BSC

PROGRAMME

CURRICULUM AND SYLLABI

(For students admitted from the academic year 2018-21)

SRM UNIVERSITY – AP,
Amaravati

SRM UNIVERSITY – AP, AMARAVATI
CURRICULUM FRAMEOWRK

PROGRAM: BSC
(For students admitted from the academic year 2018-21)

SEMESTER I

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
DC	CSC101	Programming in C	3	0	2	5	4
DC	MAT101	Single Variable Calculus	4	0	0	4	4
FC	ENL101	Communicative English	4	0	0	4	4
FC	ENV101	Environmental Science	4	0	0	4	4
		TOTAL	**16**	**0**	**0**	**17**	**16**

SEMESTER II

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
DC	CS 121	DATA STRUCTURES AND ALGORITHMUSING C	3	0	2	5	4
DC	CS 122	Computer Organization and Architecture	3	0	0	3	3
FC	DS101	Data Science	3	0	2	5	4
FC	ENL102	Why Read a Book	4	0	0	4	4
		TOTAL	**13**	**0**	**0**	**17**	**15**

SEMESTER III

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
DC	CSC201	Operating Systems	3	0	2	5	4
DC	CSC202	Introduction to Programming with PYTHON	3	0	2	5	4
DC	CSC203	Design and Analysis of Algorithms	3	0	2	5	4
FC	HIS001	Idea of India	4	0	0	4	4
		TOTAL	**13**	**0**	**6**	**19**	**16**

SEMESTER IV

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
DC	CSC204	Database Management Systems	3	0	2	5	4
DC	CSC211	Software Engineering	3	0	2	5	4
ADC	CSCA	CSC Allied subject – 1 (D1)	4	0	0	4	4
ADC	CSCA	CSC Allied subject – 1 (D2)	4	0	0	4	4
DE		CSE Elective 1	4	0	0	4	4
DC	MAT141	Discrete Mathematics	4	0	0	4	4
DC	CSC220	Industrial Standard Coding Practice	0	0	4	4	1
		TOTAL	**25**	**0**	**4**	**30**	**25**

SEMESTER V

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
ADC	CSCA	CSC Allied subject – 2 (D1)	4	0	0	4	4
ADC	CSCA	CSC Allied subject – 2 (D2)	4	0	0	4	4
FC	PHY111	Psychology for Everyday Living	4	0	0	4	4
OE		Open Elective 1	3	0	0	3	3
DE		CSE Elective 2	4	0	0	4	4
DE		CSE Elective 3	4	0	0	4	4
DC	CSC230	Industrial Standard Coding Practice	0	0	4	4	1
		TOTAL	**19**	**0**	**4**	**27**	**24**

SEMESTER VI

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
OE		Open Elective 2	3	0	0	3	3
DE		CSE Elective 4	4	0	0	4	4
DE		CSE Elective 5	4	0	0	4	4
DE		CSE Elective 6	4	0	0	4	4
DC	PRO	Project	0	0	8	8	4
DC	CSC240	Industrial Standard Coding Practice	0	0	4	4	1
		TOTAL	**13**	**0**	**12**	**27**	**20**

Total Credits: 16 + 15 + 16 + 25 + 24 + 20 = 116 credits

List of electives:

Students who would like to pursue elective in general discipline can take any of the electives listed below provided offered in the particular semester.

Computer Science General Electives

Course Code	Course Name	L	T	P	L+T+P	C
CSE 205	**Object Oriented Programming**	4	0	0	4	4
CSE 321	**Data and Web Mining**	4	0	0	4	4
CSE 421	**Natural Language Processing**	4	0	0	4	4
CSE 314	**Image Processing**	4	0	0	4	4
CSE 422	**Human Computer Interaction**	4	0	0	4	4
CSE 323	**Advanced Computer Architecture**	4	0	0	4	4
CSE 423	**Distributed Operating Systems**	4	0	0	4	4
CSE 424	**Fog Computing**	4	0	0	4	4
CSE 425	**Parallel Algorithms**	4	0	0	4	4
CSE 426	**Web Services**	4	0	0	4	4
CSE 427	**Advanced Database Management Systems**	4	0	0	4	4
CSE 322	**Complexity Theory**	4	0	0	4	4
CSE 311	**Introduction to Machine Learning**	**4**	**0**	**0**	**4**	**4**
CSE 410	**Principle of Soft Computing**	**4**	**0**	**0**	**4**	**4**
CSE A03	**Visual Information Processing**	**4**	**0**	**0**	**4**	**4**
CSE 413	**Artificial Intelligence**	**4**	**0**	**0**	**4**	**4**
CSE B01	**Introduction to Data Science**	**4**	**0**	**0**	**4**	**4**
CSE 412	**Big Data**	**4**	**0**	**0**	**4**	**4**
CSE 311	**Machine Learning**	**4**	**0**	**0**	**4**	**4**
CSE B04	**Inference and Representation**	**4**	**0**	**0**	**4**	**4**
CSE 315	**Network Security**	**4**	**0**	**0**	**4**	**4**
CSE 411	**Mobile and Wireless Security**	**4**	**0**	**0**	**4**	**4**
CSE C03	**Internet Protocols and Networking**	**4**	**0**	**0**	**4**	**4**
CSE 312	**Introduction to Cryptography**	**4**	**0**	**0**	**4**	**4**
CSE 423	**Distributed Systems**	**4**	**0**	**0**	**4**	**4**
CSE D02	**Introduction to Cloud and Fog Computing**	**4**	**0**	**0**	**4**	**4**
CSE D03	**Data Storage and Management in Cloud**	**4**	**0**	**0**	**4**	**4**
CSE D04	**Application Development in Cloud**	**4**	**0**	**0**	**4**	**4**
CSE I01	**Internet of Things: Sensing and Actuator Devices**	**4**	**0**	**0**	**4**	**4**
CSE I02	**IoT Architecture and Protocols**	**4**	**0**	**0**	**4**	**4**
CSE I03	**Privacy and Security in IoT**	**4**	**0**	**0**	**4**	**4**
CSE I04	**Data Management in IoT**	**4**	**0**	**0**	**4**	**4**

List of allied subjects:

Students who would like to pursue two allied subject from two different department other than CSE and this allied subjects listed below provided offered in the particular semester.

Other department allied subjects:

Department Mathematics

Course Code	Course Name	L	T	P	L+T+P	C
MAT 142	Single variable calculus	4	0	0	4-0-0	4
MAT 124	Multivariable Calculus	4	0	0	4-0-0	4
MAT 302	Numerical Analysis	4	0	0	4-0-0	4
MAT 303	Number Theory	4	0	0	4-0-0	4

Department Physics

Course Code	Course Name	L	T	P	L+T+P	C
PHY 204	Physics I	3	0	2	3-0-2	4
PHY 214	Physics II	3	0	2	3-0-2	4

Department Management

Course Code	Course Name	L	T	P	L+T+P	C
BBA 304 S	Human Resource Management	4	0	0	4-0-0	4
BBA H 02 S	Leadership & Team Management	4	0	0	4-0-0	4

Department Economics

Course Code	Course Name	L	T	P	L+T+P	C
ECO 251	INDIAN ECONOMY	4	0	0	4-0-0	4
ECO 121	Principles of Microeconomics	4	0	0	4-0-0	4

Department History

Course Code	Course Name	L	T	P	L+T+P	C
HIS 102 A	Human Civilizations	4	0	0	4-0-0	4
HIS 301	European Social Formations	4	0	0	4-0-0	4

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SYLLABUS
SEMESTER -I

Code	Title	Core/ Elective	L-T-P	Credits
CSC101	Programming in C	C	3-0-2	4

Semester-I

Course Objective

To make the student learn fundamentals of programming and a programming language. To enable the students to learn problem solving techniques. To teach the student to write programs in C and to solve the problems.

Course Outcomes

After Completion of this course the student would be able to

• Read, understand and trace the execution of programs written in C language.

• Write the C code for a given algorithm.

• Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.

• Write programs that perform operations using derived data types.

UNIT I

Introduction to programming languages: Evolution of programming languages, structured programming, the compilation process, object code, source code, executable code, operating systems, interpreters, linkers, loaders, fundamentals of algorithms, flow charts.

UNIT II

C Language Fundamentals: Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements, Expressions, Operators, Precedence of operators, Input-output Assignments, Control structures, Decision making and Branching, Decision making & looping.

UNIT III

C Functions: User defined and standard functions, Formal and Actual arguments, Functions category, function prototypes, parameter passing, Call-by-value, Call-by-reference, Recursion, and Storage Classes.

Arrays and Strings

One dimensional Array, Multidimensional Array declaration and their applications, String Manipulation

UNIT IV

Pointers: Pointer variable and its importance, Pointer Arithmetic, passing parameters by reference, pointer to pointer, linked list, pointers to functions, dynamic memory allocation.

Structures, Unions: Declaration of structures, declaration of unions, pointer to structure & unions.

UNIT V

File Handling: Console input output functions, Disk input output functions, Data files.

Additional Features in C

Command line arguments, bit wise operators, enumerated data types, type casting, macros, the C pre-processor, more about library functions.

TEXT BOOKS:

1. Programming with C, Byron Gottfried, Mcgrawhill Education, Fourteenth reprint, 2016
2. Programming in ANSI C, E.Balagurusamy, Tata McGraw-Hill..

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Programming in C. P. Dey and M Ghosh , Second Edition, Oxford University Press.

SEMESTER-I

Code	Title	Core/ Elective	L-T-P	Credits
MAT 101	Single Variable Calculus	C	4-0-0	4

Course Objectives

Calculus is a foundational course it plays an important role in the understanding of science, engineering, economics, and computer science, among other disciplines. This introductory calculus course covers differentiation and integration of functions of one variable, with applications.

Course Outcomes

After completing this course, students should demonstrate competency in the following skills:

1 Use both the limit definition and rules of differentiation to differentiate functions.
2 Sketch the graph of a function using asymptotes, critical points, the derivative te increasing/decreasing functions, and concavity.
3 Apply differentiation to solve applied max/min problems.
4 Evaluate integrals both by using Riemann sums and by using the Fundamental Theor Calculus
5 Apply integration to compute arc lengths, volumes of revolution and surface areas of revolu
6 Determine convergence/divergence of improper integrals and evaluate convergent im integrals.
7 Determine the convergence/divergence of an infinite series and find the Taylor series exp of a function near a point.

UNIT I: DERIVATIVES AND DIFFERENTIATION

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

UNIT II: APPROXIMATIONS AND THEIR APPLICATIONS

Measurement error of linear approximation, Quadratic approximation, Newton's method, 1 and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

UNIT III: THE INTEGRAL AND INTEGRATION THEORY

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

UNIT IV: DIFFERENT INTEGRATION TECHNIQUES AND APPLICATION OF CALCULUS

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

UNIT V: POLAR CO-ORDINATE SYSTEMS AND INFINITE SERIES

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

Books of Study:

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India , 2005.
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis,
3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.

References:

1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.

SEMESTER – I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ENL100	Communicative English	C	4	0	0	4

Course Objectives

1. Introduction to Communication is designed to help students with the principles and practice of effective oral communication skills.
2. This course will help students through formal and informal speaking activities.
3. Strategies for effective communication in social, business, and professional situations are examined.
4. In all speaking assignments, articulation and the best way to frame ideas will be covered.
5. The course objectives are for students to demonstrate an understanding of the value of rhetorical speaking skills; Paraphrase and cite research correctly; write and speak well-developed, clear, unified ideas with appropriate college-level language choices; Demonstrate a growing understanding of critical thinking in speaking, writing and in public situations.

Course Outcomes

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

1 Apply composition skills to craft clear and well-structured communications
2 Composition: Communicate with clear and precise style
3 Connotation: Understand and use connotations, tone, and style.
4 Organization: Effectively organize communications.
5 Professionalism: follow established guidelines to present yourself and your work pr professionally.
6 Thesis: Formulate a well-defined thesis
7 Use evidence and argument along with knowledge of your audience to present informatio engaging and persuasive way.
8 Audience: Tailor oral and written work by considering the situation and perspective of the receiving it.
9 Confidence: Present views and work with an appropriate level of confidence.
10 Critique: Actively and critically engage with texts and other forms of communication.
11 Evidence based: Identify and appropriately structure the information needed to supp argument effectively.
12 Medium: describe, analyze, and utilize distinctive characteristics of communicativ expressive mediums at the level of form and structure.

UNIT I: Rhetoric and Public Speaking

Rhetoric, Critical Thinking and Public Speaking; Thinking Outside the Box;How to Deliver a Speech; Fundamentals of Persuasion.

UNIT II: Nonverbal Communication

Nonverbal Communication; Spatial distance, eye contact and appearances; How nonverbal communication is more important than words.

UNIT III: Communication and the Media

Persuasion and the media; Radio, television, film, social media and the internet; How the media sells ideas, images, products and lifestyles; Fundamentals of Informative/Scientific Speeches and Research; The Heart of the Speech – Powerful Narratives; The Power of Narrative.

UNIT IV: Small Group Communication

Small group communication; Leadership, conflict and persuasion in groups; The importance of small groups in business; Dr. A. Fisher's Fundamentals of Small Groups; Group Problem Solving; Learning to say no – don't say you will when you won't, don't say yes and then don't do it, be true to your word.

UNIT V: Persuasion, Ideology and Media Bias.

Advanced Rhetoric; Ideology; Persuasive Fallacies; How to Construct a Persuasive Speech; How to Present Scientific Data in a Speech; Unmasking Media Bias and Ideology; Full circle – the dangers of rhetoric and ideology.

List of practical experiments:

1 Writing Journal 1
2 Essay on Images
3 Oral Presentation
4 Writing Journal 2
5 Essay on Community

Books of Study

1. Communication: Principles for a Lifetime. Beebe, Beebe and Ivy, 6th Edition, Pearson Publishing.

Books of Reference

1. Qualitative Communication Research Methods (2011) Bryan C. Taylor and Thomas R. Lindlof. Sage Publications, New Delhi, India, 3rd Edition.
2. The Fundamentals of Small Group Communication (2008) Scott A. Myers and Carolyn M. Anderson. Sage Publications, New Delhi, India.

Semester – I

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ENV100	Environmental Science	E	4	0	0	4

Course Objectives:

1. To provide an integrated, quantitative and interdisciplinary approach to the study of environmental systems.

Course Outcomes:

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

1 How to find sustainable solutions to various environmental issues?
2 Understand the ecological systems and different material cycles
3 Recognize the role of policies/laws on environmental conservation

UNIT I

Environment: Structure and functions in an ecosystem; Ecological succession; Ecological pyramids; Biosphere; Ecological systems and cycles – carbon cycle, water cycle, phosphorous cycle, nitrogen cycle, oxygen cycle; Broad nature of chemical composition of plants and animals; Natural resources covering renewable and non-renewable resources, forests, water, minerals, food and land; Energy sources, growing energy demands

UNIT II

Environmental Pollution: Structure and composition of atmosphere. Pollution – air, water, soil, thermal and radiation. Effects – acid rain, ozone layer depletion and greenhouse gas emission. Control measures. Determination of water and air quality – BOD, COD, TDS, AQI.

Unit III

Environmental Biotechnology: Environmental microbiology; Biomarkers; Biosensors; Biofuels; Biotransformation; Bioremediation, factors affecting bioremediation; Molecular Ecology

Unit IV

Biodiversity and its conservation: Biodiversity hotspots; Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; threats to biodiversity – habitat loss, poaching of wildlife; in-situ and ex-situ conservation.

Unit V

Environmental protection and sustainability: Problems related to urban living, waste management, climate change, sustainable solutions, environmental regulation, and environmental protection acts in India and environmental ethics

List of lab experiments

1. Water parameters- Test for alkalinity and turbidity of water
2. Determination of dissolved oxygen in water
3. Test for total suspended solids and total dissolved solids
4. Determination of total hardness of water by EDTA titration
5. Determination of biological oxygen demand of wastewater
6. Determination of chemical oxygen demand of wastewater
7. Test for iron content in river water

Textbook:

1) Basu. M, Xavier. S. "Fundamentals of Environmental Studies", 1st edition, Cambridge University Press, 2016.
2) Raina. M. Maier, Ian L. Pepper, Charles. P. "Environmental Microbiology" 2nd edition, Academic Press, 2004.

Reference book:

1. Danial. D. C. "Environmental Science", 8th edition, Jones and Barlett Publishers, MA, 2010.

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SYLLABUS
SEMESTER – II

Semester – II

Sub.Code	Sub. Name	Core/ El	L-T-P	Credits
CS 121	DATA STRUCTURES AND ALGORITHMUSING C	C	3-0-2	4

Course Objectives:

1. The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures.
2. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

Course Outcomes:

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

1. Select appropriate data structure to specific problem. Implement specific operations like searching, sorting, insertion, traversing and deletion on various data structure problems.
2. Solve both linear and nonlinear data structure problems.
3. Design and analyse the complexity of the given problems.

