SYLLABUS

SEMESTER 1

CULTURAL EDUCATION I 2 0 0 2

Objectives: *Love is the substratum of life and spirituality. If love is absent life becomes meaningless. In the present world if love is used as the string to connect the beads of values, life becomes precious, rare and beautiful like a fragrant blossom. Values are not to be learned alone. They have to be imbibed into the inner sprit and put into practice. This should happen at the right time when you have vitality and strength, when your hearts are open.*

The present course in value education is a humble experience based effort to lead and metamorphosis the students through the process of transformation of their inner self towards achieving the best. Amma's nectarous words of wisdom and acts of love are our guiding principles. Amma's philosophy provides an insight into the vision of our optimistic future.

CO1	Helps the students to imbibe values into their inner sprit and put it into real life practice.
CO2	Help the students towards achieving the best through the process of transformation of their inner self
CO3	Provides the students an insight into the vision of optimistic future.

Syllabus:

Introduction to Indian Culture

Introduction to Amma's life and Teachings

Symbols of Indian Culture

Science and Technology in Ancient India

Education in Ancient India

Goals of Life – Purusharthas

Introduction to Vedanta and Bhagavad Gita

Introduction to Yoga

Nature and Indian Culture

Values from Indian History

Life and work of Great Seers of India (1)

TEXTBOOKS:

1. *The Glory of India (in- house publication)*
2. *The Mother of Sweet Bliss. (Amma's Life & Teachings)*

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	4	3	-	-	-	-
CO2	-	-	-	-	-	-	-	4	2	3	3	-	-	-	-
CO3	-	-	-	-	4	-	3	3	-	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

COMMUNICATIVE ENGLISH 2-0-2-3

Objectives:

To help students obtain an ability to communicate fluently in English; to enable and enhance the students skills in reading, writing, listening and speaking; to impart an aesthetic sense and enhance creativity

Course Outcomes

CO1	Students will heighten their awareness of correct usage of English grammar in writing and speaking
CO2	Students will attain and enhance competence in the four modes of literacy: writing, speaking, reading and listening
CO3	Students will improve their reading fluency skills through extensive reading

Unit- I

Kinds of sentences, usage of preposition, use of adjectives, adverbs for description, Tenses, Determiners- Agreement (Subject – Verb, Pronoun- Antecedent) collocation, Phrasal Verbs, Modifiers, Linkers/ Discourse Markers, Question Tags

Unit- II

Paragraph writing – Cohesion - Development: definition, comparison, classification, contrast, cause and effect - Essay writing: Descriptive and Narrative

Unit- III

Letter Writing - Personal (congratulation, invitation, felicitation, gratitude, condolence etc.) Official (Principal / Head of the department/ College authorities, Bank Manager, Editors of newspapers and magazines)

Unit- IV

Reading Comprehension – Skimming and scanning- inference and deduction – Reading different kinds of material –Speaking**:** Narration of incidents / stories/ anecdotes- Current News Awareness

Unit-V

Prose: John Halt's 'Three Kinds of Discipline' [**Detailed**]

Max Beerbohm's 'The Golden Drugget' [**Detailed**]

Poems: Ogden Nash- 'This is Going to Hurt Just a Little Bit' [**Detailed**]

Robert Kroetsch– 'I am Getting Old Now', Langston Hughes-'I, Too'[**Detailed**]

Wole Soyinka- 'Telephone Conversation' **[Non-Detailed**]

Kamala Das- 'The Dance of the Eunuchs'[**Non-Detailed**]

Short Stories:Edgar Allan Poe's 'The Black Cat', Ruskin Bond's 'The Time Stops at Shamili' **[Non-Detailed**]

CORE READING:

1. *Ruskin Bond, Time Stops at Shamli and Other Stories, Penguin Books India Pvt Ltd, 1989*
2. *Syamala, V. Speak English in Four Easy Steps, Improve English Foundation Trivandrum: 2006*
3. *Beerbohm, Max, The Prince of Minor Writers: The Selected Essays of Max Beerbohm (NYRB Classics), Phillip Lopate (Introduction, Editor), The New York Review of Book Publishers.*
4. *Edger Allan Poe. The Selected Works of Edger Allan Poe. A Running Press, 2014.*
5. *Online sources*

References:

6. *Ruskin Bond, Time Stops at Shamli and Other Stories, Penguin Books India Pvt Ltd, 1989*
7. *Martinet, Thomson, A Practical English Grammar, IV Ed. OUP, 1986.*
8. *Murphy, Raymond, Murphy's English Grammar, CUP, 2004*
9. *Online sources*

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	3	3	-	-	-	-	-	-	-	-	-	-	-

ENVIRONMENTAL SCIENCE AND SUSTAINABILITY 3 0 0 3

Objectives: *EVS is a multidisciplinary scholastic field which efficiently considers human cooperation with the earth in light of a legitimate concern for taking care of complex issues. Ecological examinations unite the standards of the physical sciences, business/financial aspects and sociologies to take care of contemporary natural issues.*

Course Outcomes

CO1	Understanding sustainable developements, need for environmental education, Contribution of famous personalities in Environment.
CO2	Make out the aboitic and boitic factors of environment, Understanding the importance of different types of ecosystems
CO3	Study of bio diversity , different types of diversity in nature giving importance to India as a mega diversity nation.
CO4	Understanding linear and cyclic resource management with more emphasis to air, water, soil resources.
CO5	Be familiar with Environment Impact Assesment & Environment Management Plan

Syllabus

Unit 1

State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People's action.

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil/ land degradation/ pollution

Unit 2

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as:

Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people's movements and activism, Indigenous knowledge systems and traditions of conservation.

Unit 3

Common goods and public goods, natural capital/ tragedy of commons, Cost benefit analysis of development projects, Environment Impact Assessment (EIA), Environment Management Plan (EMP), Green business, Eco-labeling, Problems and solutions with case studies.

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes/ Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.

TEXTBOOKS/ REFERENCES:

1. *R. Rajagopalan, Environmental Studies: From Crisis to Cure. Oxford University Press, 2011, 358 pages. ISBN: 9780198072089.*
2. *Daniel D. Chiras, Environmental Science. Jones & Bartlett Publishers, 01-Feb-2012, 669 pages. ISBN: 9781449645311.*
3. *Andy Jones, Michel Pimbert and Janice Jiggins, 2011. Virtuous Circles: Values, Systems, Sustainability. IIED and IUCN CEESP, London. URL:http://pubs.iied.org/pdfs/G03177.pdf*
4. *Annenberg Learner, The Habitable Planet, Annenberg Foundation 2015. URL: http://www.learner.org/courses/envsci/unit/pdfs/textbook.pdf.*

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PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3		-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3			-	-	-	-	-	-	-	-	-	-	-
CO3	3	2		-	-	-	-	-	-	-	-	-	-	-	-

CO4	2	3		-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2					-		-	-		-	-	-	-

COMPUTER ESSENTIALS FOR DATA SCIENCE 3 0 0 3

Course Objectives: *The Computer Essentials module sets out basic ideas and abilities identifying with the utilization of use of devices, computer organization, data representations, databases and data science.*

Provide abilities to oversee PCs, gadgets, and information safely and viably.

COURSE OUTCOMES

CO1: Understand the fundamental concepts of electronic communication and their use in computer applications, the basic structure and operation of a digital computer, identify the logic gates and their functionality, perform Number Conversions from one System to another System, Design basic electronic Circuits (combinational circuits), and understand the Construction of Memory.

CO2: Understand the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main components and understand contemporary microprocessor designs and identify various design techniques employed

CO3: Understand the role of a database management system in an organization, use of Structured Query Language (SQL) and learn SQL syntax, needs of database processing and learn techniques for controlling the consequences of concurrent data access.

