject such as data representation mechanism, writing algorithms, assessment of complexities, mathematical and statistical foundations.

Course Objective:

- The course offers excellent learning opportunity for the student select research verticals ranging from Pattern analysis and machine intelligence, Data Science, Remote Sensing and Geospatial technology and sensor technology.
- Student should get expertise in the area of elective – 1
- Student will be able to apply the concepts for implementation of concepts for innovative tools and products.

A)Course Outline : CSC431 – Artificial Intelligence

Prerequisite

To be admitted you must have knowledge of Computing Science/ Cognitive Science, basic programming, Data Structures and Algorithms, Application Programming in Python

Unit 1: Introduction: What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, **Intelligent Agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit 2: Problem-solving: Solving Problems by Searching: Problem-Solving Agents, Example Problems, searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Heuristic Functions.

Unit 3: Knowledge, reasoning, and planning: Logical Agents, Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic.

Unit 4: Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches.

Unit 5: Learning:Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models.

Text Book

1. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Third Edition, Prentice Hall, ISBN0-13-080302-2

Web Links:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/syllabus/

3. http://web-ext.u-aizu.ac.jp/~qf-zhao/TEACHING/AI/AI.html

Expected learning outcomes

After having completed the course the student will be able to: - give an overview of the field of artificial intelligence, its background, history, fundamental issues, challenges and main directions - interpret and formulate knowledge representations in the form of logic expressions - explain basic concepts, methods and theories for search - account for classical planning of proactive agents - describe methods and theories for reactive agents, architectures based on subsumption, and potential fields - describe the physical structure of robots - account for different degrees of autonomy of robots - explain concepts, methods and theories of embodied cognition and situatedness - explain basic concepts, methods and theories of sensing - explain basic concepts, methods and theories of neural networks and learning - explain basic concepts, methods and theories of artificial evolution, genetic algorithms, multiple autonomous agents and swarm intelligence - demonstrate the ability to apply a given subset of the theories, methods and principles discussed during the course.

B)Course Outline : CSC432 - Machine Learning

Unit 1: Algorithmic models of learning - Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs from experience. Bayesian, maximum a posteriori, and minimum description length frameworks.

Unit 2: Parameter estimation : sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov Chains and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

Unit 3: Computational learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting. Dimensionality reduction, feature selection and visualization.

Unit 4: Data Visualization and Reinforcement learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering. Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

Unit 5: Selected applications - data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human-computer interaction, semantic web, and bioinformatics and computational biology.

Text Book

- Pattern Recognition and Machine Learning. By Bishop, C. (2006). Berlin: Springer-Verlag,
  - ⬚ Pattern Classification by Duda, R., Hart, P., and Stork, D. (2001). New York: Wiley.
- The elements of Statistical Learning - Data Mining, Inference, and Prediction. Berlin: Hastie, T., Tibshirani, R., and Friedman, J. (2001). Springer-Verlag

Online Web Reference
http://web.cs.iastate.edu/~cs573x/syllabus.html

Study Guide http://web.cs.iastate.edu/~cs573x/studyguide.html

C) Course Outline : CSC433 – GIS

Unit 1 Introduction to Geospatial Technology:

Introduction, Components of Geo-spatial Technology, Global positioning system, Coordinate system, Projection, Geo-Relational Vector Data model, Object based vector Data model, Raster Data model.

Unit 2 Data Models:

Non- Spatial Data Models, Database concepts, Spatial Data Models Data formats and structures

Unit 3 Data input, transformation, editing & Cartography:

Data input, Geometric transformation, Spatial Data Editing Attribute Data input & Management, surveying & mapping, Data display & Cartography.

Unit 4 Data Exploration & Analysis:

Data Exploration, Vector Data Analysis, Raster Data Analysis, Terrain Mapping & analysis, DEM, TIN.

Unit 5 Spatial interpolation, Geocoding & Modelling:

Spatial interpolation, Geocoding & Dynamic segmentation, Path analysis & Network Application, GIS model & modelling.

Practical:

Illustration of open source technology and demonstration of Geospatial Data through GIS for all units Implementation of the algorithms in open source technology

Reference Material:
Text Books:

- Chang, K. T. (2015). Introduction to geographic information systems. McGraw-Hill Science/Engineering/Math.
- An Introduction to Geographic Information Technology, Sujit Choudhary, Deepankar Chakrabarty, Suchandra Choudhary, IK international.
- An introduction to geographical information systems, Ian Heywood, Sarah Cornelius, Steve Carver
  Web Resources:
- http://www.gis.com/whatisgis/index.html
- http://www.gis.nic.in
- http://www.esriindia.com
- http://www.qgis.org
- http://www.exelisvis.com/ProductsServices/ENVI.aspx
- http://rst.gsfc.nasa.gov/start.html
- http://www.isro.org
- http://www.usgs.gov

D) Course Outline : CSC440 - Digital Signal Processing

Unit 1: Introduction Discrete-time signals and systems -Discrete-time signals as sequences, Properties of discrete-time systems, linear time-invariant systems, Difference equations, Frequency domain and Fourier transforms

Unit 2 Sampling continuous-time signals, Frequency domain representation of sampling, Reconstruction, Multirate signal processing, A/D and D/A conversion z-Transforms

Unit 3 Transforms Basics - Definition of the z-transform, Convergence, Inverse z-transform, Properties, Transform analysis of LTI systems, Frequency response, System functions, Analysis of magnitude and phase Structure for d-t systems

Unit 4 Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, Discrete cosine transform

Unit 5 Structures for FIR and IIR filters, Quantization and noise Filter design, IIR systems FIR windowing methods FIR optimal approximation methods, Discrete Fourier Transforms

Text Book:

Oppenheim, Schafer and Buck, Discrete-Time Signal Processing, 2nd ed., Prentice Hall, 1999

Recommended: Ingle and Proakis, Digital Signal Processing using Matlab, 2nd ed., Thomson-Engineering, 2006

DSP web sites:
- DSP tutorial with Java applets: http://www.dsptutor.freeuk.com
- Frequently asked questions: http://www.bdti.com/faq/
- DSP Guru: http://www.dspguru.com/
- http://www.redcedar.com/learndsp.htm **Sampling:**
- http://ptolemy.eecs.berkeley.edu/eecs20/week13/

Aliasing:
- http://ptolemy.eecs.berkeley.edu/eecs20/week13/aliasing.html
- http://ptolemy.eecs.berkeley.edu/eecs20/week13/moire.html
- http://cnx.rice.edu/content/m10793/latest/
- http://www.physlink.com/Education/AskExperts/ae490.cfm
- http://www.telacommunications.com/nutshell/pixelation.htm
- http://www.earlevel.com/Digital%20Audio/Aliasing.html **Z-transform:**
- http://mathworld.wolfram.com/Z-Transform.html
- http://www-ccrma.stanford.edu/~jos/filters/Z_Transform.html
- http://dspcan.homestead.com/files/idxpages.htm

FIR filters
- Introduction: http://www.dsptutor.freeuk.com/dfilt1.htm
- http://www-ccrma.stanford.edu/~jos/filters/filters.html
- DSP & speech: http://mi.eng.cam.ac.uk/~ajr/SA95/SpeechAnalysis.html
- Linear filters : http://mi.eng.cam.ac.uk/~ajr/SA95/node12.html
- http://www.filter-solutions.com/FIR.html

Analog SP
- http://cnyack.homestead.com/files/idxpages.htm