UNIT I

Introduction to C programming, identifiers, basic data types, constants, variables, keywords, operators: arithmetic, relational and logical, increment and decrement operators, conditional operator, assignment operators, Instruction: type declaration, Input-output, conditional, loop control, Arrays, Functions, pointers, dynamic memory management functions Derived types-structures- declaration, definition and initialization of structures, accessing member of structure, arrays of structures, structures and functions, pointers to structures, self-referential structures.

UNIT II

Introduction to data structures, Stacks and Queues: representation and application, implementation of stack and queue operations using C. Linked lists: Single linked lists, implementation of link list and various operation using C, Double linked list, circular list.

UNIT III

Trees: Tree terminology, Binary tree, Binary search tree, infix to post fix conversion, postfix expression evaluation. General tree, AVL Tree, Complete Binary Tree representation.

UNIT IV

Graphs: Graph terminology, Representation of graphs, Path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Shortest path algorithms.

UNIT V

Sorting and Searching techniques – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort, Heap sort, Radix sort, implementation using C. Linear and binary search methods, implementation using C, Hashing techniques and hash functions.

Learning Outcomes:

After the successful completion of the course the student will be able to:

1. Design correct programs to solve problems.
2. Choose efficient data structures and apply them to solve problems.
3. Analyze the efficiency of programs based on time complexity.
4. Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs.

List of Practical Experiments:

Books of Study:

1. "Data structure using C", Aaron M. Tenenbaum, Y Langsam and Mosche J. Augenstein, Pearson publication.

2. Data structures and Algorithm Analysis in C , Mark Allen Weiss, Pearson publications, Second Edition Programming in C. P. Dey and M Ghosh ,SecondEdition,Oxford UniversityPress.
3. Programming with C, Byron Gottfried, McGraw hill Education, Fourteenth reprint,2016

References:

1. "Fundamentals of data structure in C" Horowitz, Sahani & Anderson Freed, Computer Science Press.
2. "Fundamental of Data Structures", (Schaums Series) Tata-McGraw-Hill.
3. G. A. V. Pai: "Data Structures & Algorithms; Concepts, Techniques & Algorithms" Tata McGraw Hill.
4. Gilberg and Forouzan, "Data Structure- A Pseudo code approach with C" by Thomson publication

Semester – II

Subject Code	Subject Name	Core/ Elective	L-T-P	Credits
CS 122	Computer Organization and Architecture	C	3-1-0	4

Course Objective:

Students will be able to understand the organization of computer, performance evaluation of memory and CPU. They will also learn to design various components of computer system.

Course outcomes:

1 Understand basic structure and operation of digital computer
2 Understand the design of ALU to perform arithmetic and logic operations on fixed poi floating numbers
3 Understand different types instructions and addressing modes supported in the instruction CPU
4 Understand the design of control unit
5 Understand instruction and arithmetic pipeline processing
6 Understand different types of memory devices used in the computer system including memories
7 Understand different types of I/O communication techniques and standard I/O interfaces

UNIT I Basic Structure of Computers
Functional units – Bus structures – Instruction set architecture: Instruction formats - addressing modes - Architecture and instruction set of 8086/8088 microprocessor- Assembly language programming - Fixed point and floating point operations – ALU design

UNIT II Basic Processing Unit
Fundamental concepts – Execution of a complete instruction – Hardwired control – Micro programmed control design- Nano programming- CISC-RISC- principles

UNIT III Pipeline Processing
Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Pipeline optimization techniques: Compiler techniques for improving performance

UNIT IV Memory System
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 I/O Organization

Accessing I/O devices – Programmed Input/output - Interrupts – Direct Memory Access– Interface circuits – Standard I/O Interfaces - I/ O devices and Processors.

List of practical experiments:

1. Assembly language programming
2. Development of simulator for a hypothetical CPU
3. Development of Assembler for hypothetical CPU
4. Design of Hardwired control unit for a hypothetical CPU
5. Design of Microprogrammed control unit for a hypothetical CPU

Books of Study:

1. Computer System Architecture, Morris Mano, Third edition, Pearson publications
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, V Edition, McGraw-Hill publications
3. "Computer Organization and Architecture – Designing for Performance", William Stallings, Ninth edition, Pearson publications

References:

1. Structured Computer Organization, Andrew S. Tanenbaum
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface"
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill
4. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education

Semester-II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
DS 101	Introduction to Data Science	E	3	0	2	4

Course Objective: This course will introduce the rapidly growing field of data science and equip the students with some of its basic principles and tools as well as its general mind-set.
Course Description: Data Science is the study of the generalizable extraction of knowledge from data. Being a data scientist requires an integrated skill set spanning mathematics, statistics, machine learning, databases and other branches of computer science. Students will learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used. As prerequisites, students are expected to have basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics.

Course outcome: At the conclusion of the course, students should be able to:

- Describe what Data Science is and the skill sets needed to be a data scientist.
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
- Use R to carry out basic statistical modeling and analysis.
- Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
- Describe the Data Science Process and how its components interact.
- Use APIs and other tools to scrap the Web and collect data.
- Apply EDA and the Data Science process in a case study.
- Apply basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN),k-means, Naive Bayes) for predictive modeling. Explain why Linear Regression and k-NN are poor choices for Filtering Spam. Explain why Naive Bayes is a better alternative.
- Identify common approaches used for Feature Generation. Identify basic Feature Selection algorithms (Filters, Wrappers, Decision Trees, Random Forests) and use in applications.
- Identify and explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine (dimensionality reduction, singular value decomposition, principal component analysis). Build their own recommendation system using existing components.
- Create effective visualization of given data (to communicate or persuade).
- Work effectively (and synergically) in teams on data science projects.
- Reason around ethical and privacy issues in data science conduct and apply ethical practices.

Unit – I

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

Unit – II:

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

Unit - III.

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

Unit – IV.

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

Unit V.

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

Books and Reference:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
6. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science. (Note: this is a book currently being written by the three authors. The authors have made the first

draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
7. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
8. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.

Semester-II

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
ENL102	Why Read a Book	CORE	4	0	0	4

Course description: **Why Read A Book**

This course is designed to help students appreciate the importance of books and why reading books is a valuable part of culture and society. This course will increase students reading comprehension, writing and verbal English skills. A group of ancient, modern and postmodern books, poems and articles will be utilized to help students increase their appreciation and analysis of various forms of writing. This course will investigate books as a primal form of cultural and narrative transmission. The readings will include a variety of cross-cultural and multidisciplinary topics.

Course objectives:

Demonstrate an understanding of the value of books and other forms of writing for use professionally, scientifically, socially, and culturally; Paraphrase and cite authors correctly; write and speak well-developed, clear, unified ideas with appropriate college-level language choices; Demonstrate a growing understanding of the art of writing, rhetoric and critical thinking in speaking, writing and in public situations; Complete the assigned readings and maintain good class notes; Course work will include writing assignments, three exams, three quizzes, a review paper, group work, and . . . (?)

Attendance Policy: Because work completed in the classroom cannot be duplicated outside the classroom, you must plan to attend class regularly. If you are unable to attend class, contact a student from the class to find out what was covered during class. If you stop attending and do not withdraw, you will receive an "F" as your final grade in this course. Professors assign Incomplete "I" grades only when genuine emergencies prevent a student from completing the class and/or from withdrawing before the deadline and only when the student is earning a satisfactory ("C" or better) grade.

Classroom Regulations: Open and mutually respectful communication of varied opinions, beliefs, and perspectives during classroom discussion encourages the free exchange of ideas that is essential to higher learning. Students should show respect and courtesy to fellow classmates and participate earnestly in class activities. Entering class late, talking during lectures, sleeping during class, making fun of or attacking another's viewpoint, and/or behaving in a disruptive or combative manner are all considered inappropriate and may be grounds for dismissal from class. No use of electronic devices is allowed in class unless specifically related to class work. No classes are to be recorded or photographed with any device without permission of the professor. School policy does not permit students to bring friends or family members to class. Cell phone calls or texting during class are not allowed and will cause you to lose 15 points from your final grade if two written warnings are issued to the student.

Late Work: Papers and presentations will be penalized five points for each class late. After 72 hours, I will not accept late papers or projects and you will receive a "0."

Academic Integrity Policy:

Purpose

As an academic learning community of scholarship, we at SRM University are committed to the principles of truth and honesty in academic endeavours. As faculty and students in this academic community, we are called to present our academic work as an honest reflection of our abilities; we do not need to defraud members of the community by presenting others' work as our own.

Therefore, academic dishonesty is handled with serious consequences for two fundamental reasons: it is stealing – taking something that is not ours; it is also lying – pretending to be something it is not. In an academic community, such preteens is not only unnecessary it is also harmful to the individual and community as a whole. Cheating can have no place on our campus. Only with a truthful presentation of our knowledge can there be an honest evaluation of our abilities. The following acts are those that we consider to be dishonest:

Plagiarism:

Plagiarism is taking the words, ideas, opinions, theories, or thoughts of another person as your own. Students who present others' words or ideas as their own without fair attribution - documentation, citing sources - are guilty of plagiarizing. This includes, but is not limited to, a direct quotation of all or part of another's words without appropriately identifying the source. It is also wrong to have included a source within a citation page without having carefully cited the source within the text of the document.

CLASSROOM ETIQUETTE: Open and mutually respectful communication of varied opinions, beliefs, and perspectives during classroom discussion encourages the free exchange of ideas that is essential to higher learning. Students should show respect and courtesy to fellow classmates and participate earnestly in class activities. Entering class late, talking during lectures, sleeping during class, making fun of or attacking another's viewpoint, and/or behaving in a disruptive or combative manner are all considered inappropriate and may be grounds for dismissal from class. No use of electronic devices is allowed in class. No classes are to be recorded or photographed with any device without permission of the professor. Cell phones and computers must be off and out of sight during class. **Any use of cell phones or computers during class needs the professor's permission or will result in you losing points from your class grade**.

Unit I

Introduction, review syllabus:

Why Read A Book – the foundational important of reading books and how it increases critical thinking skills. The important of narrative and narrative theory

Unit II

Group Work, The Word – Historical and Narrative Understanding, The Word – Cultural and Spiritual Understanding, The Word – Memoir and Prophetic Understanding

Unit III

Introduction to the India's Partition and Partition Literature, The Female Perspective on the Partition, Reading the Partition – Historical, Critical and Postmodern Perspectives

Unit IV

The Power of Narrative – Part 1, The Power of Narrative – Part 2, Reading Comprehension. Analyzing a Text, Reading the Novel, Fundamentals Reading A Book - Overview.

SRM UNIVERSITY AP
Andhra Pradesh

SYLLABUS
SEMESTER – III

SUBJECT CODE	SUBJECT TITLE	CORE/ELECTIVE	CREDITS			
			L	T	P	C
CSC 201	Operating Systems	C	3	0	2	4

Semester-III

Course Objective:

This course will introduce the core concepts of operating systems, such as processes, threads, scheduling, synchronization, memory management, file systems, input and output device management and protection.

Course Outcomes:

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

1. Understand the structure and functions of operating systems
2. Learn about processes and process scheduling in detail.
3. Understand the basics of process synchronization techniques
4. Learn about different memory management techniques
5. Understand various input, output and file management functions of operating system

UNIT I

INTRODUCTION TO OPERATING SYSTEM:

What is an Operating System? Simple Batch Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems.

Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls

UNIT II

PROCESS MANAGEMENT: Process Concept, Process Scheduling, Operation on Processes, Interprocess communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

UNIT III

PROCESS COORDINATION: Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

UNIT IV

MEMORY MANAGEMENT: Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

UNIT V

STORAGE MANAGEMENT:

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation.

Learning Outcomes:

After the course the students are expected to be able to (this is what the exams will test):

1. Master functions, structures and history of operating systems
2. Master understanding of design issues associated with operating systems
3. Master various process management concepts including scheduling, synchronization,
4. deadlocks
5. Be familiar with multithreading
6. Master concepts of memory management including virtual memory
7. Master system resources sharing among the users
8. Master issues related to file system interface and implementation, disk management
9. Be familiar with protection and security mechanisms
10. Be familiar with various types of operating systems including Unix

Text Books:

1. Operating Systems Concepts, Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Wiley, 2012.

Books of reference:

1. Modern Operating Systems, Andrew S Tanenbaum and Herbert Bos, Fourth Edition, Pearson Education, 2014.
2. Operating Systems: Principles and Practice, Thomas Anderson and Michael Dahlin, Recursive Books, 2014.

Semester-III

UBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSC 102	Introduction to Programming with PYTHON	Elective	3	0	2	4

Course Objectives:
1. The course is designed to get the basic knowledge in Python.
2. Decision making and functions in python.
3. Helps to learn File handling and basics OOPs concept in python.

Course Outcomes:
1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
2. Express different Decision Making statements and Functions.
3. Interpret object oriented programming in Python
4. Understand and summarize different File handling operations

Unit I

Introduction to Python: Knowledge, Machines, Languages, Types, Variables Operators and Branching – **Core elements of programs**: Bindings, Strings, Input/output, IDEs, Control Flow, Iteration, Guess and Check – **Simple Programs**: Approximate Solutions, Bisection Search, Floats and Fractions, Newton-Raphson.

Unit II

Functions: Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric's, Files

Unit III

Tuples and Lists: Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – **Dictionaries**: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables –**Debugging**: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– **Assertions and Exceptions,** Assertions, Exceptions, Exception Examples

Unit IV

Classes and Inheritance: Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – **An Extended Example**: Building a Class, Visualizing the Hierarchy, adding another Class, Using Inherited Methods, Grade book Example, Generators

Unit V

Computational Complexity: Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – **Searching and Sorting Algorithms**: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort.

Books of Study

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

Books of References

1. Python Programming using problem solving Approach by ReemaThareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173
2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016)
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1st edition (6th February 2009)

Semester – III

Subject Code	Subject Name	Core/ Elective	L-T-P	Credits
CSC 203	Design and Analysis of Algorithms	C	3-0-2	4

Course Objectives:

1. To develop proficiency in problem analysis and choosing appropriate solving technique.
2. To be able to analyse Time and Space Complexity of algorithms and recurrence relations.
3. To develop basics for advanced applications in Computer Science.
4. Use and implement the fundamental abstract data types – specifically including Hash tables, Binary search trees, and Graphs – necessary to solve algorithmic problems efficiently.
5. Demonstrate the following abilities: to evaluate algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in simple programming contexts.
6. To understand the nature of NP problems and get familiar with Approximation algorithms.

Course Outcomes:

By the end of this course, the students will be able

1. To develop proficiency in problem analysis and choosing appropriate solving technique
2. To be able to analyse Time and Space Complexity of algorithms and recurrence relations
3. To develop basics for advanced applications in Computer Science
4. and Graphs – necessary to solve algorithmic problems efficiently
2. to provide justification for that selection, and to implement the algorithm in simple programming

6. Demonstrate the following abilities: to evaluate algorithms, to select from a range of possible options,
7.Demonstrate the following abilities: to evaluate algorithms, to select from a range of possible options,
contexts

emonstrate the following abilities: to evaluate algorithms, to select from a range of possible

Unit I

Algorithmic thinking & motivation with examples, Reinforcing the concepts of Data Structures with examples. Complexity analysis of algorithms: big O, omega, and theta notation, Analysis of Sorting and Searching, Hash table, Recursive and non-recursive algorithms.

Unit II

General Problem Solving (GPS) techniques:

Divide and conquer: Merge sort, Quicksort, BST, Master method for Complexity analysis

Greedy method: Fractional Knapsack, Minimum spanning trees (Prim's & Kruskal's), Shortest paths: Dijkstra's algorithm, Huffman coding

Dynamic Programming: 0/1 Knapsack, All-to-all shortest paths

UNIT III

BFS & DFS, Backtracking: 8-Queens problem, Knights tour, Travelling Salesman Problem (TSP), Branch-and-bound: 16-puzzle problem, TSSP, Randomized algorithms: Playing Cards, Scheduling algorithms.

UNIT IV

Pattern matching algorithms: Brute-force, Boyer Moore, KMP algorithms.

Algorithm analysis: Probabilistic Analysis, Amortized analysis, Competitive analysis.