CO4: Understand the concept of a database transaction and related database facilities, including concurrency control, backup and recovery, locking and related protocols. Importance of modeling in the software development life, the UML notation and symbols. Identify classes/entities of data, their attributes, and relationships. Design the logical and physical structure of a relational database for efficient data storage

CO5: Understanding the flow of a data science process, and the skill sets needed to be a data scientist, significance of exploratory data analysis in data science

SYLLABUS

Unit I

Digital Fundamentals: Number Systems-Binary, Hexadecimal, Octal, Conversion, Data encoding, Operations on Binary number system, representation of positive and negative integer, compliment operations, real number system, Boolean Algebra, Logic Gates, SOP and POS – K map Simple arithmetic circuits, Combinational circuits- Sequential circuits (10 hrs)

Unit II

Basic Computer Organization: Registers, Instruction Formats, Types of instructions, Execution of a Complete Instruction, Bus Organization, Control Unit Organizations-Hard-wired Control, Micro programmed Control. – Input Out organizations Central processing units and different CPU organizations – Subroutines -Memory – Memory Hierarchy- Types (10 hrs)

Unit-3

Introduction to Database Management Systems-Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL

Unit-4

Data representation, Data organization, Data models using UML, Types of Data, structured, unstructured, semi structured, examples of real world data, data collection techniques, data interpretation mechanisms. Data storage mechanisms, Hierarchy of storage, Characteristics of storage, Storage media, storage related technologies, online and offline storage mechanisms

Unit 5

Introduction to Data Science - Steps – Skills – Data – Datasets – Existing data sources – data models, Applications

<u>TextBook</u>

1. J. Glenn Brookshear,"Computer Science: An Overview", Addision-Wesley, Twelfth Edition, 2014.
2. Fundamentals of Database Systems, 7th Edition, Ramez Elmasri, U. Shamkant B. Navathe.
3. The Unified modelling language Reference Manual, Grady Booch, James Rumbaugh, Ivar Jacobson.
4. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.
5. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	2	3	-	-	-	1	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	3	2	-	-	-	-	-	-	-	-	-	-

PROBLEM SOLVING AND PROGRAMMING IN C 3 1 0 4

Objectives: This **course** is designed to provide complete knowledge of **C** language. Students learns programming constructs develop logic and create programs and applications in **C**.

Course Outcomes

C01	Be familiar withalgorithms and flowcharts
CO2	Be familiar with the C Programming language which includes the structure of a C program, Tokens, Expressions, Operators Control statements.
CO3	Inscribe C programs that uses pointers to access arrays, strings, structures and union.
CO4	Exercise user defined functions to solve real time problems.
CO5	Be familiar with pointers and also access files in C.

Syllabus

Unit 1
Problem Solving, Problem definition, Problem decomposition, Abstraction, Greedy Method, Divide and Conquer. Algorithm and Flowcharting, Name binding, Selection, Repetition.

Unit 2
Introduction to C language - structure of 'C' program, Programming elements(tokens) –Classes of data types –Declaration of variables, assigning values to variables, defining symbolic constants, escape sequences (backslash character constants), Operators–operator precedence and associativity, Expressions – Evaluation of expressions, type conversions(type casting). Input and Output operations – formatted and unformatted input and output–Conversion specifiers-Conditional and Control structures

Unit 3
Arrays – single dimensional arrays - declaration –memory representation– initialization and access. 2D arrays and multidimensional arrays and its applications.
Strings – defining strings, initializing, accessing, character handling functions, arithmetic operations on characters, character by character input and output, string handling functions, array of strings and its features. Structures-Definition, initializations, structures and arrays, accessing structures ,Union- declaration and initializations.

Unit 4
Functions – definition-declaration-prototypes and function call- actual and formal arguments-types of functions- call by value-call by reference-nesting of functions-recursive functions-pointers to functions-storage class specifiers.

Unit 5
Pointers, Definition, pointers and arrays, pointers and structures, Pre-processor directives, Files – Reading and writing files.

TEXT BOOKS:

1. David Riley and Kenny Hunt , Computational thinking for modern solver, Chapman & Hall/CRC, 2014
2. "Let us C", YashavantKanetkar, 13th Edition, BPB Publications.
3. "Programming in ANSI C", E. Balagurusamy, Sixth Edition, Tata McGraw-Hill Publishing Company Limited.

REFERENCES:

1. "Test your C skills", Yashavant Kanetkar,
2. "Exploring C", Yashavant Kanetkar,

Evaluation Pattern:

Internal Assessment: 50

End Semester Examination: 50

Internal Assessment:

Periodical1-15 marks

Periodical2-15 marks

Continuous Assesment-20 marks (Quizzes, assignments, tutorials, viva-voce)

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	=	-	-	-	-

PROBLEM SOLVING AND PROGRAMMING IN C LAB 0 0 3 1

Objectives:

The purpose of this course is to introduce to students to the field of programming using C language. The students will be able to enhance their analysing and problem solving skills and use the same for writing programs in C.

Course Outcomes

C01	Develop flowcharts using flowgarithm
CO2	Develop C programs that uses conditional and iterative statements, arrays, strings, functions, pointers and files

Unit 1: Flowgorithm and Linux commands

Operators- Arithmetic, Relational, assignment, logical, increment and decrement
Control Statements-if, if-else, nested if
Looping Control-while, for, do-while

Unit 2: C Programming

Operators- Arithmetic, Relational, Ternary, Logical, Bitwise
Control Statements-if, if-else, nested if, if-else if, switch, goto
Looping Control-while, for, do-while
Arrays-one-dimensional- creating, displaying merging, searching, sorting, reversing
Arrays-Two-dimensional- creating, displaying, Operations on 2D arrays
Strings-String functions, manipulation of strings, multi strings
Functions – passing arguments, returning values, recursive functions, pointers as arguments
Structures & pointers

Evaluation Pattern:

Internal Assessment: 80

End Semester Examination: 20

Internal Assessment:

Periodical1-30 marks

Periodical2-30 marks

Continuous Assesment-20 marks (Quizzes, assignments, tutorials, viva-voce)

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	1	-	-	-	-	-	-	-	-	-	-	-

COMPUTER ESSENTIALS FOR DATA SCIENCE LAB 0 0 3 1

COURSE OUTCOMES

CO1: Provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.

CO2: Understand the functional components of a computer system (processor, storage and input/output) in terms of assembly language commands. Understand the relationship between high level programming languages and machine level implementation. Understand computer architecture and its relationship to higher level machine abstractions. Also able to how to represent integers, real numbers, and character data, representation of negative numbers, storage capacity and its effect on numeric magnitude. Perform arithmetic operations on binary and hexadecimal notations. Convert numbers between decimal, binary and hexadecimal notations.

CO3: Must be able to construct simple and advanced database queries using Structured Query Language (SQL)

CO4: Understand the concept Identify Business Requirements. Entity Relationship Data Modeling, Normalization, Advanced Data Modeling Concepts, Transform a Data Model into a Functional Database. Create conceptual models of relational databases based on requirement specification documents

CO5: Understand the data storage concepts, data storage equipment's that are used to store the user / computer generated data.

SYLLABUS

Usage of Word, excel and PowerPoint

PC Assembly Data representation and operations on Binary data

SQL-Create: Table and column level constraints- Primary key, Foreign key, Null/ Not null, Unique, Default. Check, Alter, Drop, Insert, Update, Delete, Truncate, Select: using WHERE, AND, OR, IN, NOT IN

Data collection and interpretation

Data storage mechanism and tools

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	2	3	-	-	-	1	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	3	2	-	-	-	-	-	-	-	-	-	-

CO1	Helps the students to imbibe values into their inner sprit and put it into real life practice.

SEMESTER 2

CULTURAL EDUCATION II 2 0 0 2

Objectives: Love is the substratum of life and spirituality. If love is absent life becomes meaningless. In the present world if love is used as the string to connect the beads of values, life becomes precious, rare and beautiful like a fragrant blossom. Values are not to be learned alone. They have to be imbibed into the inner sprit and put into practice. This should happen at the right time when you have vitality and strength, when your hearts are open.

The present course in value education is a humble experience based effort to lead and metamorphosis the students through the process of transformation of their inner self towards achieving the best. Amma's nectarous words of wisdom and acts of love are our guiding principles. Amma's philosophy provides an insight into the vision of our optimistic future.

Course Outcomes

CO2	Help the students towards achieving the best through the process of transformation of their inner self.
CO3	Provides the students an insight into the vision of optimistic future.

Syllabus:

Bhagavad Gita and Life Management

Historicity of Ramayana and Mahabharata

Overview of Patanjali's Yoga Sutras

Highlights of Indian Mythology

Indian Society: Its Strengths and Weaknesses

Role & Position of Women in Indian Society

Indian Models of Economy, Business and Management

Health and Lifestyle related issues

Conservation of cultural heritage

Life and work of Great Seers of India (2)

TEXTBOOKS:

1. *The Glory of India (in- house publication)*
2. *Sanatana Dharma (A Compilation of Amma's teachings on Indian Culture)*

CO – PO Affinity Map

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CO2	-	-	-	-	-	-	-	4	2	3	3	-	-	-	-
CO3	-	-	-	-	4	-	3	3	-	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PROFESSIONAL COMMUNICATION **1- 0-3-2**

Objectives:

To convey and document information in a formal environment; to acquire the skill of self projection in professional circles; to inculcate critical and analytical thinking.

Course outcomes:

CO1	Understand the role of communication in personal & professional success.
CO2	Develop awareness of appropriate communication strategies.
CO3	Build and maintain healthy and effective relationships.
CO4	Identify and apply strategies to improve communication especially in meetings
CO5	Enables students to build up language and specialized abilities such as meeting, management and documentation, argumentation, conflict resolution, interpersonal and intercultural skills, professional presentations and employment starters.

Syllabus

Unit I

Vocabulary Building: Prefixes and Suffixes; One word substitutes, Modal auxiliaries,Error Analysis: Position of Adverbs, Redundancy, misplaced modifiers**,**Dangling modifiers – Reported Speech

Unit II

Instruction, Suggestion & Recommendation - Sounds of English: Stress, Intonation- Essay writing: Analytical and Argumentative

Unit III

Circulars, Memos – Business Letters - e - mails

Unit IV

Reports: Trip report, incident report, event report - Situational Dialogue - Group Discussion

Unit V

Listening and Reading Practice - Book Review

References

1.FelixaEskey. Tech Talk, University of Michigan. 2005

2.Michael Swan. Practical English Usage, Oxford University Press. 2005

3. Anderson, Paul. Technical Communication: A Reader Centered Approach, V Edition, Hercourt, 2003.

4. Raymond V. Lesikar and Marie E. Flatley. Basic Business Communication, Tata Mc Graw Hill Pub. Co. New Delhi. 2005. Tenth Edition.

5.Thampi, G. Balamohan. Meeting the World: Writings on Contemporary Issues. Pearson, 2013.

6.Lynch, Tony. Study Listening. New Delhi: CUP, 2008.

7.Kenneth, Anderson, Tony Lynch, Joan Mac Lean. Study Speaking. New Delhi: CUP, 2008.

8.Marks, Jonathan. English Pronunciation in Use. New Delhi: CUP, 2007.

9.Syamala, V. Effective English Communication For You (Functional Grammar, Oral and Written Communication): Emerald, 2002.

References

10. FelixaEskey. Tech Talk, University of Michigan. 2005

11. Michael Swan. Practical English Usage, Oxford University Press. 2005

12. Anderson, Paul. Technical Communication: A Reader Centered Approach, V Edition, Hercourt, 2003.

13. Raymond V. Lesikar and Marie E. Flatley. Basic Business Communication, Tata Mc Graw Hill Pub. Co. New Delhi. 2005. Tenth Edition.

14. Thampi, G. Balamohan. Meeting the World: Writings on Contemporary Issues. Pearson, 2013.

15. Lynch, Tony. Study Listening. New Delhi: CUP, 2008.

16. Kenneth, Anderson, Tony Lynch, Joan Mac Lean. Study Speaking. New Delhi: CUP, 2008.

17. Marks, Jonathan. English Pronunciation in Use. New Delhi: CUP, 2007.

18. Syamala, V. Effective English Communication For You (Functional Grammar, Oral and Written Communication): Emerald, 2002.

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CO2	2	1	1		-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3				-		-	-		-	-	-	-

STATISTICS AND PROBABLILITY 3 1 0 4

Unit I

Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Range, Inter quartile range, Standard deviation,), skewness and kurtosis.

Unit II

Sample Space and Events, Interpretations and Axioms of Probability, Addition rules, Conditional Probability, Multiplication and Total Probability rules, Independence, Bayes theorem.

Unit III

Random variables, Probability Distributions and Probability mass functions, Cumulative Distribution functions, mathematical expectation, variance, moments and moment generating function.

Unit IV

Standard discrete distributions - Binomial, Poisson and Uniform. Standard continuous distributions – Exponential and Normal distributions. Chebyshev's theorem.

Unit-V

Two dimensional random variables-Joint, marginal and conditional probability distributions for discrete case only. Conditional mean, conditional variance, covariance and correlation. Correlation Analysis, Regression analysis, Method of least squares - Fitting a straight line.

Textbooks:

1. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons Inc., 2005
2. Amir D Azcel, Jayavel Sounderpandian, Palanisamy Saravanan and Rohit Joshi, Complete Business Statistics, 7th edition McGrawHill education 2012.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education Asia, 2007.

Reference books:

1. Ross S.M., *Introduction to Probability and Statistics for Engineers and Scientists*, 3rd edition, Elsevier Academic Press.

2. Ravichandran, J. Probability and Statistics for engineers, First Reprint Edition, Wiley India, 2012.

Database Management System 3 0 0 3

Objectives*: The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS. Particular course also proposed to provide the competent way of designing and maintaining database systems and optimized retrieval of data at the right time.*

Course Outcomes

CO1	**Master the basic concepts of DBMS and its types. Understand the concepts of data independence and three schema architecture.**
CO2	**Be familiar with the CODD's rules and E-R Model and also have clear picture about the structure of the relational databases.**
CO3	**Master the concept of normalization and different types of normalization. Design normalised database objects and process the data in an optimized way.**
CO4	**Be familiar with the basics of query evaluation techniques and query optimization and also to get a clear picture about transaction processing.**
CO5	**Comprehend the conversion of queries into relational algebra and to construct query transactions having atomic, consistent, isolated and durable properties.**

UNIT 1

Introduction to Data and Database. Significance of Database Management System, Various Types of DBMS. Data Independence - The Three Levels Of Architecture - The External Level - Conceptual Level - Internal Level - Client/Server Architecture- System Structure , Instance and schema,

UNIT 2

Keys - CODD’s Rules, Design Issues -ER – Model –Attribute types- Weak Entity Sets - Extended ER Features –ER to Relational Mapping, Structure Of Relational Databases, Creation and Manipulation of Database using Basic SQL(DDL, DML,DCL,TCL)

UNIT 3

Normalization –Anomalies- Functional Dependency: Armstrong's axioms- closure of a relation and closure of attribute– Lossless decomposition-1NF, 2NF, 3NF, Boyce - Codd Normal Form

UNIT 4

The Relational Algebra -- Query Processing and Optimization: Evaluation of Relational algebra expressions-Query Equivalence-Transaction Processing: ACID properties, states of a transaction-Introduction to concurrency control-Deadlock-Recovery.

TEXTBOOKS:

1. Silberschatz. Korth. Sudarshan: Database System Concepts - 6thEdition Mcgraw-Hill International Edition
2. Ivan Bayross: Sql- PL/SQL The Programming Language Of Oracle- 4rd Edition- Bpb Publications

REFERENCE:

1. C.J. Date: An Introduction To Database Systems - Eighth Edition - PearsonEducation Asia
2. Kevin Loney - George Koch: Oracle 9i The Complete Reference Mcgraw-Hill International Edition
3. "Fundamentals of Database Systems" by Elmasri and Navathe

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-2	-	-	-	-	-	-	-	-	-	-
CO2	2	1	4	3	-2	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	2	-3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	-	-2	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	3		-		-	-		-	-	-	-

OBJECT ORIENTED PROGRAMMING USING JAVA 3 1 0 4

Objectives: *The main objective of this course is to understand the basic concepts and techniques which form the object oriented programming paradigm using Java Language.*

COURSE OUTCOMES

CO1: Identify classes, objects, members of a class and relationships among them needed for a specific problem.