Unit V

Non-polynomial complexity: examples and analysis, Vertex cover, Set cover, TSP, 3-SAT

Approximation Algorithms: Vertex cover, TSP, Set cover

List of Practical Experiments:

1. Implement two different programs with different time complexities to find the sum= $1+X+X^2+X^3+\ldots+X^n$
2. Implement two different programs with different time complexities to find theprefix averages. The i-th prefix average of an array X is average of the first $(i + 1)$ elements of X:

$$A[i]= (X[0] + X[1] + \ldots + X[i])/(i+1)$$

3. Selection sort, Insertion sort, Heap sort
4. OOP: Let us play cards
5. Creating singly linked list +Hash table as a set of linked lists
6. Towers of Hanoi (Recursive& Non-recursive)

Divide-and –Conquer

7. Binary search
8. Merge sort
9. Quick sort
10. K^{th} largest number

Greedy method

11. Fractional Knapsack
12. Minimum-spanning tree
13. One-to all shortest paths

Dynamic Programming

14. All-to-all shortest paths
15. 0/1 knapsack
16. Transitive closure/ Reachability problem

Backtarcking& Branch and bound

17. Eight queens' problem
18. 16-puzzle
19. TSP approximation algorithm
20. Vertex cover: Approximate algorithm

Pattern Matching

21. Pattern Matching: Brute force
22. Pattern Matching: Boyer Moore
23. Pattern Matching: KMP

Books of Study:
Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", 3rd Edition, MIT press, 2009
Parag Dave & Himanshu Dave, "Design and Analysis of Algorithms", Pearson Education, 2008

Reference books:
Michel Goodrich, Roberto Tamassia, "Algorithm design-foundation, analysis & internet examples", Wiley., 2006A V Aho, J E Hopcroft, J D Ullman, "Design and Analysis of Algorithms", Addison-Wesley Publishing. Algorithm Design, by J. Kleinberg and E. Tardos, Addison-Wesley, 2005 Algorithms, by S. Dasgupta, C. Papadimitriou, and U. Vazirani, McGraw-Hill, 2006

Semester III

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
HIS 100	IDEA OF INDIA	Core	4	0	0	4

COURSE DESCRIPTION:

The Indian subcontinent (today the home of Bangladesh, Pakistan, India, Sri Lanka, Nepal and Bhutan) is often imagined as an exceptional and timeless space and place: home to a dizzying array of ancient philosophical traditions; spiritual and physical inquiry; long-standing traditions in art, literature, architecture, aesthetics, music and dance. Birthplace of two of the world's great traditions (Hinduism and Buddhism) and home to the largest Muslim population in the world, the subcontinent has seen dozens of dynasties ruling peoples who speak scores of languages and worship thousands of gods on the one hand, and only One on the other.

In this 2-part course, we will take a rapid jaunt through this dizzying land in its past and present, and through all its manifold contradictions, from the sublime heights of abstract philosophy to the brutal realities of postcolonial poverty; from the masterpieces of art and architecture to the teeming cities of the subcontinent; from the epics represented in its traditions of dance and music to its contemporary obsession with Bollywood and cricket, that Indian game accidentally birthed in Britain. Our inquiries will be driven by a single question, that is of relevance to every inhabitant of the south Asian subcontinent and many others beyond it: how do we reconcile the land's millennia of civilization with the tortured fractures of its present?

REQUIRED READING:

Thomas Trautmann: India: Brief History of a Civilization

Upinder Singh: A History of Ancient and Early Medieval India

Michael H. Fisher: The Mughal Empire

All readings will be scanned and put online.

This class will proceed thematically, rather than straightforwardly chronologically.

THEMES

INTRODUCTION

INDIA, HINDIA, ARYAVARTA OR BHARAT?

Readings: Ranabir Chakravarthi – Early India, Ch:1

THEME ONE: OF BONES, BRICKS AND CITIES

The Subcontinent's Prehistoric Past (The Paleolithic to Neolithic Transition)

The Harappan Civilization

Readings:

Upinder Singh – A History of Ancient and Early Medieval India, Ch: 2-4

Shereen Ratnagar – Understanding Harappa

THEME TWO: STORIES OF GOD AND MEN (AND WOMEN?)

The Vedic Civilization

Tribes and wars -

Women, men and the Household

Varna in the Vedas

Readings:

Thomas Trautmann – India: Brief History of a Civilization, Ch: 1-3

Romila Thapar – Early India, Ch:3

THEME THREE: WAR AND GOVERNANCE

Of Kings and Chiefs - The Rise of the Janapadas

Mauryas and the Arthasastra

Megaliths and the Early Historic Period 'Sangam era') in South India

The Tamil Epics – Cilapadikaram and Manimekalai

Readings:

Romila Thapar – Early India, Ch: 4, Cultural Pasts – Essay titled The Mauryas Revisited

Trautmann – Arthasastra, Ch: 6

Noboru Karashima : A Concise History of South India – Ch.3-5

THEME FOUR: CASTE

Puranic Hinduism

Varna and Jati

Temples, Shrines and Deities

Readings:

Doniger, Hinduism, Ch. 9

Ambedkar, Annihilation of Caste

Kancha Ilaiah, "Why I am not a Hindu?"

Uma Chakravarti – Gendering Caste

Upinder Singh – A History of Ancient and Early Medieval India, Ch: 8

THEME FIVE: CENTRALIZING AUTHORITY?

Asoka – the renunciant as king/ the renunciant king

The Gupta Empire

South India -- Cholas and Shaivism

The Pallavas, Rashtrakutas and the Satavahanas

Readings:

Romila Thapar – Ancient Indian Social History, Ch:2-3

Upinder Singh: A History of Ancient and Early Medieval India, Ch: 7& 9

Noboru Karashima: A Concise History of South India

Vijaya Ramaswamy – Walking Naked, Conclusion

THEME SIX: COMING OF ISLAM

Islam in the subcontinent (Read Trautmann, Ch. 9)

Two millennia of religious pluralism: Jews and Christians in India

Readings:

Thomas Trautmann ,Ch: 9

Excerpts from The Periplus of the Erythrean Sea and Jornada

Excerpt – Raghava Warrier, The Jewish Copper Plate of Bhaskara Ravi

THEME SEVEN: PRECURSORS TO THE MUGHALS

State and Society in the Sultanate Period

Baburnamah (selections)

The Vijayanagara Empire

Readings:

Satish Candra -Medieval India,Vol.1,Seleced Chapters

Irfan Habib – People Hisory of India,Vol.14

THEME EIGHT: MUGHALS

Mughal Institutions & Expansion

Readings:

Harbans Mukhia - The Mughals of India

Ruby Lal – Empress /Domesticity and Power in Early Modern World

THEME NINE: THE BRITISH IN INDIA

Life and Times under the Raj

The Making of the Nation

Readings:

Sumit Sarkar – Modern India,Ch.3-5

Arun Bandhopadhyay – Plassey to Partition, Selected Chapters

Irfan Habib –People's History of India,Vol.25

Partha Chaterjee – 'Anderson's Utopia'

THEME TEN: SPORT

March 25: Cricket, Caste, and Colonialism

March 25: Cricket, Caste, and Colonialism

Readings:

Appadurai Ch. 5: Decolonization of Cricket

SYLLABUS
SEMESTER – IV

Semester – IV

SUBJECT CODE	SUBJECT TITLE	CORE/ELECTIVE	CREDITS			
			L	T	P	C
CSC 204	Database Management System	C	3	0	2	4

Course Objectives:

- Explain the advantages of DBMS, its Characteristics, Concepts and ER-Model.
- Demonstrate Relational Database using SQL detailing the role of Relational Algebra and Relational Calculus
- Illustrate the normal forms of Relational DBMS detailing the process of normalization.
- Examine Transaction Management, Concurrency Control and data recovery.
- Create and Access Database for various Applications

Course Outcomes:

By the end of this course, a student will be able to

- Understand the advantages of DBMS over traditional file system and its Characteristics
- Design ER-models to represent simple database applications.
- Design relational database and execute various queries using SQL
- Understand various anomalies that can occur in databases and overcome those with the help of normal forms.
- Understand the concepts of Transaction Management, Concurrency Control and data recovery.

UNIT I: Introduction to DBMS and Relational model:
File Processing System, Advantages of DBMS over File Processing System, Database System Applications
DBMS Architecture: The three schema architecture, Data Independence: Logical and Physical Data Models: Hierarchical, network and relation models, Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values. Database constraints (Domain, Key constraints, integrity constraints) and their importance.

UNIT II : Query processing: Relational Algebra
Relational Calculus, Introduction to SQL: Database Objects- DDL Schema definitions. DML-Insert, select, update, delete. Views, exercise on SQL queries. Transaction support in SQL : Aggregate Functions, Null Values, Views, Complex Integrity Constraints in SQL, Assertions, Triggers .

UNIT III : Conceptual model and database design :

Entity Relationship model Entity types, Entity Sets, Attributes, and Keys Relationships, Relationship types and constraints, Weak Entity types
Enhanced ER (EER) Modeling : Super/Sub Classes Specialization and Generalization. Constraints and characteristics of Specialization and Generalization
Example EER Schema
Basics of Normalization, Normal Forms: First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), BCNF, 4NF

UNIT IV: Transaction Processing, Concurrency Control and Recovery:

Introduction of transaction processing, advantages and disadvantages of transaction processing system , Serializability and Recoverability of transaction, Concurrency Control, Lock based Protocols, Timestamp Based Protocols – Validation based Protocols - Multiple Granularity Locking, Recovery techniques

UNIT V: Overview of Storage and Indexing
Data on External Storage, File Organization and Indexing - Clustered Indexes, Primary and Secondary Indexes.
Indexed Sequential Access Methods(ISAM) B+ Trees: Tree Structure, Search, Insert, Delete.
Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendible vs. Linear Hashing.

List of Practical experiments:

1	Implementation of data storage and indexing methods using files
2	DML queries on single table
3	Queries on Joining tables and Aggregate Functions
4	Nested queries, Queries on creation of views, indexes, sequences and access privileges
5	Triggers, Assertions
6	SQL Transactions
7	PL/SQL, Stored Procedures
6	Design and Develop Applications

Text Books:
1. Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems. 3rd ed. McGraw-Hill, 2002. ISBN: 9780072465631.

Books of reference:
1. Heller stein, Joseph, and Michael Stonebreaker. Readings in Database Systems (The RedBook). 4th ed. MIT Press, 2005. ISBN:9780262693141.

Semester-IV

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 211 (ES)	Software Engineering	C	3	0	2	4

Course Objectives:

1. Comprehend software development life cycle and prepare SRS document.
2. Explain software design and development techniques
3. Demonstrate various software modelling techniques.
4. Illustrate various software testing techniques and their applicability.
5. Detail the project management life cycle.

Course Outcomes:

By the end of the course, a student will be able to

1. Understand the principles of software engineering, life cycle models.
2. Specify, analyze and document software requirements through a productive working relationship with project stakeholders
3. Understand the importance of software modeling and learn various modeling languages
4. Understand the necessity of software testing and design various test cases for a software.
5. Adapt Software maintenance and understand the concepts of project management.

UNIT I: SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II: REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III: SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV: TESTING AND MAINTENANCE

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model- Reengineering process model-Reverse and Forward Engineering.

UNIT V: PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

List of experiments:

1. Develop requirements specification for a given problem
2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem
3. To perform the function oriented diagram : DFD and Structured chart
4. To perform the user's view analysis : Use case diagram
5. To draw the structural view diagram : Class diagram, object diagram
6. To draw the behavioral view diagram : Sequence diagram, Collaboration diagram
7. To draw the behavioral view diagram : State-chart diagram, Activity diagram
8. To draw the implementation view diagram: Component diagram
9. To draw the environmental view diagram : Deployment diagram
10. To perform various testing using the testing tool unit testing, integration testing

Text Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", 7th International Edition, McGraw-Hill Education (Asia), Singapore

Sub. Code	Sub. Name	Core/Elective	L-T-P	Credits
MAT 141	Discrete Mathematics	C	4-0-0	4

References:

1. Ian Somerville, "Software Engineering", 8th Edition, 2007, Pearson Education Inc., New Delhi.

Fundamentals of Software Engineering – Rajib Mall. (PHI-3rd Edition), 2009

Semester-IV

Course Objectives:

The objective is to equip the students with the mathematical definitions, proofs and applicable methods

Course Outcomes:

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

1 To appreciate the basic principles of Boolean algebra, Logic, Set theory
2 Permutations and combinations and Graph Theory.
3 Be able to construct simple mathematical proofs
4 Be able to understand logical arguments and logical constructs. Have a understanding of sets, functions, and relations
5 Acquire ability to describe computer programs in a formal mathematical manner

UNIT I

The Foundations Logic and Proofs (10hours)

Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

UNIT II

Set Theory (5 hours)

Laws of set theory, Set Operations, Functions, Sequences and Summations, Matrices.

UNIT III

Elementary Number Theory, Induction and Recursion (10hours)

Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruence's; Mathematical Induction, Strong Induction and Well- Ordering, Recursive Definitions and Structural Induction.

UNIT IV

Counting Principles (9hours)

The Basics of Counting, the Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations.

UNIT V

Introduction to Graph theory (11hours)

Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems.

Books of Study:

1. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh edition, Tata McGraw-Hill,2012.
2. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

References:

1. S.Lipschutz and M.L.Lipson, Schaum'sOutlineof Theory andProblems of Discrete Mathematics,3rd Ed., Tata McGraw-Hill, 1999.

2. M. K. Venkataraman, N. Sridharan, and N. Chandrasekaran, Discrete Mathematics, NationalPublishing Company, 2003.

Sub. Code	Sub. Name	Core/Elective	L-T-P	Credits
PHY 111	Psychology for Everyday Living	FC	4-0-0	4

Semester-V

Course Objectives:

1. To understand the fundamental psychological processes in everyday living

2. To comprehend important theories in psychology

3. To apply knowledge of psychology in improving self and others

Course Outcomes:

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

1. Explain fundamental psychological processes in everyday living
2. Explicate important theories in psychology in the areas of sensation, perception, personality and learning
3. Make personal professional and social applications of psychology

Unit I: Nature of Psychology

Definition, nature and goals of psychology, Schools of psychology; Basic and applied areas of psychology, Art vs. science; Nature vs. nurture

Unit II: Sensation and Perception

Definitions; Absolute and difference threshold, Signal detection theory, Perception: Understanding perception, Gestalt laws of organization, common illusions, Perceptual constancy - depth perception, size perception, perception of movement

Unit III: Intelligence

Definitions and nature of intelligence, Theories of intelligence- multiple intelligences and triarchic theory, Emotional and social intelligence, Measuring IQ, EQ and SQ

Unit IV: Personality and Learning

Definition; Approaches to personality – trait and type, Psychoanalytical and humanistic theory, Tests of personality – MBTI and NEO-PI, Classical and operant conditioning, Identity; Self-concept, self-esteem and self-efficacy

Unit V: Stress and Coping

Nature, sources of stress and its reactions, Factors influencing stress, Coping with and managing stress - cognitive and behavioral techniques

TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

Baron, R. A. (2001). *Psychology.* New Delhi: Pearson Education India.

Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014).*Atkinson &Hilgard's Introduction to Psychology.*16th Ed. United Kingdom: Cengage Learning.

Morgan, C. T., King, R. A., & Schopler, J. (2004). *Introduction to Psychology*. New Delhi: Tata McGraw Hill.

Sub.Code	Sub. Name	Core/ Elective	L-T-P	Credits
CSC 205	Object Oriented Programming using C++	C	3-0-3	5

Computer Science General Electives
Semester – II

Course Description:

This course trains the student to be proficient in C++ syntax and programming. This course introduces to students the concepts of Object Oriented Programming (OOP) and provides in-depth coverage of OOP principles and techniques using C++. Topics include classes, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features

Course Objectives:

1. To gain familiarity and usage of C++ syntax
2. To understand the principles of object oriented programming
3. To introduce the object oriented approach in problem solving.
4. To gain proficiency in all aspects OOP environment which includes, Data abstraction, Polymorphism and Inheritance with suitable applications

Course outcomes:

On completion of the course, the students will be able to

1. Acquire a full Object Oriented perspective for analysis, design and implementing real world problems.

2. Employ the object oriented concepts/ techniques, tools in modelling software systems

3. Design, implement and evaluate a system / computer based system process, component or program to meet desired needs

4. Design and conduct experiments as well as analyze and interpret data.

5. Apply design and development principles in the construction of software systems. (CS)

UNIT I: INTRODUCTION

What is object oriented programming? Comparison of procedural programming and Object-Oriented Programming - Characteristics of Object-Oriented Languages - C++ Programming Basics: Basic Program Construction - Data Types, Variables, Constants - Type Conversion, Operators, Library Functions - Loops and Decisions, Structures - Functions : Simple Functions,

Passing arguments, Returning values, Reference Arguments. - Recursion, Inline Functions, Default Arguments - Storage Classes - Arrays , Strings, Addresses and pointers. Dynamic Memory management. Linked lists in C++.