CO2: Write Java application programs using OOP principles and proper program structuring

CO3: Demonstrate the concepts of polymorphism, inheritance and thread and document a Java program using Javadoc.

CO4: Use Java AWT and Swing classes to build GUIs and understand how collection interface is implemented.

CO5: Demonstrate the Conceptual model of UML, activity diagram and their modelling techniques.

SYLLABUS

Unit1

Introduction to object oriented software design, Comparison of programming methodologies, Object Basics, Java Environment, Classes and Object, Data Members, Access Specifiers, Arrays within a Class, Array of Objects, Constructors, Default Constructors, Destructors, Static Members, Constant Members,

Unit2

Overview of Streams, Bytes vs. Characters, File Object, Binary Input and Output, Reading and Writing Objects, Method Overriding, Polymorphism, Super, Interfaces and Abstract Classes, Packages, Exception

Unit3

Introduction to Threads, Creating Threads, Thread States, Runnable Threads, Coordinating Threads, Interrupting Threads, Runnable Interface, Synchronization.

Unit 4

Collection framework, Collection interfaces and classes, AWT, Swing, Event Handling, Javadoc

Unit 5

Object Oriented Design with UML, Class, object diagrams and sequence diagrams. Use case diagrams and activity diagrams.

TEXTBOOK:

Herbert Schildt, *"Java: The Complete Reference, Eleventh Edition", Oracle 2018*

REFERENCES:

1. *Ali Bahrami, "Object Oriented Systems Development", Second Edition, McGraw-Hill,2008.*
2. *Grady Booch and Robert A. Maksimchuk, "Object-oriented Analysis and Design with Applications", Third Edition,Addison Wesley, 2006.*
3. *Jaime Nino, Fredrick a Hosch, "An Introduction to Programming and Object Oriented Design using Java", Wiley India Private Limited, 2010.*

CO – PO Affinity Map

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CO2	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	-	2	-	-	-	-	-	-	-	-	-	-
CO4	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	1	-	2	-	-	-	2	-	-	-	-	-	-

OPERATING SYSTEMS 3 1 0 4

Objectives: Fundamental concepts and designs will be covered along with the practical aspects that pertain to the most popular operating systems such as Unix/Linux and Windows, and some instructional operating systems will be studied as well.

CO1: Understand the basic concepts of operating system with different types of OS, services and system calls

CO2: Get knowledge of process management, Inter process communication and various CPU scheduling algorithms

CO3:Learn about deadlocks, methods of handling deadlocks and preventing deadlocks.

CO4:Understand the concept of memory management -paging and segmentation.

CO5:Learn about various I/O systems and mass storage structures

UNIT 1

Introduction to Operating Systems: Mainframe systems-Desktop systems-Multiprocessor systems- Distributed systems-Clustered systems-Real-time systems-Handheld systems.
Operating System Structures: System components-Operating System services-System calls-System Programs.

UNIT 2

Process Management: Process Concept-Process Scheduling-Operations on processes-Cooperating processes-Inter Process Communication. CPU Scheduling: Basic concepts-Scheduling criteria-Scheduling Algorithms-First Come First served Scheduling, Shortest job First Scheduling, Round Robin Scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling. Process synchronisation: Background, critical section problem, semaphores, monitors, producer consumer problem, dining philosophers problem, readers and writers problem.

UNIT 3

Deadlocks: System Model-Deadlock Characterization-Methods for handling Deadlocks-Deadlock Prevention-Deadlock Avoidance-Deadlock detection-Recovery from deadlock.

UNIT 4

Memory Management: Background-Swapping-Contiguous Memory allocation-Paging-Segmentation-Segmentation with Paging. Virtual Memory: Background-Demand paging-Process creation-Page replacement-Allocation of Frames-Thrashing.

UNIT 5

I/O Systems: Overview, I/O Hardware
Mass storage structure- Disk structure, disk scheduling, disk management.
Case study on desktop and mobile operating system

TEXT BOOK:

1. Silberschatz and Galvin, "*Operating System Concepts*", 9th Edition, John Wiley and Sons, 2012.

REFERENCES:

1. Godbole - Operating Systems - Tata McGraw Hill Publications

2. H.M Deitel - Operating Systems - Second Edition - Pearson Edition Asia
3. Andrew S. Tannenbaum, "*Modern Operating Systems*", 4th Edition, Pearson, 2015.

CO – PO Affinity Map

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CO2	2	3	2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	3	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	-	-	-	-	-	-	-	-	-	-	-

OBJECT ORIENTED PROGRAMMING USING JAVA LAB 0 0 3 1

COURSE OUTCOMES

CO1: The skills to apply OOP in Java programming in problem solving.

CO2: Write a complete class definition and with in the class definition, write constructor and overloaded methods.

CO3: Conceptualize, Analyze and write programs to solve more complicated problems using the concepts of multi-threading and Exception handling.

CO4: Use Java AWT and Swing classes to build GUIs and understand how collection interface is implemented.

CO5: Demonstrate event handling in GUIs.

SYLLABUS

Input / Output statements, Manipulators, Structures, Classes, Objects, Static members and functions, Constructors and destructors, Constructor overloading, Function overloading, Forms of inheritance, Exception handling, Interfaces, Multithreading, Thread Synchronization, Collection Framework, AWT, Swing, Event Handling.

CO – PO Affinity Map

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CO1	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	1	-	2	-	-	-	-	-	-	-	-	-	-
CO4	1	1	3	-	2	-	-	-	-	-	-	-	-	-	-
CO5	1	1	2	-	2	-	-	-	-	-	-	-	-	-	-

Database Management System LAB 0 0 3 -1

Objectives*:* *The course is aimed at providing the skills for developing database and it various objects. Students will be able to create structured query language to manipulate data in the database. They will be also able to construct application using P/SQL.*

Course Outcomes

CO1	**Master the basic commands of SQL and its usage**
CO2	**Design tables and insert Relevant data for query manipulation**
CO3	**Understand the application of SQL functions, sub queries and joins**
CO4	**Construct interactive PL/SQL programs for database applications**

Syllabus

Basic SQL Commands DML- Select, insert, Delete

DDL Commands-Create, Drop, Alter

Built in SQL functions- Set operations, Sub Queries-Joins-DCL – TCL- Views – Sequences – Index – Locks

PL/SQL Basics – Exceptions – Cursors - Stored Functions – Triggers

Programming with PL/SQL

TEXTBOOKS:

1. Ivan Bayross: Sql- PL/SQL The Programming Language Of Oracle- 4rd Edition- Bpb Publications

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CO2	1	2	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	4	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	4	1	-	-	-	-	-	-	-	-	-	-	-

SEMSTER 3

AMRITA VALUES PROGRAMME I 1 0 0 1

Objectives: Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Course Outcomes:

CO1	To make students familiar with the rich tapestry of Indian life, culture, arts, science and heritage.

CO2	To give exposure to students about richness and beauty of Indian way of life.

Syllabus: Courses offered under the framework of Amrita Values Programmes I and II

Insights into Indian Classical Music
The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Sapta talas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

Insights into Traditional Indian Painting
The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

Insights into Indian Classical Dance
The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the Abhinava Bharati. The course introduces various styles of Indian classical dance such as Bharatanatyan, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

Indian Martial Arts and Self Defense
The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala's traditional Kalari Payattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

Social Awareness Campaign
The course introduces the students into the concept of public social awareness and how to transmit the messages of social awareness through various media, both traditional and modern. The course goes through the theoretical aspects of campaign planning and execution.

Temple Mural Arts in Kerala
The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirties, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the vasthupurusha.

Organic Farming in Practice

Organic agriculture is the application of a set of cultural, biological, and mechanical practices that support the cycling of farm resources, promote ecological balance, and conserve biodiversity. These include maintaining and enhancing soil and water quality; conserving wetlands, woodlands, and wildlife; and avoiding use of synthetic fertilizers, sewage sludge, irradiation, and genetic engineering. This factsheet provides an overview of some common farming practices that ensure organic integrity and operation sustainability.

Ayurveda for Lifestyle Modification:
Ayurveda aims to integrate and balance the body, mind, and spirit which will ultimately leads to human happiness and health. Ayurveda offers methods for finding out early stages of diseases that are still undetectable by modern medical investigation. Ayurveda understands that health is a reflection of when a person is living in harmony with nature and disease arises when a person is out of harmony with the cycles of nature. All things in the universe (both living and non-living) are joined together in Ayurveda. This leaflet endow with some practical knowledge to rediscover our pre- industrial herbal heritage.

Life Style and Therapy using Yoga
Yoga therapy is the adaptation of yogic principles, methods, and techniques to specific human ailments. In its ideal application, Yoga therapy is preventive in nature, as is Yoga itself, but it is also restorative in many instances, palliative in others, and curative in many others. The therapeutic effect comes to force when we practice daily and the body starts removing toxins and the rest is done by nature.

CO – PO Affinity Map

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CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

LIFE SKILLS I **1 0 2 2**

Objectives: Bridge the gap between a student and a student becoming an employee or an entrepreneur. Aims to provide students with the knowledge and skills to understand and participate in the modern business scenario and the world of economics so as to prepare them to achieve success in their career.

Course outcomes

	Soft Skills:
CO1	At the end of the course, the students would have developed self-confidence and positive attitude necessary to compete and challenge themselves. They would also be able to analyse and manage their emotions to face real life situations.
CO2	At the end of the course, the students shall learn to examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arrive at a consensus.
CO3	At the end of the course, the students will have the ability to prepare a suitable resume. They would also have acquired the necessary skills, abilities and knowledge to present themselves confidently. They would be sure-footed in introducing themselves and facing interviews.
CO4	At the end of the course the students will have the ability to analyse every question asked by the interviewer, compose correct responses and respond in the right manner to justify and convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.
	Aptitude:

CO5	At the end of the course, the student will have acquired the ability to analyse, understand and classify questions under arithmetic, algebra and logical reasoning and solve them employing the most suitable methods. They will be able to analyse, compare and arrive at conclusions for data analysis questions.
CO6	At the end of the course, students will be able to interpret, critically analyse and solve logical reasoning questions. They will have acquired the skills to manage time while applying methods to solve questions on arithmetic, algebra, logical reasoning, statistics and data analysis and arrive at appropriate conclusions.
	Verbal:
CO7	At the end of the course, the students will have the ability to understand the nuances of English grammar and apply them effectively.
CO8	At the end of the course, the students will have the ability to relate, choose, conclude and determine the usage of right vocabulary.
CO9	At the end of the course, the students will have the ability to decide, conclude, identify and choose the right grammatical construction.

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self-motivation and continuous knowledge upgradation.

Self Confidence: Characteristics of the person perceived, characteristics of the situation, Characteristics of the Perceiver. Attitude, Values, Motivation, Emotion Management, Steps to like yourself, Positive Mental Attitude, Assertiveness.

Presentations: Preparations, Outlining, Hints for efficient practice, Last minute tasks, means of effective presentation, language, Gestures, Posture, Facial expressions, Professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words.

Listening Skills: The importance of listening in communication and how to listen actively.

Prepositions and Articles: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving; Number System; LCM &HCF; Divisibility Test; Surds and Indices; Logarithms; Ratio, Proportions and Variations; Partnership; Time speed and distance; work time problems;

Data Interpretation: Numerical Data Tables; Line Graphs; Bar Charts and Pie charts; Caselet Forms; Mix Diagrams; Geometrical Diagrams and other forms of Data Representation.

Logical Reasoning: Family Tree; Linear Arrangements; Circular and Complex Arrangement; Conditionalities and Grouping; Sequencing and Scheduling; Selections; Networks; Codes; Cubes; Venn Diagram in Logical Reasoning.

TEXTBOOKS:

1. A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.

2. Adair J (1986) - "Effective Team Building: How to make a winning team", London, U.K: Pan Books.

3. Gulati S (2006) - "Corporate Soft Skills", New Delhi, India: Rupa& Co.

4. The Hard Truth about Soft Skills, by Amazone Publication.

REFERENCES:

1. *Quantitative Aptitude, by R S Aggarwal, S Chand Publ.*
2. *Verbal and Non-verbal Reasoning, R S Aggarwal, S Chand Publ.*
3. *Data Interpretation, R S Aggarwal, S Chand Publ.*
4. *Nova GRE, KAPAL GRE, Barrons GRE books;*
5. *Quantitative Aptitude, The Institute of Chartered Accountants of India.*
6. *More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.*
7. *The BBC and British Council online resources*
8. *Owl Purdue University online teaching resources*
9. *www.thegrammarbook.com online teaching resources*
10. *www.englishpage.com online teaching resources and other useful websites.*

CO – PO Affinity Map

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CO2	-	-	-	-	-	-	-	-	1	-	1	1	-	-	-
CO3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	1	1	1	-	1	-	-	-	-	-	-	-	-	-
CO6	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO7	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO8	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO9	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-

EXPLORATORY DATA ANALYSIS USING PYTHON 3 0 3 4

Objective: The course aims to *make the student* acquainted *with general computer programming concepts like conditional execution, loops, Python programming language syntax, semantics, and the runtime environment, as well as with general coding technique. The course also helps to* understand about how to handle data and to visualize data using various Python packages and tools.

Course Outcomes

CO1	Give basic knowledge about python variables, operators and data types
CO2	Helps to get an idea about python control structures
CO3	To be aware of python complex data types
CO4	Familiarize with Python files, databases and advanced python objects.
CO5	Get an overall idea about various python packages and GUI programming along with thorough understanding of data and its formatting.

Unit 1
Introduction to Python: Python variables, Python basic Operators, Understanding python blocks. Python Data Types, Declaring and using Numeric data types: int, float etc.

Unit 2
Python Program Flow Control Conditional blocks: if, else and else if, Simple for loops in python, For loop using ranges, string, list and dictionaries. Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.

Unit 3
Python Complex data types: Using string data type and string operations, Defining list and list slicing, Use of Tuple data type. String, List and Dictionary, Manipulations Building blocks of python programs, string manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list and dictionary in-built functions. Python Functions, Organizing python codes using functions.

Unit 4
Advanced Python Objects, map(),Advanced Python Lambda and List Comprehensions, Advanced Python Demonstration: The Numerical Python Library (NumPy), The Series Data Structure, Querying a Series, The DataFrame Data Structure, DataFrame Indexing and Loading, Querying a DataFrame, Indexing Dataframes, Missing Values.

Unit 5

Understanding the Python Packages for Data Science- SciKit Learn, MatPlotLib, Importing and Exporting Data in Python, Getting Started Analyzing Data in Python, Understanding the Data, Dealing with Missing Values in Python, Data Formatting in Python

Text Book/References

1. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016
2. Jeeva Jose &P.SojanLal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Publishers, New Delhi, 2016
3. Downey, A. et al., "How to think like a Computer Scientist: Learning with Python", John Wiley, 2015
4. John Zelle, “Python Programming: An Introduction to Computer Science”, Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410

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CO3	3	3	2	1	2	-		-	-	-	-	-	-	-	-
CO4	3	3	3	2	3	-	1	-	-	-	-	-	-	-	-
CO5	4	3	3	3	3	-	1	-	-	-	-	-	-	-	-

DATA STRUCTURES AND ALGORITHMS 3 1 0 4

OBJECTIVES: This course is intended to introduce abstract concepts and shows how those concepts are useful in problem solving, and then shows how the abstractions can be made concrete by using a programming language. The course aims to provide an understanding about different data structures and relevant standard algorithms for them. Equal emphasis is placed on both the abstract and the concrete versions of a concept. The only prerequisite for students is an understanding in programming.