UNIT II: FEATURES OF OBJECT ORIENTED PROGRAMMING

Introduction to Classes and Objects, Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces). Constructors and its types, Destructors - Passing Objects as Function arguments and Returning Objects from Functions –

UNIT III: POLYMORPHISM

Concept of Polymorphism, Function overloading, examples and advantages of function overloading, pitfalls of function overloading, Operator overloading, Overloading unary operations. Overloading binary operators, pitfalls of operators overloading.

UNIT IV: INHERITANCE

Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation: Classes within classes, inheritance and program

UNIT V: TEMPLATES AND EXCEPTIONS

Templates: Function templates, Class templates - Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions - Re-throwing Exception and Exception Specifications, Custom Exception. Standard Template Library: Containers, Algorithms, iterators - potential problems with STL - Algorithms: find(), count(), sort(),search(),merge() - Function Objects: for_each() , transform() - Sequence Containers: vectors, Lists, Dequeues - Iterators and specialized

Text Books:

1. Lischner, Ray. STL Pocket Reference: Containers, Iterators, and Algorithms. " O'Reilly Media, Inc.", 2003.
2. Lippman, Stanley B. C++ Primer. Pearson Education India, 2005.
3. Schildt, Herbert. C++: The complete reference. McGraw-Hill/Osborne, 2003.
4. Bruce, Eckel. "Thinking in C++ Vol 1." (2010).
5. Lafore, Robert. Object-oriented programming in C++. Pearson Education, 1997.

List of Practical Experiments:

1. Write a Program to design a class having static member function named showcount() which has the property of displaying the number of objects created of the class.
2. Write a Program using class to process Shopping List for a Departmental Store. The list include details such as the Code No and Price of each item and perform the operations like Adding, Deleting Items to the list and Printing the Total value of a Order.

3. Write a Program which creates & uses array of object of a class.(for eg. implementing the list of Managers of a Company having details such as Name, Age, etc..).
4. Write a Program to find Maximum out of Two Numbers using friend function.Note: Here one number is a member of one class and the other number is member of some other class.
5. Write a Program to swap private data members of classes named as class_1, class_2 using friend function.
6. Write a Program to design a class complex to represent complex numbers. The complex class should use an external function (use it as a friend function) to add two complex numbers. The function should return an object of type complex representing the sum of two complex numbers.
7. Write a Program using copy constructor to copy data of an object to another object.
8. Write a Program to allocate memory dynamically for an object of a given class using class's constructor.
9. Write a Program to design a class to represent a matrix. The class should have the functionality to insert and retrieve the elements of the matrix
10. Write a program to design a class representing complex numbers and having the functionality of performing addition & multiplication of two complex numbers using operator overloading.
11. Write a Program to overload operators like *, <<, >> using friend function. The following overloaded operators should work for a class vector.
12. Write a program for developing a matrix class which can handle integer matrices of different dimensions. Also overload the operator for addition, multiplication & comparison ofmatrices.
13. Write a program to overload new/delete operators in a class.
14. Write a program in C++ to highlight the difference between overloaded assignment operator and copy construct.
15. Write a Program illustrating how the constructors are implemented and the order in which they are called when the classes are inherited. Use three classes named alpha, beta, gamma such that alpha, beta are base class and gamma is derived class inheriting alpha & beta
16. Write a Program to design a student class representing student roll no. and a test class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sports and test class should be inherited by a result class having the functionality to add the scores and display the final result for a student.
17. Write a program to maintain the records of person with details (Name and Age) and find the eldest among them. The program must use this pointer to return the result.
18. Write a Program to illustrate the use of pointers to objects which are related by inheritance.
19. Write a program illustrating the use of virtual functions in class.
20. Write a program to design a class representing the information regarding digital library (books, tape: book & tape should be separate classes having the base class as media). The class should have the functionality for adding new item, issuing, deposit etc. the program should use the runtime polymorphism.
21. Write a program to show conversion from string to int and vice-versa.
22. Write a program showing data conversion between objects of different classes.
23. Write a program showing data conversion between objects of different classes and conversion routine should reside in destination class.
24. Write a program to copy the contents of one file to another.
25. Write a program to implement the exception handling.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 321	Data and Web Mining	E	4	0	0	4

COURSE OBJECTIVES:

The course objectives of the data and web mining course are given below:

- Discuss the need for data mining
- Discuss various stages in data mining process
- Learn about various data mining algorithms and its application domain
- Learn about web mining in detail and the need for web mining
- Discuss the use of web mining in social network analysis.

LEARNING OUT COMES:

- Identify appropriate data mining algorithms to solve the given real-world problems
- Compare and evaluate different data mining techniques like classification, prediction, clustering, association rule mining, etc.
- Know the basics of web crawling, web-page pre-processing and page ranking which will help to design and develop strategies in this domain
- Acquire data from social networking websites and they can analyze it for efficient recommendation purpose.

Unit I:

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics. Data Mining Goals .Stages of the Data Mining Process, Data Mining Techniques , Knowledge Representation Methods. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations

Unit II:

Data preprocessing: Data cleaning .Data transformation , Data reduction. Data mining knowledge representation, Attribute-oriented analysis. Data mining algorithms: Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently , Correlation analysis.

Unit III:

Data mining algorithms: Classification, Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm ,Decision trees , Covering rules. Data mining algorithms: Prediction , The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models.

Unit IV:

Web crawling: Basic crawler algorithm, Focused crawlers, Topical crawlers, Web search: Web page pre-processing, Inverted index, HITS algorithm, Page ranking algorithm, Leadership algorithm,

Unit V: Social network analysis: Co-citation and bibliographic coupling, Community discovery. Web usage mining: Recommender systems. Mining Twitter, Mining Face book, Mining Instagram.

Text books

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 421	Natural Language Processing	E	4	0	0	4

1. Han, J., Kamber, M., & Pei, J. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann publications.
2. Introduction to Data Mining, Vipinkumar, Michael Steinbach, Pang-Ning Tan, Person publications,2016
3. Mining the Web, SoumenChakrabarti, Elseier publications, 2002
4. Web Data Mining, Bing Liu, Second Edition, Springer publications, 2011.
5. Mining the Social Web, Mathew A. Russel, Mikhail Klassen, Third edition, Oreily publications, 2018.

COURSE OBJECTIVES:

The basic objectives of natural language processing course are the following:

- Learn the basics of natural language processing and understand various steps in it.
- To introduce the fundamentals of language processing from the algorithmic viewpoint.
- To discuss various issues that make natural language processing a hard task.
- To discuss some well-known applications of natural language processing

LEARNING OUTCOMES:

At the end of the course, the student should be able to:

- Appreciate the fundamental concepts of natural language processing.
- Design algorithms for natural language processing tasks.
- Develop useful systems for language processing and related tasks involving text processing.

UNIT I : Introduction

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.

UNIT II : Word Level and Syntactic Analysis

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III: Semantic Analysis and Discourse Processing

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV : Natural Language Generation and Machine Translation

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V : Information Retrieval and Lexical Resources

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net-Stemmers-POS Tagger- Research Corpora.

Text Books:

1. Daniel Jurafsky , James H. Martin , “Speech & language processing”, Pearson publications.
2. Allen, James. Natural language understanding. Pearson, 1995.

References:

1. Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog” , Springer.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 314	Digital Image Processing	E	4	0	0	4

Course Objective:

- Develop an overview of the field of image processing.
- Understand the fundamental algorithms and how to implement them.
- Prepare to read the current image processing research literature.
- Gain experience in applying image processing algorithms to real problems.

Course Outcomes:

Students are able to

- understand the need for digital image processing and various task involved in image processing pipeline.
- learn different techniques employed for the enhancement of images.
- learn different causes for image degradation and overview of image restoration techniques.
- understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
- learn different feature extraction techniques for image analysis and recognition
- develop any image processing application.
- understand the rapid advances in Machine vision.

UNIT-I

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels,

Image acquisition and Pre-processing: Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening

UNIT-II

Filtering in the Frequency Domain: basic filtering in the frequency domain, image smoothing and sharpening

Image Restoration: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function

UNIT-III

Image segmentation: Fundamentals, point, line detection, basic edge detection techniques, Hough transform, Thresholding, basic global threholding, optimal thresholding using Otsu's method, multi-spectral thresholding, Region based segmentation, region growing, region splitting and merging.

UNIT-IV

Color Image Processing: color models, Color transformation

Image Compression: Fundamentals, Some basic compression methods

UNIT-V

Image Representation: Shape features (Region-based representation and descriptors), area, Euler's number, eccentricity, elongatedness, rectangularity, direction, compactness, moments, covex hull, texture features, color features.

Object and Pattern Recognition: Pattern and pattern classes, Matching, minimum distance or nearest neighbor classifier, matching by correlation, Optimum statistical classifier, Neural network classifier.

Text Books:

1. R.C. Gonzalez, R.E. Woods, Digital Image Processing, 3rd Edition, Pearson Education

Reference Books:

1. S.Sridhar, Digital Image Processing, Oxford University Press, 2011
2. Milan Sonka, Vaclav Hlavac and Roger Boyele,Image processing, analysis, and machine vision. 3e, Cengage Learning, 2014.
3. Computer Vision A modern approach, David A. Forsyth and Jeam Ponce, Pearson Education.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 422	Human Computer Interaction	E	3	0	0	3

COURSE OBJECTIVES:

The course objectives of the human computer interaction (HCI) course are as follows:

- Discuss the capabilities of both humans and computers from the viewpoint of human information processing.
- Demonstrate typical HCI models, styles and various historic HCI paradigms.
- Apply an interactive design process and universal design principles to designing HCI systems.
- Illustrate and utilize HCI design principles, standards and guidelines.
- Analyze and identify user models, user support, socio-organizational issues and stakeholder requirements of HCI systems.
- Discuss tasks and dialogues of relevant HCI systems based on task analysis and dialogue design.

LEARNING OUTCOMES:

After completion of this course, the student will be able to:

- Identify the user requirements for HCI and challenges
- Apply the theories and principles to design new Interface concepts
- Design and development of HCI interfaces for mobile applications and web interfaces

UNIT I : Foundations of HCI

The Human: I/O channels – Memory – Reasoning and problem solving - The computer: Devices – Memory – Processing and networks - Interaction: Models – frameworks – Ergonomics – styles – elements – Interactivity- Paradigms.

UNIT II: Design and Software Process

Interactive design basics – Process – Scenarios – Navigation – Screen design – Iteration and prototyping - HCI in software process – Software life cycle – Usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III : Models and Theories

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV: Mobile HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V: Web Interface Design

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Pearson Education.
2. Brian Fling, “Mobile Design and Development”, O’Reilly Media Inc.Bill Scott and Theresa Neil, “Designing Web Interfaces”, O’Reilly.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 323	Advanced Computer Architecture	E	4	0	0	4

Course objective: This course provides an introduction to the hardware side of high-performance computing, which became a necessary knowledge to fully exploit the performance of not only the high-end supercomputers, but general PCs, in the last decades.

Course outcome: Students will be able to understand the key issues to enhance, limit, or degrade the performance of modern computers, so that they can immediately apply this set of knowledge to improve the efficiency of their own program codes.

UNIT I: Instruction Level Parallelism
ILP – Concepts and challenges – Hardware and software approaches – Dynamic scheduling – Speculation - Compiler techniques for exposing ILP – Branch prediction.

UNIT II: Multiple Issue Processors
VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism– Hardware versus software speculation mechanisms – IA 64 and Itanium processors–Limits on ILP.

UNIT III: Multiprocessors and Thread Level Parallelism
Symmetric and distributed shared memory architectures – Performance issues – Synchronization – Models of memory consistency – Introduction to Multithreading.

UNIT IV: Memory and I/O
Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time – Main memory and performance – Memory technology. Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system.

UNIT V:Multi-Core Architectures
Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture - heterogenous multi-core processors – case study: IBM Cell Processor.

Text Book:

1. John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007.

References:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A hardware/software approach" , Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 423	Distributed Operating Systems	E	4	0	0	4

Course Objective:

1. To understand the concepts that underlie distributed computing systems along with design and implementation issues.

2. To study the key mechanisms and models for distributed systems.

Expected Outcome:

The Students will be able to :

1. Demonstrate various architectural models and design issues in distributed systems.
2. Illustrate various time services in distributed systems.
3. Explain different concurrent programming languages.
4. Identify various Inter Process Communication techniques.
5. Compare distributed scheduling algorithms.

UNIT I

Fundamentals: What is distributed operating system, issues in designing distributed operating system, Computer networks: Lan, WAN technologies, communication protocols, internetworking, Message passing: Issues in IPC by message passing, synchronization, buffering group communication, case study. .

UNIT II

Remote procedure calls: The RPC model, Implementing RPC, RPCs in heterogeneous environment, lightweight RPC, case study. Distributed shared memory: General architecture of DSM systems, Design and implementation issues of DSM, Consistency models, Replacement strategies, Advantages of DSM. .

UNIT III

Process management: Introduction, Process migration, Threads. Synchronization: Clock synchronization, event ordering, Mutual exclusion, deadlock, Election Algorithms. Resource management: Global scheduling algorithm, Task assignment, Load sharing and balancing approaches.

UNIT IV

Distributed File system: Desirable features of a good DFS, file models, file accessing models, file sharing semantics, file caching schemes, file replication, fault tolerance, atomic transactions, Design principles, Case study: Google DFS and Hadoop DFS.

UNIT V

Naming: Desirable features of a good naming system, system oriented names, object locating mechanisms, human oriented names, name caches, naming and security. Security: potential attacks, cryptography, authentication, access control, digital signatures, design principles.

References:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Advanced Concepts in Operating Systems, MukeshSinghal and NiranjanShivratri, McGrawhill publications, 2017
3. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 424	Fog Computing	E	4	0	0	4

Course Objectives:

1. To understand the limitations of today's Cloud computing models which are not designed for the volume, variety, and velocity of data generated by billions of IoT devices.
2. To understand the Fog Computing architecture and business model that address the challenges of resource management and optimization.
3. To analyse the requirements of Fog Computing model for handling IoT data: minimizing latency, conserving bandwidth, and data movement across geo-locations.
4. To familiarize with Fog applications that monitor real-time data from network-connected things and initiating action involving machine-to-machine (M2M) communication.
5. To understand how developers, write IoT applications for Fog Computing nodes that are closest to the network edge and ingest the data from IoT devices.
6. To understand how Fog Nodes, extend the Cloud to the Network Edge through the Case studies for Response time, Data storage time, coverage area, and kinds of applications.

Course Outcomes:

Upon completion of the course, the students are expected to:

1. Demonstrate various architectural models and design issues in Fog Computing.
2. Identify and mitigate Resource management and optimization challenges of Fog Computing model.
3. Learn and apply various Fog+IoT Programming paradigms and Fog+Edge Middleware.
4. Develop useful applications with examples: Smart Building, Predictive Analysis with FogTorch, and application of ML Techniques for defending IoT Devices, etc.
5. Will gain hands on experience with three Case studies for real-life Fog applications.

Unit I. Fog Computing

Limitation of Cloud computing, Differences between Cloud and Fog computing, What is Fog? Advantages of Fog computing, Business Models, Architecture of Fog computing, Opportunities and Challenges

Unit II: Addressing the Challenges in Fog Resources

Introduction, Taxanomy and Characteristics, Resource Management Challenge, Optimisation challenges, Miscellaneous Challenges, IoT and Fog: Introduction . Programming paradigms for IoT+ Fog, Research challenges and Future Research Directions

Unit III: Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds

Introduction, Background, Network Slicing in 5G , Network Slicing in Software-Defined Clouds , Network Slicing Management in Edge and Fog , Future Research Directions: Middleware for Fog and Edge Computing: Design Issues , Introduction. Need for Fog and Edge Computing Middleware: Design Goals, State-of-the-Art Middleware Infrastructures, System Model , Clusters for Lightweight Edge Clouds , Architecture Management – Storage and Orchestration , IoT Integration, Security Management for Edge Cloud Architectures, Future Research Directions

Unit IV: Data Management and Analysis in Fog Computing

Introduction, Background, Fog Data Management, Future Research and DirectionmMotivating Example: Smart Building, Predictive Analysis with Fog Torch, Survey of ML Techniques for Defending IoT Devices, Machine Learning in Fog Computing , Future Research Directions

Unit V: Case Studies

Uscase 1: Introduction, Human Object Detection, Object Tracking, Lightweight Human Detection. Usecase 2: Introduction,Data-Driven Intelligent Transportation Systems, Mission-Critical Computing Requirements of Smart Transportation Applications, Fog Computing for Smart Transportation Applications, Case study 3: Intelligent Traffic Lights Management (ITLM) System, Testing Perspectives

Reference book:

1. Fog and Edge Computing, RajkumarBuyya, Satish Narayana Srirama, Wiley Publications, 2019.
2. Fog computing in the Internet of Things: Springer publications, 2018

(Other reference: Research papers from IEEE, ACM, Springer and Elsevier)

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 425	Parallel Algorithms	E	4	0	0	4

Course Objectives:

The course provides a modern introduction to design, analysis and implementation of sequential and parallel algorithms. In particular, the course is based on a pragmatic approach to parallel programming of message-passing algorithms through the C language and the MPI library. This course introduces critical methods and techniques related to parallel computing. Particularly, the course focuses on hardware, algorithms, and programming of parallel systems, providing students a complete picture to understand pervasive parallel computing.