Course Outcomes

CO1	Student will be able to understand the basic pseudocode conventions and methods of analysing algorithms
CO2	Learn the working of various searching and sorting algorithms
CO3	Able to develop applications using suitable data structures
CO4	Understand the tree and tree traversal concepts
CO5	Gives an idea about graphs and finding shortest path

Unit 1. Algorithm Analysis

Basic mathematical review, RAM model of computation, Pseudocode conventions, Worst case, Average case and Best case analysis, Asymptotic Analysis, Back Substitution Method, masters method, Euclid's algorithm, Exponentiation.

Unit 2: Searching and Sorting

Linear Search, Binary Search – Analysis, Bubble Sort, Insertion Sort, Merge sort, Quick Sort

Unit 3. Linear Data Structures

Abstract Data Type, List ADT: Singly linked lists, Doubly linked lists, Circular Linked Lists, Stack ADT implementation and applications, Queue ADT: Implementation and Application. Circular Queue, Priority Queue

Unit 4. Non-Linear Data Structures.

Basic concepts of trees, Implementation of trees, Traversal, Binary tree, Expression tree, Binary search tree, AVL tree, Heaps.

Unit 5. Graphs

Adjacency matrix, Adjacency list, BFS, DFS, MST, PRIMS and KRUSKAL'S, DIJKSTRA'S algorithm

Text Book: Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education

References: 1. Samanta, Debasis. Classic data structures. PHI Learning Pvt. Ltd., 2004.

2. Cormen, Thomas H. Introduction to algorithms. MIT press, 2009.

DATA STRUCTURES AND ALGORITHMS LAB-I 0 0 3 1

Objectives: The **course** is designed to develop skills to design and analyse simple linear and non-linear **data structures** and **c**ompare the performance of different algorithms for same problem. It strengthen the ability to the students to identify and apply the suitable **data structure** for the given real world problem.

Course Outcomes

CO1	Student will be able to implement various sorting algorithms
CO2	Learn to apply array, Linked list, stack and queue concepts to solve real world problems
CO3	Learn to implement binary search trees, traversal algorithms and various operations
CO4	Understand graph and traversal algorithms

Syllabus

Topic 1: Sorting – Searching

1. Write a program to implement Bubble Sort.
2. Write a program to implement selection sort.
3. Write a program to implement Quick Sort.
4. Write a program to implement Insertion Sort.
5. Write a program to implement Merge Sort.
6. Write a program to implement Binary Search.

Topic 2: ***Arrays –Stacks-Recursion***

7. Write and test a function that transposes a square matrix.
8. Write and test a recursive function that prints all the permutations of the first n characters of a string.
9. Write and test a recursive function that returns the power x^n
10. Write a program to implement a stack of strings (illustrate the operations push (), pop(), size(), empty() and top()).
11. Write a program to show the linked implementation of the ***Stack*** class.
12. Write a program to covert infix to postfix.
13. Write a program to implement Towers of Hanoi using Stack.

Queues-Linked-Lists

14. Write a program to implement a linear list and perform the operation such as insert(), search() and delete().
15. Write a program to implement a queue by adding the functions such as
    - (i) Determine the size
    - (ii) input queue
    - (iii) output a queue
    - (iv) split a queue into two queues
16. Write a program to search a circular linked list with a header node.

Topic 3: ***Binary Trees - Binary Tree Traversal***

17. Write a program to implement Binary Search Tree.
18. Priority queue implementation.
19. Write a program to create a binary tree and find the height of a binary tree.
20. Write a program to perform the binary tree traversals.
21. Write a program to perform a deletion from a Binary Tree (using a delete () function).

Topic 4: ***Graphs***

20. Matrix representation of graphs
21. DFS traversal
22. BFS traversal

COMPUTER NETWORKS 3-1-0-4

COURSE OBJECTIVES:

This course studies the standard models for the layered approach to communication between autonomous machines in a network, and the main characteristics of data transmission across various physical link types. It considers how to design networks and protocols for diverse situations, analyses several protocols, and identifies significant problem areas in networked communications.

COURSE OUTCOMES

CO1: Understand the basic network concepts, including the structure and operation of the different types of networks

CO2: Must be able to understand the design of different networks and related reference models used.

CO3: Comprehend the basic working principles behind switching techniques used in communication channels.

CO4: Familiarize the routing techniques and congestion control mechanisms used in Routers. Must be able to understand and successfully apply routing algorithms for optimization.

CO5: Must be able to understand, how is the end-to-end connection mechanism works at the transport layer.

SYLLABUS

Unit 1:- Introduction to Computer Networks

Introduction To Computer Networks: Introduction: Definition of a Computer Network; Components of a computer network; Classification of networks; Transmission Medium; Wireless transmission; Local area networks, Metropolitan area networks, Wide area networks, Wireless networks ; Data transmission modes;

Unit 2:-Layered architecture

Network Software & Network Standardization: Networks Software; Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Reference models; The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models

Unit 3:- Physical layer

Physical Layer: Network topologies; Switching; Circuit switching, Message switching, Packet switching, Relationship between Packet Size and Transmission time, Comparison of switching techniques: Multiplexing; FDM, WDM, TDM

Unit 4:-Network Layer

Network Layer: Design issues of Network layer; Nature of the service provided, Routing, Congestion control, Types of routing algorithms, Classes of routing algorithms, Properties of routing algorithms, Optimality principle: Routing algorithms; Shortest path algorithm, Flooding, Distance vector routing, Hierarchical routing, Link state routing, Factors of congestion, Comparison of flow control and congestion control, General principles of congestion control

Unit 5:- Transport Layer

Transport Layer: Services of Transport layer; Service primitives: Connection establishment: Connection Release: Transport Protocols;

Text Books:-

1. Computer Networks, 4th Edition, Andrew S. Tanenbaum.

Reference text books:

2. Computer Networks top down approach by Mc graw hill:- Forouzan
3. Computer Networks top down approach by pearson :- James F Kurose

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO 2	PSO 3
CO1	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	1	-	-	-	1	-	-	-	-	-
CO4	3	3	1	1	3	1	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	1	-	-	-	-	-	-	-	-	-	-

DATA SCIENCE USING SPREADSHEET MODELLING LAB 0-0-3-1

Objectives: To familiarize students with the spreadsheet data presentation and analysis features using graphs and charts. Also performing qualitative data analysis using functions like IF, data sort and filter. This course also aims in performing conditional formatting and using pivot tables for qualitative data analysis. Finally it covers how to develop macros and perform inferential statistics of data using Chi-square, z-test and ANOVA.

Course Outcomes

CO1	Presentation and Analysis of quantitative data using graphs and charts.
CO2	Presentation of Qualitative data using IF, data sort and filter.
CO3	Perform conditional formatting using autosum, vlookup, hlookup, math functions.
CO4	Analysis of qualitative data using pivot table and charts.
CO5	Develop macros and perform inferential statistics of data using Chi-square, z-test and ANOVA.

Syllabus:

Presentation of quantitative data: Data Visualization – types of graphs and charts

Analysis of quantitative data – Descriptive Statistics

Presentation of qualitative data: Preparation, Data Conversion using IF, Data conversion from non-excel sources, Data Queries with sort, filter and advanced filter

Conditional formatting, format as table, autosum, fill, Vlookup, Hlookup, Math functions, Name manager, Group and Ungroup data

Analysis of qualitative data – Dealing with errors - Trace, Pivot reports – Pivot table and charts

Data Validation, Macros

Inferential statistics of data – Chi-square test, z-test, t-test, confidence intervals for sample statistics, ANOVA

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	4	4	2	4	-	4	-	1	-	-	-	-	-	-	-
CO2	4	4	2	3	4	3	-	1	-	-	-	-	-	-	-
CO3	4	4	2	3	4	3	-	1	-	-	-	-	-	-	-
CO4	4	4	2	4	4	4	-	1	-	-	-	-	-	-	-
CO5	4	4	2	5	4	4	-	1	-	-	-	-	-	-	-

SEMESTER IV

AMRITA VALUES PROGRAMME II 1 0 0 1

Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Courses offered under the framework of Amrita Values Programmes I and II

Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Sapta talas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

Insights into Indian Classical Dance

The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the Abhinava Bharati. The course introduces various styles of Indian classical dance such as Bharatanatyan, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

Indian Martial Arts and Self Defense

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala's traditional Kalari Payattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

Social Awareness Campaign

The course introduces the students into the concept of public social awareness and how to transmit the messages of social awareness through various media, both traditional and modern. The course goes through the theoretical aspects of campaign planning and execution.

Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirties, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the vasthupurusha.

Organic Farming in Practice

Organic agriculture is the application of a set of cultural, biological, and mechanical practices that support the cycling of farm resources, promote ecological balance, and conserve biodiversity. These include maintaining and enhancing soil and water quality; conserving wetlands, woodlands, and wildlife; and avoiding use of synthetic fertilizers, sewage sludge, irradiation, and genetic engineering. This factsheet provides an overview of some common farming practices that ensure organic integrity and operation sustainability.

Ayurveda for Lifestyle Modification:

Ayurveda aims to integrate and balance the body, mind, and spirit which will ultimately leads to human happiness and health. Ayurveda offers methods for finding out early stages of diseases that are still undetectable by modern medical investigation. Ayurveda understands that health is a reflection of when a person is living in harmony with nature and disease arises when a person is out of harmony with the cycles of nature. All things in the universe (both living and non-living) are joined together in Ayurveda. This leaflet endow with some practical knowledge to rediscover our pre- industrial herbal heritage.

Life Style and Therapy using Yoga

Yoga therapy is the adaptation of yogic principles, methods, and techniques to specific human ailments. In its ideal application, Yoga therapy is preventive in nature, as is Yoga itself, but it is also restorative in many instances, palliative in others, and curative in many others. The therapeutic effect comes to force when we practice daily and the body starts removing toxins and the rest is done by nature.

LIFE SKILLS II **1 0 2 2**

Professional Grooming and Practices: Basics of Corporate culture, Key pillars of Business Etiquette. Basics of Etiquette: Etiquette – Socially acceptable ways of behaviour, Personal hygiene, Professional attire, Cultural Adaptability. Introductions and Greetings: Rules of the handshake, Earning respect, Business manners. Telephone Etiquette: activities during the conversation, Conclude the call, To take a message. Body Language: Components, Undesirable body language, Desirable body language. Adapting to Corporate life: Dealing with people.

Group Discussions: Advantages of Group Discussions, Structured GD – Roles, Negative roles to be avoided, Personality traits to do well in a GD, Initiation techniques, How to perform in a group discussion, Summarization techniques.

Listening Comprehension advanced: Exercise on improving listening skills, Grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading Comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving – Money Related problems; Mixtures; Symbol Based problems; Clocks and Calendars; Simple, Linear, Quadratic and Polynomial Equations; Special Equations; Inequalities; Functions and Graphs; Sequence and Series; Set Theory; Permutations and Combinations; Probability; Statistics.

Data Sufficiency: Concepts and Problem Solving.

Non-Verbal Reasoning and Simple Engineering Aptitude: Mirror Image; Water Image; Paper Folding; Paper Cutting; Grouping Of Figures; Figure Formation and Analysis; Completion of Incomplete Pattern; Figure Matrix; Miscellaneous.

Special Aptitude: Cloth, Leather, 2D and 3D Objects, Coin, Match Sticks, Stubs, Chalk, Chess Board, Land and geodesic problems etc., Related Problems

TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. *Adair J (1986) - "Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati S (2006) - "Corporate Soft Skills", New Delhi, India: Rupa& Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*

REFERENCES:

1. *Quantitative Aptitude, by R S Aggarwal, S Chand Publ.*
2. *Verbal and Non-verbal Reasoning, R S Aggarwal, S Chand Publ.*
3. *Quantitative Aptitude by AbjithGuha, Tata McGraw hill Publ.*
4. *More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.*
5. *The BBC and British Council online resources*
6. *Owl Purdue University online teaching resources*
7. *www.thegrammarbook.com online teaching resources*
8. *www.englishpage.com online teaching resources and other useful websites.*

DATA MINING Credit:3-0-0-3

COURSE OBJECTIVE

CO1: To understand data mining process and the resulting patterns, types of data, attributes and knowledge discovery process

CO2: To study the different data preprocessing techniques before applying the data mining process

CO3: To characterize the kinds of patterns that can be discovered by association rule mining

CO4: To learn the different prediction, classification and clustering algorithms

CO5: To categorize and carefully differentiate between situations for applying different data-mining techniques for different applications

Unit 1

Introduction: Introduction to Data Mining-Types of Data and Patterns Mined- Technologies-Applications-Major Issues in Data Mining. Introduction to Data Warehousing: Basic Concepts and Techniques

Unit 2

Knowing about Data-Data Preprocessing: Cleaning– Integration–Reduction–Data Transformation and Discretization

Unit 3

Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods -Apriori and FP Growth algorithms -Mining Association Rules

Unit 4

Classification and Predication: Issues – Algorithms- Decision Tree Induction - Bayesian Classification –k Nearest Neighbor - Prediction - Accuracy- Precision and Recall

Unit 5

Clustering: Overview of Clustering – Types of Data in Cluster Analysis – K Means and K Medoid, Hierarchical Clustering Algorithms

TEXTBOOKS / REFERENCES:

1. Jiawei Han, Micheline Kamber and Jian Pei, “Data mining concepts and Techniques”, Third Edition, Elsevier Publisher, 2006.
2. K.P.Soman, Shyam Diwakar and V.Ajay, “Insight into data mining Theory and Practice”, Prentice Hall of India, 2006.
3. William H Inmon “Building the Data Warehouse”, Wiley, Fourth Edition 2005.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	-	-	3		-	-	-	-	-	-	-	-	-	-
CO2	1	1	2	-		-	-	-	-	-	-	-	-	-	-
CO3		-		3		-	-	-	-	-	-	-	-	-	-
CO4	2	1		3		-	-	-	-	-	-	-		-	-
CO5	2			3	-	2	2	-	-	-	-	-	-	-	-

R Programming for Data Sciences **2- 0- 3** **3**

Preamble

Data Science with R gives a student necessary skill to apply the R programming language through practical examples in order to extract valuable knowledge from data. The goal of this course is to help the student learn the most important tools in R programming language that will allow him/her to practice data science.

Course Outcomes

CO-01: Learn the basic syntax of R programming language
CO-02: Pre-process raw data in R for further analysis.
CO-03: Conduct exploratory data analysis using R
CO-04: Create insightful visualizations to identify patterns from data.
CO-05: Use statistical estimates to make meaningful predictions from data.

Syllabus

Unit 1

Introduction to data science, Knowledge discovery in databases, The Data Science Process - data collection, pre-processing, transformation and modeling, data mining, interpretation and evaluation.

The R Programming Language- Basic concepts, definitions and notations, R as a calculator, Identifiers, constants, R data types, R- Objects: Vectors, Lists, Matrices, Arrays, Factors, Data Frames; Atomic and Recursive Variables, R-Operators.

Unit 2

Conditional statements and Control structures, Looping constructs and Loop control statements.

Function in R Programming- Components of a Function, Built in and user defined Functions, Vector and Matrix manipulation functions, R -strings and string manipulation functions.

Unit 3

Scoping rules in R, Package in R- Installing and Loading Packages in R, using help, access functions from packages.

Getting Data In and Out of R - Importing data from excel, Working with data from files, importing larger Data Sets, loading data from databases, Working with structured and unstructured data, Reading from URL, Storing data using R functions.

Unit 4

Exploring data- Using summary statistics, Visually inspecting data - Histograms and Density plots, Dot Plots, Line Charts, Pie Charts, Boxplots, Scatterplots, saving and exporting results.

R for managing data-Data cleansing, Treating missing values, data transformations, sampling data for modeling- test and training splits, creating sample groups, Data reduction.

Unit 5

R for Basic Statistics- Descriptive Statistics: arithmetic mean, median, Measure of dispersion - Minimum and Maximum values, quantiles, percentiles, IQR, standard deviation, variance.