Course Outcomes:

- An ability to apply knowledge of computing and mathematics appropriate to the discipline.
- An ability to analyze a problem and identify the computing requirements appropriate for its solution; an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs
- An ability to apply mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity.
- An ability to function effectively as a member of a team in order to accomplish a common goal.

UNIT I

Sequential model, need of alternative model, parallel computational 8 models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II

Performance Measures of Parallel Algorithms, speed-up and 8 efficiency of PA, Cost-optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III

Parallel Sorting Networks, Parallel Merging Algorithms on on 8 CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC/, linear array.

UNIT IV

Parallel Searching Algorithm, Kth element, Kth element in X+Y on 8 PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V

Graph Algorithms - Connected Graphs, search and traversal, 8 Combinatorial Algorithms-Permutation, Combinations, Derrangements.

Text Books:

1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGrawHill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms” 3. S.G. Akl, ”Parallel Sorting Algorithm” by Academic Press

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 426	Web Services	E	3	0	0	3

Course Objective:

Students will try to learn:

To get familiar with the basics of the Service Oriented Architecture & Web Services.
To explore different web extensions and web services standards
To get familiar with Service Registry, Discovery, Selection and Composition.
To get familiar with semantic web

Course Outcome:

Students will able to:

Describe and differentiate different Web Extensions and Web Services.
Develop web service using SOAP and REST
Understand, and evaluate different service composition mechanism.
Semantic Web and Ontologies

UNIT I

Introduction to Web Services - fundamental of web services, basic operational model of web services, Business motivations for web services, B2B, B2C, Technical motivations, basic steps of implementing web services, benefits and challenges of using web services, tools and technologies enabling web services, Web services Architecture and its characteristics, web services communication models, core building blocks of web services, web services technology stack.

UNIT II

Service–oriented Architecture (SOA), implementation view, logical view, process view, deployment view, composition of web services, from application server to peer to peer, life in the runtime.

Fundamentals of SOAP-SOAP Message Structure, SOAP encoding, Encoding of different data types, SOAP communication and messaging, SOAP message exchange models, limitations of SOAP.

UNIT III

Transport protocols for web services, messaging with web services, WSDL, Anatomy of WSDL, manipulating WSDL, web service policy, discovering web services, UDDI, Anatomy of UDDI, Web service inspection, Ad – Hoc Discovery, Securing web services.

UNIT IV

Discovering Web Services, service discovery mechanisms, role of service discovery in a SQA, UDDI-UDDI registries, uses of UDDI Registry, UDDI data structures, Programming with UDDI, Publishing, searching and deleting information in a UDDI Registry, Publishing API, limitations of UDDI.

UNIT V

Semantic Web – Role of Metadata in web content, Resource Description Framework, RDF schema, Architecture of semantic web.

Web Services Interoperability - Means of ensuring Interoperability, creating Java client for a Web service, Goals of Cryptography, Digital signature, Digital Certificate, Challenges in Web Services Interoperability. Web Services Security, XML security framework, XML Encryption.

Text Book

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.

Reference Books:

1. Java Web Service Architecture, James McGovern, Sameer Tyagi etal., Elsevier
2. Building Web Services with Java, 2 Edition, S. Graham and others, Pearson Edn.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
4. Web Services, G. Alonso, F. Casati and others, Springer.Outcomes

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 427	Advanced Database Management Systems	E	4	0	0	4

Course Objectives:

Students will understand

To store data using fixed and variable length records in the file
To implement index structures in the file
To implement query parsing and execution
Concurrency control protocols used for transaction processing
Recovery techniques for recovering from transaction failures

Course Outcomes:

Students will be able to:

Store data in the files and to implement indexing schemes for the fast retrieval of data
Implement query complier, planner and executor
Implement concurrency control protocols for transaction processing system

Unit I

Overview of the DBMS, Introduction to DBMS implementation using Megatron 2000 database system, Data storage using main memory and hard disks, Disk failures, Recovery from disk crashes. Representing data elements: Record, Representing block and record address, Variable length data and records, Record modifications

Unit II

Index structures: Indexes on sequential files, secondary indexes, B-Trees, Hash tables. Multidimensional indexes: Hash and tree like structures for multidimensional data, Bitmap indexes

Unit III

Query execution: Algebra for queries, Introduction to Physical-Query-Plan Operators. One-Pass Algorithms for Database Operations, Nested-Loop Joins, Two-Pass Algorithms Based on Sorting Two-Pass Algorithms Based on Hashing, Index-Based Algorithms, Buffer Management, Algorithms Uging More Than Two Passes, Parallel Algorithms for Relational Operations

Unit IV:

The query compiler: Parsing, Algebraic Laws for Improving Query Plans, From Parse Trees to Logical Query Plans, Estimating the Cost of Operations, Introduction to Cost-Based Plan Selection, Choosing an Order for Joins, Completing the Physical-Query-Plan Selection,

Unit V:

Concurrency control: Conflict-Serializability, view serializability, Enforcing Serializability by Locks, Locking Systems With Several Lock Modes, An Architecture for a Locking Scheduler, Concurrency control by timestamps and validation, Transactions that Read Uncommitted Data, Coping with system failures: Undo logging, Redo logging, Undo/Redo logging, Protecting media failures.

Books of Study

1. Database System Implementation, Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Person publications, First Edition, 2002

Books of References

1. Database system the complete book: Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Person New International Edition, Second Edition, 2013
2. Research papers on DBMS implementation

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 322	Complexity Theory	E	4	0	0	4

Course Objectives:

The complexity of a problem describes whether the problem can be solved using algorithms, and how much resources (in form of time and space) it takes to solve a problem algorithmically. The course studies problems that cannot be solved and problems for which it is difficult to design efficient algorithms. We see how we can recognize such hard problems. The course gives a precise definition of what an algorithms is via Turing machines. The main focus is on central complexity classes, in particular NP-complete problems.

Course Outcomes:

- Understands what an algorithm is, and which problems that be solved by an algorithm.
- Understands the relationship between formal languages and Turing machines.
- Knows about various complexity classes and the relationship between them
- Recognize problems that cannot be solved computationally, and recognize NP-hard problems.
- Prove the NP-completeness of some of the most basic hard problems.
- Perform polynomial-time reductions
- The student can recognize computationally hard problems, and contribute to research on classification of new problems as tractable or intractable.

UNIT I: Computability:

Review of Turing Machines, view of PDAs, 2DFAs, FAs as restricted TMs and related theorems. Tape reduction, and robustness of the model. Encoding and Enumeration of Turing Machines, Undecidability. Rice-Myhill-Shapiro theorem. Relativisation. Arithmetic and Analytic Hierarchy of languages. Proof of Godel's incompleteness theorem based on computability. Kolmogorov Complexity. Resource bounded computation. Notion of a computational resource. Blum's Speedup theorem.

UNIT II: Time Complexity

Time as a resource, Linear Speedup theorem. Crossing Sequences and their applications. Hierarchy theorems. P vs NP. Time Complexity classes and their relationships. Notion of completeness, reductions. Cook-Levin Theorem. Ladner's theorem. Relativization Barrier : Baker-Gill-Solovoy theorem.

UNIT III: Space Complexity

Space as a resource. PSPACE, L and NL. Reachability Problem, Completeness results. Savitch's theorem, Inductive Counting to show Immerman-Szelepscenyi theorem. Reachability Problems, Expander Graphs, SL=L

UNIT IV: Complexity of Counting & Randomization

Counting Problems. Theory of #P-completeness. The complexity classes PP, ParityP, BPP, RP, BPP is in P/poly, Toda's theorem.

Text Books:

1. Automata and Computability - Dexter Kozen
2. Theory of Computation - Dexter Kozen
3. Theory of Computational Complexity - Du and Ko - (Reviews) , (Errata)

Complexity Theory: A Modern Approach - Sanjeev Arora and Boaz Barak

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 311	INTRODUCTION TO MACHINE LEARNING	E	4	0	0	4

Course Objectives:

This course provides an introduction to basic skill set required in this fast expanding field of machine learning. Students will learn relevant basics in machine learning such as regression, clustering and classification. In addition, this course introduces advanced Python programming as a standard and common language for machine learning. This course is proposed to meet a growing business needs of individuals skilled in artificial intelligence, data analytics, statistical programming and other software skills. The proposed course will combine theory and practice to enable the student to gain the necessary knowledge to compete in the ever changing work environment.

Course Outcomes:

1. Develop an appreciation for what is involved in learning models from data.
2. Understand a wide variety of learning algorithms.
3. Understand how to evaluate models generated from data.
4. Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT-I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation Linear Regression: Introduction, Linear regression, Python exercise on linear regression

UNIT-II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision TreeInstance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem, python exercise on SVM

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm, python exercise on neural network

Introduction to Computational Learning Theory: Introduction, sample complexity, finite hypothesis space, VC dimension

UNIT- V

Ensembles: Introduction, Bagging and boosting Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering

TEXT BOOK

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

REFERENCE BOOKS

1. Introduction to Machine Learning Edition 2, by EthemAlpaydin
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 410	PRINCIPLES OF SOFT COMPUTING	E	4	0	0	4

Course Objectives:

Upon successful completion of the **course**, students will have an understanding of the basic areas of **Soft Computing** including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms. Provide the mathematical background for carrying out the optimization associated with neural network **learning**.

Course Outcome:

Upon completion of the course, the students are expected to

- To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- Understand the Genetic Algorithm and able to identify the application area
- Reveal different applications of these models to solve engineering and other problems

UNIT - I

Introduction to Soft Computing, Artificial Neural Network (ANN) : Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, Learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perceptron, Adaline, Madaline, Multi-Layer Perceptron, Feed forward Back propagation Network : back propagation learning, Learning Effect of Tunning parameters of the Back propagation

UNIT-II

RBF Network, Associative memory: Auto, hetero and linear associative memory, network, Adaptive Resonance Theory: ART1, ART2, Introduction to Computer vision, Introduction to Convolutional neural network, Popular architectures: Alex Net, Google Net, VGG Net

UNIT-III

FUZZY LOGIC: Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule based reasoning

UNIT-IV

Genetic Algorithms: Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling: Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications, Real life Problems. Particle Swarm Optimization and its variants.

UNIT-V

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back Propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

Text Book:

Principles of Soft Computing- S.N. Sivanandan and S.N. Deepa, Wiley India, 2nd Edition,2011

Reference Book:

1.Neuro Fuzzy and Soft Computing, J. S. R. JANG, C.T. Sun, E. Mitzutani, PHI
2.Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE A03	Visual Information Processing	E	4	0	0	4

UNIT-I

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels,

Image acquisition and Pre-processing: Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening

UNIT-II

Filtering in the Frequency Domain: basic filtering in the frequency domain, image smoothing and sharpening

Image Restoration: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function

UNIT-III

Image segmentation: Fundamentals, point, line detection, basic edge detection techniques, Hough transform, Thresholding, basic global threholding, optimal thresholding using Otsu's method, multi-spectral thresholding, Region based segmentation, region growing, region splitting and merging.

UNIT-IV

Color Image Processing: color models, Color transformation

Image Compression: Fundamentals, Some basic compression methods

UNIT-V

Image Representation: Shape features (Region-based representation and descriptors), area, Euler's number, eccentricity, elongatedness, rectangularity, direction, compactness, moments, covex hull, texture features, color features.

Object and Pattern Recognition: Pattern and pattern classes, Matching, minimum distance or nearest neighbor classifier, matching by correlation, Optimum statistical classifier, Neural network classifier.

Text Books:

1. R.C. Gonzalez, R.E. Woods, Digital Image Processing, 3rd Edition, Pearson Education

Reference Books:

1. S.Sridhar, Digital Image Processing, Oxford University Press, 2011
2. Milan Sonka, Vaclav Hlavac and Roger Boyele,Image processing, analysis, and machine vision. 3e, Cengage Learning, 2014.
3. Computer Vision A modern approach, David A. Forsyth and Jeam Ponce, Pearson Education

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 413	ARTIFICIAL INTELLIGENCE	E	4	0	0	4

Course Objective:

- To create understanding of both the achievements of AI and the theory underlying those achievements.
- To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems
- To review the different stages of development of the AI field from human like behavior to Rational Agents.
- To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
- To create an understanding of the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.
- To introduce advanced topics of AI such as planning, Bayes networks, natural language processing and Cognitive Computing

Course Outcome:

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Formulate and solve problems with uncertain information using Bayesian approaches.
- Apply concept Natural Language processing to problems leading to understanding of cognitive computing.

Unit-I

Introduction: What is Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents.

Unit-II

Search: Introduction to Search, Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, current-best-hypothesis search, least commitment search

Unit-III

Knowledge Representation and Reasoning: Inference, Propositional Logic, Predicate Logic (first order logic), Logical Reasoning, Forward &Backward Chaining, Resolution; AI languages and tools - Lisp, Prolog, CLIPS

Unit-IV

Problem Solving: Formulating problems, problem types, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

Unit-V

Learning: Overview of different forms of learning, decision trees, rule based learning, neural networks, reinforcement learning.

Game playing: Perfect decision game, imperfect decision game, evaluation function, minimax, alpha-beta pruning.

Text Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education
2.Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
3.E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education
4. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 313	Introduction to Data Science	E	4	0	0	4

Course Objective: This course will introduce the rapidly growing field of data science and equip the students with some of its basic principles and tools as well as its general mind-set.

Course Description: Data Science is the study of the generalizable extraction of knowledge from data. Being a data scientist requires an integrated skill set spanning mathematics, statistics, machine learning, databases and other branches of computer science. Students will learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used. As prerequisites, students are expected to have basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics.

Course outcome: At the conclusion of the course, students should be able to:

- Describe what Data Science is and the skill sets needed to be a data scientist.
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
- Use R to carry out basic statistical modeling and analysis.
- Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
- Describe the Data Science Process and how its components interact.
- Use APIs and other tools to scrap the Web and collect data.
- Apply EDA and the Data Science process in a case study.
- Apply basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN),k-means, Naive Bayes) for predictive modeling. Explain why Linear Regression and k-NN are poor choices for Filtering Spam. Explain why Naive Bayes is a better alternative.
- Identify common approaches used for Feature Generation. Identify basic Feature Selection algorithms (Filters, Wrappers, Decision Trees, Random Forests) and use in applications.
- Identify and explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine (dimensionality reduction, singular value decomposition, principal component analysis). Build their own recommendation system using existing components.
- Create effective visualization of given data (to communicate or persuade).
- Work effectively (and synergically) in teams on data science projects.
- Reason around ethical and privacy issues in data science conduct and apply ethical practices.

Unit – I

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

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

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

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

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

Books and Reference:

9. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
10. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
11. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
12. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
13. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
14. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science. (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
15. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 412	Introduction to Big Data	E	4	0	0	4

Course Objectives:

1.
2.
3.
4.
5.

Course Outcomes:

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

1.
2.
3.
4.

UNIT I :

Big Data introduction - Big data: definition and taxonomy - Big data value for the enterprise - Setting up the demo environment - First steps with the Hadoop "ecosystem" – Exercise- The Hadoop ecosystem - Introduction to Hadoop - Hadoop components: MapReduce/Pig/Hive/HBase - Loading data into Hadoop - Handling files in Hadoop - Getting data from Hadoop Exercises – Exercise

UNIT II:

Querying big data with Hive - Introduction to the SQL Language - From SQL to HiveQL – Exercises

UNIT III:

Querying big data with Hive - Introduction to HIVE e HIVEQL - Using Hive to query Hadoop files - Exercises

UNIT IV:

Big data & Machine learning - Quick into to Machine learning - Big Data & Machine Learning - Machine learning tools - Spark & SparkML- H2O - Azure ML - Exercises

UNIT V:

Big data & Machine learning - Big Data & Machine Learning (continued) - Next steps in the big data world Exercises - A case study

Software used: Apache Hadoop

Reference:

1. Big Data and Hadoop- Learn by Example Paperback – Import, 1 Jan 2018 by Mayank Bhushan (Author)
2. Data Analytics Made Accessible, by A. Maheshwari

3. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die by E. Siegel
4. Big data. Architettura, tecnologie e metodi per l'utilizzo di grandi basi di dati, A. Rezzani, Apogeo Education, 2013 Hadoop For Dummies, Dirk deRoos, For Dummies, 2014
5. Big Data Paperback – 20 May 2017 by Anil Maheshwari (Author)
6. Big Data Paperback – 20 May 2017 by Anil Maheshwari (Author)

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 311	**Machine Learning**	**Elective**	**4**	**0**	**0**	**4**

This course provides a broad introduction to machine learning and statistical inference. Topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, and support vector machines); unsupervised learning (clustering, dimensionality reduction, kernel methods); learning theory (bias/variance tradeoffs; VC theory; large margins); reinforcement learning and adaptive control. The course will also discuss recent applications of machine learning, such as to robotic control, data mining, autonomous navigation, bioinformatics, speech recognition, and text and web data processing.

Unit I

Introduction: applications, methods, concepts; Good Machine Learning hygiene: test/training/validation, overfitting, Introduction: applications, methods, and concepts, Good Machine Learning hygiene: test/training/validation, overfitting, linear classification: Perceptron algorithm, Support vector machines (SVMs)

Unit II

Statistical learning background: Decision theory; Bayes risk, Probabilistic models vs no model, Generative and discriminative models, controlling complexity: regularization, bias-variance trade-off, and priors.Resampling, cross-validation.The multivariate normal distribution.Linear regression: Least squares, Regularization: ridge regression, lasso, Brief primer on optimization

Unit III

Linear Classification, revisited, Logistic regression, Linear Discriminant Analysis; Support vector machines revisited: Algorithms, The kernel trick; Theoretical analysis of machine learning problems and algorithms: Generalization error bounds; Nearest neighbour methods: k-nearest-neighbour; Decision trees: Classification and regression trees: Random Forests, Boosting; Neural networks: Multilayer perceptron, Applications

Unit IV

Unsupervised methods: Clustering, Density estimation, Dimensionality reduction; Applications in Data Mining: Collaborative filtering, The power and the peril of Big Data; Linear classification: Perceptron algorithm, Support vector machines (SVMs); Statistical learning background

Unit V

Linear regression: Least squares, Regularization: ridge regression, lasso Brief primer on optimization; Linear Classification, revisited; Logistic regression, Linear Discriminant Analysis, Support vector machines revisited; Theoretical analysis of machine learning problems and algorithms; Nearest neighbor methods; Decision trees; Neural networks; Applications in Data Mining

Text Book

1. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017. [SS-2017]
2. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009. [TH-2009]

Reference Books

1. Foundations of Data Science. Avrim Blum, John Hopcroft and Ravindran Kannan. January 2017. [AB-2017]
2. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006. [CB-2006]

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE B04	Inference and Representation	E	4	0	0	4

Course Objectives:

1. Course covers how to think about, formulate, and model data.
2. Introduces the tools of probabilistic graphical models as a means of representing and manipulating data, modelling uncertainty, and discovering new insights from data.
3. Will particularly emphasize latent variable models, examples of which include latent Dirichlet allocation (for topic modelling), factor analysis, and Gaussian processes.
4. Will also discuss modelling temporal data (e.g., hidden Markov models), hierarchical models, deep generative models, and structured prediction.

Course Outcomes:

Upon completion of the course, the students are expected to:

1. Take a new problem or data set, formulate an appropriate model, learn the model from data.
2. Answer their original question using inference in the model.

UNIT – I:
Introduction- Bayesian networks- Probability review - Bayesian network basics- Probabilistic Programming and Bayesian Methods - Algorithm for d-separation-PyMC3 tutorial – Introduction to Probabilistic Topic Models - Probabilistic modelling in neuroscience - political science - Review of case studies and BN structure learning - Undirected graphical models - Conditional random fields, Gaussian MRFs Case study : Astronomy (Dan Foreman-Mackey)- Some subtleties on BNs, MRF review, CRF introduction

UNIT II:
Exact inference - Variable elimination, treewidth, belief propagation Graph separation in MRFs, revisiting CRFs, BP, pruning barren nodes - Unsupervised learning Expectation Maximization Case study - Monte-Carlo methods - Gibbs sampling - Causal inference & Bayesian additive regression trees

UNIT III:
Topic modeling - Introduction to Probabilistic Topic Models - Case study: Musical influence via dynamic topic models - Modeling musical influence with topic models - Gaussian processes - Application to predicting wind flow - Learning Markov random fields - Moment matching,

Chow-Liu algorithm, pseudo-likelihood - Case study: Cognitive science Idea - Exponential families, learning MRFs, and GPs - An Introduction to Conditional Random Fields - Approximate maximum entropy learning in MRFs

UNIT V:
Variation inference - Mean-field approximation - Graphical models, exponential families, and vibrational inference - Learning deep generative models - Stochastic vibrational inference, Variation auto-encoder - Structured prediction - Overview of structured prediction, parametrizing CRFs - Integer linear programming - MAP inference, linear programming relaxations, dual decomposition - Derivation relating dual decomposition & LP relaxations - Integer Programming for Bayesian Network Structure Learning

References

1. Kevin Murphy, Machine Learning: a Probabilistic Perspective, MIT Press, 2012. You can read this online for free from NYU Libraries. We recommend the latest (4th) printing, as earlier editions had many typos. You can tell which printing you have as follows: check the inside cover, below the "Library of Congress" information. If it says "10 9 8 … 4" you've got the (correct) fourth print.
2. Daphne Koller and Nir Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press, 2009.
3. Mike Jordan's notes on Probabilistic Graphical Models
4. MIT lecture notes on algorithms for inference.
5. Probabilistic Programming and Bayesian Methods for Hackers by Cam Davidson Pilon

Specialization: Cyber Security

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 315	Network Security	E	4	0	0	4

Course Objective:

1. To introduce fundamental concepts of security.
2. To introduce and discuss the relevance of security in operating system, web services etc.
3. To introduce fundamental concepts of secure electronic transactions.

Expected Outcome:

The Students will be able to :

1. Identify the common threats faced today
2. Appreciate the relevance of security in various domains
3. Identify security issues in network, transport and application layers and outline appropriate security protocols
4. Develop secure web services and perform secure e-transactions
5. Design a secure system

Unit-1:
Need for Security, Security Attack, Security Services, Information Security, Methods of Protection. Network Concepts, Threats in Networks, Network Security Controls.

Unit-2:
Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

Unit-3:
Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET), Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats.

Unit-4:
Firewalls: Firewalls – Types, Comparison of Firewall Types, Firewall Configurations.

References:

1. Network Security and Cryptography, Bernard Menezes, CENGAGE Learning.
2. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
3. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition.
4. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 411	Mobile and Wireless Security	E	4	0	0	4

Unit-1:

Fundamentals of Wireless & Mobile Systems: key features and mechanisms of wireless and mobile systems, Security Standards in current Wireless & Mobile Systems: WiFi Security (WEP, WPA, WPA-Enterprise); Cellular Security (GSM, 3G, LTE); Internet of Things / Wireless Sensor Networks / RFID, Emerging Privacy concerns: location, tracking, traffic analysis, mobile and the cloud.

Unit-2:

Wireless and Mobile as a Cyber Physical Infrastructure (CPS), Denial of Service Attacks Cellular, WiFi, GPS, Implications to CPS: e.g., Electricity grid, Internet of Things

Unit-3:

Security of Mobile Computing Plaforms, Android and iOS security models, Threats and emerging solutions (e.g., side channel attacks)

Unit-4:

Security of GSM Network, Security of UMTS Networks, Android Security Model, IOS Security Model, Security Model of the Windows Phone, SMS/MMS, Mobile Geolocation and Mobile Web Security, Security of Mobile VoIP Communications, Emerging Trends in Mobile Security

References:

1. Noureddine Boudriga, Security of Mobile Communications, 2010.
2. Levente Buttyán and Jean-Pierre Hubaux, Security and Cooperation in Wireless Networks, 2008. [Available Online]
3. James Kempf, Wireless Internet Security: Architectures and Protocols, 2008.
4. Android Security Internals: An In-Depth Guide to Android's Security Architecture, Author: Nikolay Elenkov, No Starch Press, First Edition, Nov. 2014

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE C03	Internet Protocols and Networking	E	4	0	0	4

Course Objective:

The broad objective of this course is to understand –

1. The architecture and principles of today's Internetworking of computer Networks
2. The protocols and their functionalities
3. The requirements for the future Internet and its impact on the computer network architecture

Course Outcomes:

Upon completion of this course students will be able to:

1. To understand the fundamentals of organisational interconnectivity, Internet technologies, and to relate them to a business environment.
2. Recognise common Internet communication protocols and describe the services associated with them.
3. Demonstrate understanding of manager role in developing a communication infrastructure.

Unit-1:

Network Models: Layered Tasks, The OSI Model, Layers in OSI Model, TCP/IP Protocol suite,Addressing. Connecting devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

Unit-2:

Principles of Internetworking, Connectionless Interconnection, Application Level Interconnection, Network Level Interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Routers TCP, UDP & IP: TCP Services, TCP Features, Segment, A TCP Connection, Flow Control, Error Control, Congestion Control, Process to Process Communication, User Datagram, Checksum, UDP Operation, IP Datagram, Fragmentation, Options, IP Addressing: Classful Addressing, IPV6.

Unit-3:

Data Traffic, Congestion, Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Source Based Congestion Avoidance, DEC Bit Scheme, Quality of Service, Techniques to Improve QOS: Scheduling, Traffic Shaping, Admission Control, Resource Reservation, Integrated Services and Differentiated Services.

Unit-4:

Concepts of Buffer Management, Drop Tail, Drop Front, Random Drop, Passive Buffer Management Schemes, Drawbacks of PQM, Active Queue Management: Early Random Drop, RED Algorithm.

Course Outcomes

Upon completion of this course students will be able to:

•To understand the fundamentals of organisational interconnectivity, Internet technologies, and to relate them to a business environment

.•Recognise common Internet communication protocols and describe the services associated with them.

•Demonstrate understanding of manager role in developing a communication infrastructure.

References:

1) Douglas. E.Comer, “Internetworking with TCP/IP “, Volume I PHI
2) Behrouz A Forouzan, “TCP/IP Protocol Suite”, TMH, 3rd Edition
3) B.A. Forouzan, “Data communication & Networking”, TMH, 4th Edition.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 312	Introduction to Cryptography	E	4	0	0	4

Course Objective:

1. To introduce fundamental concepts of symmetric cipher models and asymmetric cipher models.
2. To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To understand the various key distribution and management schemes.

Course Outcomes:

The Students will be able to :

1. summarize different classical encryption techniques
2. identify mathematical concepts for different cryptographic algorithms
3. demonstrate cryptographic algorithms for encryption/key exchange
4. summarize different authentication schemes
5. demonstrate various digital signature schemes

Unit-1:
History and overview of cryptography, Overview of cryptography. What is a cipher? Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Unit-2:
Block ciphers, Attacks on block ciphers, Block Cipher Principles, The Data Encryption Standard (DES), Block Cipher Design Principles, Block cipher modes of operation, The Euclidean Algorithm, Finite Fields of the Form GF(2n), Advanced Encryption Standard (AES), Stream Ciphers, RC4.

Unit-3:
Testing for Primality, The Chinese Remainder Theorem, The RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

Unit-4:
Cryptographic Hash Functions, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

References:
Stallings, William. Cryptography and network security, 4/E. Pearson Education India, 2006.
D. Stinson Cryptography, Theory and Practice (Third Edition)

Handbook of Applied Cryptography by A. Menezes, P. Van Oorschot, S. Vanstone.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE 423	Distributed Systems	EL	4	0	0	4

Course Objectives:

Students will learn:

Fundamentals of distributed systems
Various architectures of distributed systems
Process communication and Naming resources in distributed environment
Synchronization, consistency and replication issues in distributed systems
Techniques for implementing fault tolerance and security

Course Outcomes:

Students will be able to:

Identify the concepts used for building large distributed systems
Build a cluster computing system using open source software
Design, develop and deploy applications in a cluster computing environment
Examine the state-of-art distributed file systems such as Hadoop distributed file system

UNIT I: Introduction and Architectures

Introduction: Definition of a distributed system, Goals, types of distributed systems Architectures: Architecture styles, System architectures, Architectures versus middleware, Self-management in distributed systems.

UNIT II: Processes and Communication

Processes: Threads, Virtualization, Clients, Servers, Code Migration. Communication: Fundamentals, Remote Procedure Call, Message and Stream oriented communication, Multicast communication.

UNIT III: Naming and Synchronization

Naming: Flat naming, Structured naming, Attribute-based naming. Synchronization: Clock synchronization, Logical clocks, Mutual exclusion, Election algorithms

UNIT IV: Consistency and Replication

Data and client centric consistency models, Replica management, Consistency protocols, Introduction to distributed file system, consistency and replication issues in distributed file system.

UNIT V: Fault tolerance and Security

Fault tolerance: Introduction, Process Resilience, Reliable client server communication, Reliable group communication, Distributed Commit, Recovery. Security: Secure channels, Access control, Security Management.

References:

1. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.
2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
4. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE D02	Introduction to Cloud Computing	EL	4	0	0	4

Course Objectives:

Students will learn:
- Fundamentals of cloud computing systems
- Virtualization techniques
- Service oriented architecture
- Service models of the cloud
- Application development environments in cloud

Course Outcomes:

Students will be able to:
- Work with virtualization tools
- Use and examine different types of cloud computing services
- Design, develop and deploy applications in the public cloud
- Build private cloud environment using open source software

Unit I:

Distributed system models: Scalable computing over the internet, Technologies for network-based systems, System models and software environments for distributed and cloud computing, performance, security and Energy Efficiency Computer clusters for Scalable parallel computing: Clustering for Massive parallelism, Computer clusters and MPP Architectures, Design principles of computer clusters, Cluster job and resource management.

Unit II:

Virtual Machines and Virtualization of Data Centres: Implementation levels of virtualization, Virtualization structures, tools and mechanisms, Virtualization of CPU, Memory and I/O devices, Virtual clusters and resource management, Virtualization for Data center automation.

Unit III:

Cloud computing and service models, Data center design and interconnection networks, Architectural design of Compute and storage clouds, Public cloud platforms, Inter-cloud resource management, Cloud security and trust management.

Unit IV:

Services and service oriented architecture, Message oriented middleware, Portals and science gateways, Discovery, Registries, Meta data and databases. Workflow in service oriented architectures,

Unit V:

Features of cloud and Grid platforms, Parallel and distributed programming paradigms, Programming support for Google application engine, Programming on Amazon AWS and Microsoft Azure, Emerging cloud software environments.

TEXT BOOKS

- Distributed and Cloud Computing. Kal Hwang. Geoffeiy C.Fox. Jack J.Dongarra. Elsevier. 2012.
- Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James broberg and AndrZej M. Goscinski
- Cloud computing, Black book. Deven Shah, Kailash Jayaswal, Donald J. Houde, Jagannath Kallakurchi
- Cloud Computing: Concepts, Technology & Architecture (The Prentice Hall Service Technology Series from Thomas Erl) 1st Edition, Thomas Erl (Author), Ricardo Puttini , Zaigham Mahmood

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE D03	Data Storage and Management in Cloud	EL	4	0	0	4

Course Objective:

Students will try to learn:

Basics of data storage in cloud computing.
Concepts of key-value store.
Distributed transaction processing
Cloud Backup and solutions

Course Outcome:

Students will able to:

Design & develop multi-tenant applications in Cloud Applications
Use and Examine different cloud computing services
Use transaction processing mechanisms using Cloud based Data storage services
Design & develop backup strategies for cloud data based on features

Unit I:

Distributed File system: Architecture, Processes, Communication, Naming, Synchronization, Consistency and replication, Fault tolerance, Security

Unit II:

Distributed data management: distributed systems, peer to peer systems, database systems, Overview of key value stores and examples, Design choices and their implementations. Transactions on co-located data: Data ownership, Transaction execution, Data storage, Replication, A survey of the systems.

Unit III

Database like functionality in cloud storage, Transactional support for geo-replicated data, Incremental update processing using distributed transaction, Scalable distributed synchronization using mini transactions. Multi-tenant database systems: Multitenancy models, database elasticity in the cloud, Autonomic control for data base workloads in the cloud.

Unit IV:

Azure database service platform: Understanding the Service, Designing SQL Database, Migrating an Existing Database, Using SQL Database, Scaling SQL Database, Governing SQL Database. MySQL and PostgreSQL.

Unit V:

SQL server 2017, Hybrid cloud features, Migrate databases to Azure IaaS, Run SQL Server on Microsoft Azure Virtual Machines, Considerations on High Availability and Disaster Recovery Options with SQL Server on Hybrid Cloud and Azure IaaS, Working with NoSQL Alternatives.

Text Books

1. Data management in the cloud: challenges and opportunities: Divyakant Agrawal, Sudipto das, Amr EI Abbadi, 2013
2. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.
3. Cloud data design, Orchestration and Management using Microsoft Azure, Francesco Diaz Roberto Freato, Apress, Springer publications, 2018
4. Cloud database development and Management, Lee chao, CRC Press, Taylor and Francis group. 2014
5. Cloud data management, Liang Zhao, Sherif Sakr, Anna Liu, Athman Bouguettaya, Springer publications, 2014

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE D04	Application Development in Cloud	EL	4	0	0	4

Course Objective:

Students will try to learn:

Basics of configuring applications.
Concepts Open stack ecosystem.
Multi-tenant Cloud Applications

Course Outcome:

Students will able to:

Design & develop Cloud Applications in Google App Engine
Understanding Open stack ecosystem
Use transaction processing mechanisms using Cloud based Data storage services
Design & develop backup strategies for cloud data based on features

Unit I:

Creating and configuring applications in Google Application Engine, Request Handlers, Instances, Using modules, Data store entries, Data store queries. Data store transactions

Unit II:

Data modeling with ndb, Data store administration, using google cloud SQL with application engine, The memory cache, The Django Web application framework.

Unit III:

Selecting and configuring Amazon EC2 instances, Configuring and Securing a virtual private cloud, Managing AWS resources using AWS cloud formation, Securing Access to Amazon EC2 instances.

Unit IV:

Monitoring Amazon EC2 instances, Using AWS data services, accessing other AWS services (S3, SES, SNS and SQS), Deploying AWS applications: using Docker containers, using chef and using puppet.

Unit V:

Understanding Open stack eco system, Application development and deployment in Openstack: Building applications from the scratch, converting legacy applications into Open stack applications, Monitoring and metering, Updating and patching.

Text Books

1. Open stack cloud application development, John Belametric, Scott Adkins, Jason E. Robinson, Vincent Giersch, Wrox publications, 2016.
2. Mastering AWS development, Uchit Vyas, PACKT publishing, 2015.
3. Amazon EC2 cookbook, Sekhar Reddy, Aurobindo Sarkar, PACKT publishing, 2015.
4. Programming Google Application Engine with Python, Dan Sanderson, Oreily publications, 2015

Python Google Application Engine, Massimiliano Pippi, PACKT publishing, 2015

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE I01	INTERNET OF THINGS: SENSING AND ACTUATOR DEVICES	EL	4	0	0	4

UNIT I – INTRODUCTION

Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device

UNIT II - SEVEN GENERATIONS OF IOT SENSORS TO APPEAR

Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap

UNIT III - TECHNOLOGICAL ANALYSIS

Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module

UNIT IV -IOT DEVELOPMENT EXAMPLES

ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks -Focus on Wearable Electronics

UNIT V - PREPARING IOT PROJECTS

Creating the sensor project - Preparing Raspberry Pi - Clayster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data - Creating the actuator project- Hardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states - Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings -Initializing the camera

REFERENCES

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Développement Copyrights ,2014

2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market
4. Deployment', River Publishers, 2014
5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE I02	IoT ARCHITECTURE AND PROTOCOLS	EL	4	0	0	4

UNIT I – OVERVIEW

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT II – REFERENCE ARCHITECTURE

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT III – IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS

PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT IV – TRANSPORT & SESSION LAYER PROTOCOLS

Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

UNIT V – SERVICE LAYER PROTOCOLS & SECURITY

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer

REFERENCES

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
1. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

4. 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

3. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE IO3	PRIVACY AND SECURITY IN IoT	EL	4	0	2	4

UNIT I – INTRODUCTION: SECURING THE INTERNET OF THINGS

Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT - Insufficient Authentication/Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT.

UNIT II- CRYPTOGRAPHIC FUNDAMENTALS FOR IOT

Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes – Digital Signatures – Random number generation – Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication

UNIT III- IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IOT

Identity lifecycle – authentication credentials – IoT IAM infrastructure – Authorization with Publish / Subscribe schemes – access control

UNIT IV- PRIVACY PRESERVATION AND TRUST MODELS FOR IOT

Concerns in data dissemination – Lightweight and robust schemes for Privacy protection – Trust and Trust models for IoT – self-organizing, Things - Preventing unauthorized access.

UNIT V - CLOUD SECURITY FOR IOT (9 hours)

Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing

REFERENCES

1. Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren
2. Securing the Internet of Things Elsevier
3. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSE I04	Data Management in IoT	EL	4	0	0	4

UNIT I - BIG DATA PLATFORMS FOR THE INTERNET OF THINGS

Big Data Platforms for the Internet of Things: network protocol- data dissemination –current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements coming from different Smart City applications

UNIT II - RFID FALSE AUTHENTICATIONS

On RFID False Authentications: YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self-aware Internet of Things: self-healing systems- Role of adaptive neural network- Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models

UNIT III - FOG COMPUTING

Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies – role of metadata

UNIT IV - WEB ENHANCED BUILDING

Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements- Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine

UNIT V - SUSTAINABILITY DATA AND ANALYTICS

Sustainability Data and Analytics in Cloud-Based M2M Systems - potential stakeholders and their complex relationships to data and analytics applications - Social Networking Analysis - Building a useful understanding of a social network - Leveraging Social Media and IoT to Bootstrap Smart Environments: lightweight Cyber Physical Social Systems - citizen actuation

REFERENCES

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.

2. Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
CSC 204	Computer Networks	C	3	0	2	4

Course Objective:

This course is to provide students with an overview of the concepts and fundamentals of computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

Course Outcomes:

1	Understanding of computer networking fundamentals with data communication syste TCP/IP & OSI reference model
2	Analyze the requirements for a given organizational structure and selection of appr network architecture and topology
3	Specify and identify working limitation in existing protocols of networking layers a to formulate new and better protocols
4	Explain the services and design issues of Transport layer, Session layer and Prese layer and able to Compare and contrast TCP and UDP protocol.
5	State basic understanding of the use of cryptography and network security
6	Explain the functions of Application layer and Presentation layer paradigms and Pro

UNIT - I:

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.

Physical Layer: Guided transmission media, wireless transmission media.

Data Link Layer - design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window protocol

UNIT - II:

Multi Access Protocols - ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

UNIT - III:
Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

UNIT - IV:
Inter-networking: Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses, CIDR, IMCP, ARP, RARP, DHCP.
Transport Layer: Services provided to the upper layer's elements of transport protocol-addressing connection establishment, connection release, Connection Release, Crash Recovery.
UNIT - V:
The Internet Transport Protocols UDP-RPC, Real Time Transport Protocols, The Internet Transport Protocols- Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.
Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH.

List of practical experiments:

1. Explain about wireshark and display how to send packets or packets from one layer to another.
2. Write a Java program to implement Error Detection Technique using CRC Algorithm.
3. Write a Java program to implement Error Correction Technique using Hamming code.
4. Write a Java program to implement TCP Client Server programming.
5. Write a Java program to implement UDP Client Server Programming.
6. Write a Java program to implement 1-bit Stop and Wait Protocol at data link layer.
7. Write a Java program to implement N-bit Sliding Window Protocol at data link layer
8. Write a Java program to implement Dijkstra Shortest path routing protocol.
9. Write a Java program to implement Distance Vector Routing.
10. Write a Java program to implement echo command in client server socket programming
11. Write a Java program to implement Trace-route command
12. Write a Java program to implement Ping command
13. Write a Java program to display the class of IP address, network mask and generate the subnet IP address based on the subnet bits entered from the keyboard
14. Write a Java program to implement sliding window protocol at the transport layer
15. Write a Java program to transfer file using TCP ?

TEXT BOOKS:
1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
REFERENCES BOOKS:
1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Edication.

List of allied subjects:

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 112	Single Variable Calculus	CSCA	4	0	0	4

Course Objectives

Calculus is a foundational course it plays an important role in the understanding of science, engineering, economics, and computer science, among other disciplines. This introductory calculus course covers differentiation and integration of functions of one variable, with applications.

Course Outcomes

After completing this course, students should demonstrate competency in the following skills:

1 Use both the limit definition and rules of differentiation to differentiate functions.
2 Sketch the graph of a function using asymptotes, critical points, the derivative test for increasing/decreasing functions, and concavity.
3 Apply differentiation to solve applied max/min problems.
4 Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus
5 Apply integration to compute arc lengths, volumes of revolution and surface areas of revolution.
6 Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
7 Determine the convergence/divergence of an infinite series and find the Taylor series expansion of a function near a point.

UNIT I: DERIVATIVES AND DIFFERENTIATION

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

UNIT II: APPROXIMATIONS AND THEIR APPLICATIONS

Measurement error of linear approximation, Quadratic approximation, Newton's method, 1 and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

UNIT III: THE INTEGRAL AND INTEGRATION THEORY

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

UNIT IV: DIFFERENT INTEGRATION TECHNIQUES AND APPLICATION OF CALCULUS

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

UNIT V: POLAR CO-ORDINATE SYSTEMS AND INFINITE SERIES

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

Textbooks

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India , 2005.
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis,

3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.

Reference Books

1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 124	Multi-variable Calculus	CSCA	4	0	0	4

Course Objectives:

This is a fundamental course Student able to learn how to find double integral, triple integral& surface integral.

Course Outcomes:

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

1 An understanding of a parametric curve as a trajectory described by a position vector; the ability to find parametric equations of a curve and to compute its velocity and acceleration vectors.
2 A comprehensive understanding of the gradient, including its relationship to level curves (or surfaces), directional derivatives, and linear approximation.
3 The ability to compute derivatives using the chain rule or total differentials.
4 In understanding of line integrals for work and flux, surface integrals for flux, general surface integrals and volume integrals. Also, an understanding of the physical interpretation of these integrals.
5 The ability to set up and compute multiple integrals in rectangular, polar, cylindrical and spherical coordinates.
6 An understanding of the major theorems (Green's, Stokes', Gauss') of the course and of some physical applications of these theorems.

UNIT I
Vector and Matrices (15 hours)
Vectors, Dot product, Determinants; cross product, Matrices; inverse matrices, Square systems; equations of planes, Parametric equations for lines and curves, Velocity, acceleration, Kepler's second law

UNIT II
Partial Derivatives (16 hours)
Level curves; partial derivatives; tangent plane approximation, Max-min problems; least squares, Second derivative test; boundaries and infinity, Differentials; chain rule, Gradient; directional derivative; tangent plane, Lagrange multipliers,Non-independent variables, Partial differential equations

UNIT III
Double integral and line integrals in the plane (15 hours)
Double integrals, Double integrals in polar coordinates; applications, Change of variables, Vector fields and line integrals in the plane, Path independence and conservative fields,Gradient fields and potential functions, Green's theorem, Flux; normal form of Green's theorem, Simply connected regions

Unit IV
Triple integrals in 3D (17 hours)
Triple integrals in rectangular and cylindrical coordinates,Spherical coordinates; surface area, Vector fields in 3D; surface integrals and flux, Divergence theorem:applications and proof.

Unit V
Surface integral in 3D (12 hours)
Line integrals in space, curl, exactness and potentials, Stokes' theorem, Topological considerations, Maxwell's equations.

Textbooks:

Edwards, Henry C., and David E. Penney. Multivariable Calculus. 6th ed. Lebanon, IN: Prentice Hall, 2002.
G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edn., Pearson Education India, 1996.

Reference Book:

1. T. M. Apostol, Calculus - Vol.2, 2nd Edn., Wiley India, 2003.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 302	Numerical Analysis	CSCA	4	0	0	4

Scope & Aim of this course**: This course is an introduction to numerical analysis. The objective is to equip the students with the mathematical definitions, proofs and applicable methods.

Unit I - Equation Forms in Process Modeling (5 lectures)
Linear and Nonlinear Algebraic Equation, Optimization based Formulations, ODE-IVPs and Differential Algebraic
Equations, ODE-BVPs and PDEs , ODE-BVPs and PDEs, Abstract model forms.

Unit II- Fundamentals of Vector Spaces (16 lectures)
Generalized concepts of vector space, sub-space, linear dependence, Concept of basis, dimension, norms defined on general vector spaces, Examples of norms defined on different vector spaces, Cauchy sequence and convergence, introduction to concept of completeness and Banach spaces, Inner product in a general vector space, Inner-product spaces and their examples, Cauchy-Schwartz inequality and orthogonal sets.

Unit III – Problem Discretization Using Approximation Theory (10 lectures)
Transformations and unified view of problems through the concept of transformations, classification of problems in numerical analysis, Problem discretization using approximation theory, Weierstrass theorem and polynomial approximations, Taylor series approximation

Unit IV – Solving Linear Algebraic Equations (10 lectures)
Classification of solution approaches as direct and iterative, review of Gaussian elimination, Introduction to methods for solving sparse linear systems: Thomas algorithm for tridiagonal and block tridiagonal matrices, Block-diagonal, triangular and block-triangular systems, solution by matrix decomposition.

Unit V – Solving Ordinary Differential Equations – Initial Value Problems (ODE-IVPs) (10 lectures)
Introduction ,Existence of Solutions, Analytical Solutions of Linear ODE-IVPs , Analytical Solutions of Linear ODE-IVPs (contd.), Basic concepts in numerical solutions of ODE-IVP: step size and marching, concept of implicit and explicit methods.

** Apart from the regular lectures, the allotted lecture hours can be used for tutorial and problem solving sessions.
Books of Study:
1. Richard L. Burden, J. Douglas Faires, Numerical analysis, 3 ed. - Boston : Prindle, Weber & Schmidt, 1985.
2. Philips, G. M.,Taylor,P. J. ; Theory and Applications of Numerical Analysis (2nd Ed.), Academic Press, 1996.
Books of Reference:
1. Gourdin,A. and M Boumhrat;Applied Numerical Methods.Prentice Hall India, New Delhi,(2000).

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
MAT 303	Number Theory	CSCA	4	0	0	4

Scope & Aim of this course**: This course is an introduction to number theory. The objective is to equip the students with the mathematical definitions, proofs and applicable methods.

Unit I - Primes, Divisibility and the Fundamental Theorem of Arithmetic (5 lectures)
Introduction, Diophantine Equations, Divisibility, GCD

Unit II- Greatest Common Divisor (GCD), Euclidean Algorithm (6 lectures)
Euclidean Algorithm, Primes, Binomial Coefficients

Unit III – Congruences, Chinese Remainder Theorem, Hensel's Lemma, Primitive Roots (14 lectures)
Congruences, Fermat, Euler, Wilson, Linear Congruences, Chinese Remainder Theorem, Algorithms, Primality, Factoring, RSA, Hensel's Lemma, Congruences mod Primes, Order, Primitive Roots, Index Calculus

Unit IV – Quadratic Residues and Reciprocity (10 lectures)
Quadratic Residues, Quadratic Reciprocity, Jacobi Symbol, Computation, Zolotareff's Definition, Square Roots, Tonelli's Algorithm, Number of Consecutive Pairs of Squares mod p, Cyclotomic Polynomials, Primes Congruent to 1 mod n, Arithmetic Functions, Mobius Inversion Formula, Zeta Functions, Li Recurrences

Unit V – Arithmetic Functions, Diophantine Equations, Continued Fractions (10 lectures)
Generating Functions, More on Generating Functions, Two Squares Theorem, Continued Fractions, Quadratic Irrationalities, Brahmagupta-Pell Equation, Four Squares Theorem, Pythagorean Triples, Fermat Descent, Rational Points on Conics

** Apart from the regular lectures, the allotted lecture hours can be used for tutorial and problem solving sessions.

Books of Study:

1. David M. Burton: Elementary Number Theory (McGraw-Hill Higher Education, International Edition)
2. G. H. Hardy, Edward M. Wright, Andrew Wiles. An Introduction to the Theory of Numbers. 6th Edition.

Books of Reference:

1. David Burton. Elementary Number Theory. 7th Edition

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
PHY 204	Physics I	CSCA	3	0	2	4

Course Objectives:

The course aims to cover the fundamental formalism and applications of Physics. It mainly includes basic Newtonian Mechanics, Heat & Thermodynamics, Electricity & Magnetism

Course Outcome:

1. Apply the fundamental concepts of mechanics such as force, energy, momentum etc. more rigorously as needed for further studies in basic science
2. Students' physical intuition and thinking process through understanding the theory
3. Model simple mechanical systems by correlating it to the real world practical problems

UNIT I - Review of Newtonian Mechanics

Review of Scalars, Vectors, Kinematics: Equations of motion for constant acceleration and non-constant acceleration Dynamics: Contact forces, Static friction, kinetic friction and worked examples, Free body force diagram; Applications of Newton's law. Worked examples Tension, Pulley systems, worked examples, Solving various pulley systems using free body force diagram and Newton's law Momentum and Impulse, Impulse momentum theorem, Average force, Worked examples Conservation of Momentum, Momentum Diagrams, Worked examples Center of Mass of point objects and continuous systems e.g., rod, rectangular sheet Center of Mass of a Uniform and different objects Motion of the Center of Mass; Velocity and Acceleration of the Center of Mass, Reduction of a System to a Point Particle, Center of Mass Trajectory, projectile blast problem

UNIT II – Work and Energy

Kinetic Energy and Work in 1D, 2D and 3D; Work by a Constant and a non- Constant Force Work-Kinetic Energy Theorem and worked examples, Conservative and Non-conservative Forces with examples, Potential Energy due to gravity and Potential Energy of a spring Principle of energy conservation; worked examples. Collision and its type. Collision in 1D and 2D; Rigid body, Rotational Motion, moment of inertia Moment of inertia of various objects, worked examples, Parallel and perpendicular axis theorem, Torque and Angular momentum, conservation of angular momentum, worked examples Rolling motion, worked examples, Conservation of energy in rotational motion

UNIT III – HEAT & HERMODYNAMICS

Basic Thermodynamics – Concept of Temperature, First and Second Law(s) applicable to Heat Engines and Refrigerators; Thermodynamic Process-Isothermal, Adiabatic, Isobaric, Isochoric, Adiabatic relations of system for perfect gas Pressure-Volume and Temperature-Entropy Diagrams for engines Conversion of Heat into Work and its converse, Carnot's Cycle and Carnot's Heat Engine and its efficiency Otto cycle, Diesel cycle and its comparison, efficiencies, The Carnot Refrigerator Maxwell–Boltzmann Distribution, Equipartition theorem Seebeck, Peltier and Thomson effect, Thermoelectric generators and its applications, Thermocouples, Temperature measurement, Thermoelectric materials

UNIT IV: ELECTROSTATICS

Coordinate system, Cartesian, Cylindrical and Spherical polar Gradient, divergence and curl Properties of charge and Coulomb's law Gauss's law and its applications

Electric potential and potential energy, examples Capacitors, parallel plate, cylindrical and spherical Introduction to Electric Dipole and dipole Moment Torque and potential energy of a dipole Potential and field due to electric dipole

UNIT V: MAGNETISM

Magnetic force and cyclotron Biot-Savart Law for magnetic fields Magnetic field due to various current loops Motion of a current carrying coil in magnetic field and torque Ampere's circutal law Introduction to time-varying fields Faraday's law of induction Lenz law and electro-motive force Maxwell's equations in free space

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))
2. Introduction to Electrodynamics –David J. Griffiths; 4th Edition, 2012, PHI Eastern Economy Editions

Description of Experiments:

1. Revisions of Vernier caliper and Screw Gauge
2. Plotting graphs and Error analysis
3. Determine moment of inertia of a flywheel
4. Determination of spring constant
5. Determination of thermal conductivity of a given material
6. Measurement of specific heat capacity of any given material
7. To find the dielectric constant of the medium using parallel plate capacitor
8. Use Faraday's law for finding the total magnetic flux through the coil
9. Verify the Biot-Savart law for a given circular coil

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
PHY 214	Physics II	CSCA	3	0	2	4

Course Objectives:
The course aims to cover the fundamental formalism and applications of Physics. It mainly includes introduction to modern physics, fundamentals of quantum mechanics, solid state physics and devices

Course Outcome:

2. Apply the fundamental concepts of modern physics and explain physics phenomenon
3. Students' physical intuition and thinking process through understanding the theory
4. Understand basics of solid state physics and functioning of devices

UNIT I - Introduction to Modern Physics
Electromagnetic waves; coupled magnetic and electric oscillations Introduction to special theory of relativity Inertial and non-inertial frames of reference Length contraction and time dilation Mass energy relation Quantum states of an electron in an atom, Introduction Atomic Spectra Early models of H-atoms Spectrum of Hydrogen Photoelectric effect and Compton scattering

UNIT II – Origin of Quantum Mechanics
Limitation of classical mechanics, Review of Black body radiation, examples Wave particle duality Matter waves - De Broglie hypothesis, Photoelectric effect, Linear Vector Space, Hilbert Space Heisenberg's uncertainty principle, Postulates of quantum mechanics – Schrödinger Wave function and its physical interpretation, Position, Momentum operator, angular momentum operator, and total energy operator, Orthogonality, Orthonormality, Operator Schrödinger time dependent and independent equation, Schrödinger Representation, Heisenberg Representation, Interaction Representation

UNIT III – Application of Quantum Mechanics
Equation of continuity, and its physical significance Bound State, Free particle, Particle in infinitely deep potential well (one - dimension) Particle in three dimension rigid box Scattering State Step potential, Potential barrier. (Qualitative discussion), Angular Momentum Generalized Angular Momentum Spin Momentum Qualitative discussion on the radial and angular parts of the bound state energy

UNIT IV: Introduction to Solid State Physics
Crystalline and amorphous solids, Lattice, Basis, Translational vectors, Primitive and non-primitive unit cell Symmetry operations, Different types of lattices-2D and 3D (Bravais lattices), Miller indices SC, BCC and FCC structures, Packing fraction Various types of crystal structures Crystal structures-NaCl, diamond, CsCl, ZnS, HCP Concept of reciprocal lattice and its properties Ionic, covalent, molecular and metallic binding in crystalline solids Bragg's law and Bragg's Diffraction condition in direct and reciprocal lattice, Ewald's construction, Debye Schrrerer method

UNIT V: Solid State Devices
Classification of solids based on band theory Semiconductors - origin of band gap Intrinsic and extrinsic semiconductors, *p* and *n* type, and p-n junction diodes Transistors and its characteristics Different types of transistors and their uses Examples of various transistors and applications Energy storage devices, Supercapacitors, fuel cells. Photodetectors, transducers

and sensors; applications, Solar Cells

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))
2. Introduction to Solid State Physics – C Kittel; Eighth Edition, Wiley publishers
3. Concepts of Modern Physics (2017)- Arthur Besier, Shobhit Mahajan, S. Rai Choudhury (Tata McGraw Hill)

Description of Experiments:

1. Determine velocity of sound
2. Verification of Stefan`s Law
3. Characteristics of a p-n junction
4. Study the various Transistor Biasing configurations and CE Characteristics, load line and Q-factor
5. Characteristics of a Solar cell
6. Determine charge carrier type and concentration of a given semiconductor using Hall Effect
7. Study spectral lines from Neon using a Neon discharge lamp and determine the Rydberg constant using the Bohr model formulation
8. Determine lattice parameter of a given crystalline powder using X-ray diffractometer

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
BBA 304 S	Human Resource Management	CSCA	4	0	0	4

Unit I:
Introduction to Human Resource Management Meaning, Function, Significance & Challenges of HRM, HR Policies, Introduction to Human Resource Planning, Various Methods of HRP, Forecasting and HR Effectiveness – Case Study Analysis

Unit II:
Recruiting, Selecting & Socializing Introduction, Recruitment Policy, Issues, sources of people, selection process & tests, Socialization, Internal Mobility, Career Planning – Case Study Analysis

Unit III:
Training & Developing Workforce and Organizational Development Concept, need, method, importance & evaluation of training & development; principle of learning; Introduction to and Interventions in OD – Case Study Analysis

Unit IV:
Performance and Compensation Management System Definition, importance, objectives, components and methods of performance management system, Principal compensation issue, job evaluation, pay-structure, individual & group incentives – Case Study Analysis

Unit V:
Social Security and Labour Welfare Concept of Social Security and Industrial Relations, Workers Participation in Management Significance and various social security legislations in India – Case Study Analysis

Text Book:

"Managing Human Resources" by Bohlander and Snell Thomson Publications, "Human Resource Management" Gary Dessler and Biju Varkkey Pearson Publications

REFERENCE BOOKS:

1.Human Resource Management, Gary Dessler, Pearson Education
2.Human Resource Management, Casio Jaico Publishing House
3.Human Resource Management, Ivancevich McGraw Hill
4.The Management of People at Work Dale S.Beach Tata McGraw-Hill
5.Personnel Management, CB Memoria, Himalaya Publishing House
6. Human Resource Management Mizra S.Saiyadain Tata McGraw Hill
7. Human Resource Management ,VSP Rao Excell Books
8. Human Resource Management , P.Subba Rao,Himalaya Publishers

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
BBA H 02 S	Leadership and Team Management	CSCA	4	0	0	4

Unit I

Leadership – basic definition of the concept and components of leadership. Trait approach in theories of leadership (development and the present situation). Personal characteristics that support effective leadership. Leader and values. The significance of self-knowledge for the role of leader (identity and integrity of leader) - Motivation in the context of personality - sources of motivation - Motivation and performance, performance motivation, aspirations, work satisfaction - Specific theories of motivation, stimulation tools, motivation program in organization - motions and self-management, emotional intelligence and its significance in the role of leader. Handling emotions and stress. Personal risk of leader: personal traits endangering effective leadership.

Unit II

Significance of communication skills for work life and leadership - Social perception in organization- Competency and behavior approaches to leadership. Model of four competencies for leadership. The contingency theory of leadership; situational leadership - Transactional and transformational leadership. Models of wellbalanced and authentic leadership - Leader and his or her followers. Models of relation between leadership and followership. LMX theory.

Unit III

Leadership of workgroups and teams. Group structure and dynamics - Individual in a group. Formation of teams and team work. Group problem-solving. Team excellence. Participative leadership.

Unit IV

Leadership development. Skills for leadership and performance management: Goal setting, support of employee development and communication of feedback; delegation; solving of conflict situations and negotiation. Tools for analysis of leadership styles and 360-degree feedback. Couching and mentoring.

Unit V

Creative leadership. Influence on the creative potential of work groups and teams; formation of innovative climate in organizations - Leadership and power. Sources of power in organizations. Micropolitics, its strategy and tactics - Gender and leadership - Leadership and organization culture. Link between leadership and activities leading to the formation, assertion or changes in organization culture - Intercultural aspects of leadership. Differences in the accentuation of various aspects of leadership in the context of national cultures.

References:

1. DUBRIN, A J. Principles of leadership [Mason] SouthWestern/Cengage Learning
2. ACHUA, C F. – LUSSIER, R N. Effective leadership [Mason] SouthWestern/Cengage Learning
3. KOUZES, J. M., POSNER, B. Z. Learning Leadership. The Five Fundamentals of Becoming an Exemplary Leader. Wiley

4. YUKL, G. Leadership in Organizations. Eighth Edition. Pearson Education

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
HIS102A	Human Civilizations	CSCA	4	0	0	4

Course Objectives:

This course will engage students with the story of Human evolution, origin and development of civilisation in a broad archaeological and historical context. We will analyse geographical, political, economic, religious and social structures of ancient civilisation with focused attention on Mesopotamia, India, Egypt, China and Europe. The course is designed to create an understanding about the earliest cities, states, kingdoms and empires that developed in different parts of the world.

Course Outcome:

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

1. Identify the key concepts and terminologies in Ancient History
2. Understand the origins of Homo Sapiens and associated theories
3. To understand the development of civilizations and the significance of human migration
4. To explore the evolution of key phenomena in human history such as state, gender and religion

UNIT I – Early Human Evolution

What is Civilisation? Stages of Human evolution, African Origins of Humanity, Sexual Dimorphism, Development of Language, Patterns of Lithic Technological Development, Hunter – Gathering Society; its social and economic structure

UNIT II – Towards the Neolithic

Climate change and end of Ice Age, Towards the Mesolithic period and extension of settlement in new ecological zones, Changes in subsistence strategies based on the case studies from West Asia, Europe or Meso America, Shifts in tool manufacture and social organization from the Mesolithic to the Neolithic, Neolithic Period: Origins of food production, Gender Division of Labour; Case studies of early farming settlements at Catal Hoyuk, Abu Hureya, Jericho, Syria or Jordan. Early farming societies in Europe, Asia and the Nile Valley. Art and Architecture at Neolithic Sites; A study of cave paintings. Neolithic religious formations – burial customs and beliefs

UNIT III – Bronze Age Social Formations

Discovery of metals and its impact, Development of writing systems, Tigris and Euphrates river valley: Emergence of Cities, Urban Revolution: Ancient Egyptian Civilisation, Private life in ancient Egypt, Minoan Civilisation of Crete, Eastern Mediterranean World in the Ancient Period, Harappan Civilisation, Origin of Chinese Civilisation

UNIT IV: Other Ways of Living

Nomadic Pastoralism, Pastoral People of the Middle East, Pastoralism in Central Asia, Socio-political interaction of pastoral tribes with the urban centres, The advent of Iron - its origin and implications.

UNIT V: The Hellenic World

Ancient Greece; the emergence of polis, Athens and Sparta, the Myth of Arcadia, The Slave Mode of Production: Emergence of Slavery in ancient Greece, Organization of production in Ancient Greece The Nature of classical urbanism, Private life in ancient Greece, Hellenistic Phase: Characteristic features of Hellenism, Art and Culture in the Hellenic World

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Bogucki, P. *The Origins of Human Society*. Massachusets and Oxford: Wiley Blackwell Publishers,1999
2. Amar Farooqui. *Early Social Formations*. Delhi: Manak Publications, 2001.
3. Fernand Braudel, *The Mediterranean in the Ancient World*, Penguin, 2007.
4. R.J Wenke *Pattern in Prehistory*: *Humankind's First Three Million Years,* Oxford University Press, 2006.
5. Redman, C.L. *The Rise of Civilisations. From Early Farmers to Urban Society in the Ancient Near East*. San Fransisco: W.H. Freeeman 1978.
6. V. Gordon Childe, *What Happened in History*, 1942.

SUBJECT CODE	SUBJECT TITLE	CORE/ ELECTIVE	CREDITS			
			L	T	P	C
HIS 301	European Social Formations	CSCA	4	0	0	4

Course Objectives:

The transition from Feudalism to Capitalism, as it happened in Western Europe was accompanied by such thinking and led to discoveries as well as inventions that turned the world upside down. Rather, as Christopher Hill presented it, the world began to be seen upside down by the people and that is what the changes in Western Europe induced into civilizations across the world. This course, which is compulsory to those opting for a Major in History will also be offered as an Elective to those in other Liberal Arts Majors and seek to expose them to the historical roots of the contemporary globalized world.

Course Outcome:

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

1. To explore the complex phenomena which shaped European modernity
2. To analyse and understand the theories of the decline of feudalism
3. To address the issue of religious reformation and its impact in Europe
4. To identify the causes for the emergence of capitalism as a world system

UNIT I – Transition from Feudalism to Capitalism

Empires in the East; The Ottomans, The Mughals, The Mings, Political Economy (Trade, Commerce and Agrarian System), Geographical expansion of the world through voyages and discoveries Slave trade and gold rush, Mercantilism and its impact on Feudal Europe; The Dobb-Sweezy debate on Transition, Black Death

UNIT II – The Churning of the Catholic Church

Renaissance and Reformation in Europe, Martin Luther and Reformation, Spread of Lutheranism John Calvin and the doctrine of predestination, Spread of Calvinist thought The advent of the Printing Press, The coming of book in history, The Novel and the revolutionary impact on the printing press

UNIT III – The Scientific Revolution

Reshaping Cosmology; Copernicus, Tycho Brahe, Johannes Kepler, Galileo, Newton The age of Discoveries; Columbus, Vasco da Gama et.al., Inventions; the Spinning jenny, the Flying Shuttle et.al., Steam engine and the transport revolution

UNIT IV: The Rise of England as an Industrial Economy

Primitive Accumulation of Capital, The Enclosure Movement, The Putting Out System to the Factories, The Triangular Trade and the Empire of Cotton

UNIT V: Industrial Capitalism to Finance Capitalism

Capitalism and Colonialism: Economic Divergence, European and Asian economies before divergence, The divergence of Britain, causes for the great economic divergence, Emergence of France and Germany as colonial powers, Colonisation of the Americas, the Africas and Asia

TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL

1. Fernand Braudel, *Afterthoughts on Material Civilization and Capitalism*, The John Hopkins University Press, 1977
2. Fernand Braudel, *Civilization and Capitalism, 15th to 18th Century,* 3 Volumes, Harper & Row, New York, 1982-84.
3. Harbans Mukhia, *The Mughals of India* (Peoples of Asia), Wiley-Blackwell, 2004.
4. Immanuel Wallerstein, *The Modern World System: Capitalist Agriculture and the Origins of the European World Economy in the Sixteenth Century*, Volume 1, 1974.
5. Prasannan Parthasarathi, *Why Europe Grew Rich and Asia Did Not: Global Economic Divergence*, *1600-1850*, 2011.
6. Quentin Skinner, *The Foundations of Modern Political Thought: The Age of Reformation*, Volume II, 1978.
7. Robert B. Marks, *The Origins of the Modern World: A Global and Ecological Narrative*, Rowman & Littlefield Publishers, 2002.
8. Thomas Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought*, 1957.
9. Sanjay Subrahmanyam, *Explorations in Connected History: Mughals and Franks*, Oxford University Press, 2005