Linear regression – using linear and logistic regression and making predictions. Characterizing prediction quality. Using correlation to find relations between variables –Pearson, Kendall and Spearman tests.

Lab:

1. Basic Programming assignments to understand the R Syntax, R – objects conditional and loops.

2. Use R functions and packages to extend the R programming environment.
3. Data analysis case study: loading and processing data, visually inspecting and analyzing using statistical estimates.

Text Books:

1. Data Science with R: A Step By Step Guide with Visual Illustrations & Examples, Andrew Oleksy.
2. Practical Data Science with R, Nina Zumel and John Mount, Dreamtech/Manning, 2014
3. R Programming for Data Science, Roger D. Peng, Lean publishing, 2015.

References:

1. "R for Data Science", Hadley Wickham and Garett Grolemund, , O'Reilly, 2017
2. "Data Mining for Business Analytics: Concepts, Techniques and Applications in R", Galit Shmueli, et al, Wiley India, 2018.

CO – PO Affinity Map

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3	-	-	-	-	-	-	-
CO2	3	3	2	2	3	2	-	-	-	-	-	-
CO3	2	3	3	3	3	-	-		-	-	-	-
CO4	3	3	3	3	3	-	-	2	-	-	-	-
CO5	3	3	3	3	3	-	-	3	-	-	-	-

SOFTWARE ENGINEERING 2 1 0 3

Objectives **To provide foundation in software engineering principles and techniques required for development of best applications with varied domains. To impart required software development skills for the students to adapt to readily changing environments using the appropriate theory, principles and processes**

Course Outcomes:

CO1: Learn to apply the knowledge of software engineering methodologies to identify, formulate, and solve software engineering problems.

CO2: Understand the ability to analyse the complex system by applying analytical, engineering and knowledge-based techniques to clearly understand the requirements.

CO3: an ability to design a system, component, or process to meet desired needs within realistic constraints relevant to the system

CO4: an ability to implement, verify, validate, test and maintain software systems developed using modern techniques, skills and engineering tools.

CO5: an ability to function on multi-disciplinary teams with an understanding of professional and ethical responsibility to create solutions for significant application domains.

Unit 1

Software Engineering Concepts - A Generic view of Process - Categories of Software - Process Models - Waterfall model - Incremental - Evolutionary - Prototyping – Spiral – Concurrent – RAD – Specialized models - Unified Process Models. - Agile Models. Requirements Engineering: Tasks Initiation - Elicitation - Developing Use Cases - Building the analysis model - Use Case Modelling - Negotiation - Validation.

Unit 2

Building the Analysis Model: Approaches - Data modelling concepts - Flow Oriented Modelling - Behavioural Modelling – State transition diagram – Sequential Diagram. Data Dictionary. Design Engineering: Design characteristics, Design Process and Quality - Design Concept - Creating an Architectural Design - Software Architecture - Data Design - Architectural Styles and Patterns - Architectural Design - Mapping Data Flow into Software Architecture - Object oriented Design - Agile definition roles in agile, principles of agile manifesto, agile principles, agile characteristics, agile iteration planning. Release planning in agile.

Unit 3

Software Testing Fundamentals - Objectives of Testing - Testing Principles – Testability - Testing Process and Methods – Testing Strategies - Testing Tactics. - White Box - Black Box testing - Debugging process.

Text books:

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Tata McGraw-Hill Publishing Company Pvt. Ltd, Seventh Edition.

2. Ian Somerville, “Software Engineering”, 10th Edition, Pearson Publication, 10th edition, 2015.

Reference book:

1. Shooman, “Software Engineering”, Tata McGraw-Hill Publishing Company, Pvt. Ltd, 1987

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1			2	2	1		2	1
CO2	2	3	2	2	3	1	1	3	2	-	2	2
CO3	3	3	3	2	2	1	1	2	1	-	2	2
CO4	2	2	1	2	2	1	1	1	-	-	2	2
CO5	2	2	3	3	3	1	1	2	2	1	3	2

WEB TECHNOLOGIES 3 0 3 4

Course Outcomes

CO-01: Learn the basic web programming technologies
CO-02: Equip with latest web development tools
CO-03: Understand the industrial standards with frameworks
CO-04: Create a full fledge CRUD web application on their own.
CO-05: Learn scripting skills with PHP

Unit -1 : Web Development Basics

Web History; Client-Server ; Browser-Web Server; W3 Consortium;
HTML5 and CSS3
HTML5- Basic Tags, Tables, Forms, Input tag, HTML Graphics, HTML media, HTML Graphics, HTML APIs.
CSS - Background, Borders, margin, Box model. Styling text, fonts, list, links, tables. CSS overflow, float, inline blocks, pseudoclasses, pseudoelements. CSS border images, rounded corners

Unit-2 : Client side scripting : JavaScript

Introduction to JavaScript, internal and external Java script files, variables, control statements, loops, Arrays , string handling , functions in JavaScript, Form Handling, Input Validation, Regular Expression, Event Handling
DOM concept, creating html elements using java script. Drawing 2D shapes. Introduction to AJAX

Unit-3 : JavaScript Framework

Building Single page applications with Angular JS Single page application – introduction , two way data binding, MVC in angular JS, controllers, getting user inputs , loops , Client side routing – accessing URL data, various ways to provide data in angular JS.

Unit -4 : Server Side Programming - PHP

Server side scripting, Difference between client side and server side scripting languages.
Introduction to PHP, variables, control statements, loops, Arrays, string handling, PHPforms, Global variables in PHP, Regular expression and pattern matching,
Database programming: inputting and outputting data from MySQL using PHP, insertion ,
deletion and updating data.
State management in web applications, cookies, Application and session state.

Unit-5 : XML & JSON

Introduction to XML, usage of XML, XML tags, elements and attributes, attribute type,
XML validation: DTD and XSD, XML DOM ; XML & PHP; JSON.

CO – PO Affinity Map

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	1	2	1	2	1	-	1	2	1
CO2	2	2	3	1	3	-	1	2	-	-	2	-
CO3	1	3	3	2	3	2	2	3	1	-	2	2
CO4	2	3	3	3	2	2	2	3	1	-	3	2
CO5	2	1	2	2	2	-	1	2	-	-	2	-

Textbook/Reference:
The Complete Reference, HTML and CSS by Thomas A Powell latest edition
XML Bible by Horold, Ellotte Rusty
Web Reference:- W3Schools.com

DATA MINING AND APPLICATIONS Lab 0-0-3-1

(In Python) and Use Kaggle
Using Pandas Data frames
Visualization and plots - seaborn
Data Preparation – Cleaning – Missing data, Data Reduction – PCA, Data Transformation – Normalization, Binning, distance measures, similarity
Association mining
Regression – Linear
Naïve Bayes Classifier, Decision tree, KNN
KMeans, Hierarchical clustering

Case study based seminar 1 0 0- 1

Preamble:

The case-study based seminar course constitute a form of experiential learning which promotes critical thinking, learning, and participation among students, especially in terms of the ability to view an issue from multiple perspectives and to grasp the practical application of core course concepts. Through guided discussions, each student will be able to expand his/her understanding of how different kinds of problems are approached and solved in the field of data science.

Course Objectives:

CO-01: Understand current applications, practices and challenges in the field of data science.

CO-02: Form connections between specific academic topics and real-world problems and applications.

CO-03: Help the student to conduct thorough literature review on the problem domain which facilitate interdisciplinary learning.

CO-04: Refine analytical, presentation and leadership skills as demonstrated by written and oral communications.

CO-05: Reinforce active listening skills, as demonstrated by response to and further development of ideas presented by classmates.

Course Syllabus

Unit 1

Research Process, Quantitative vs. Qualitative Approaches to Research, Exploratory vs. Confirmatory Research, Experimental vs Theoretical Research. Introduction to Case study research. Designing CSR.

Unit 2

Conducting Literature Review, Referencing, Information Sources, Information Retrieval, Role of libraries in Information Retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes

Unit 3

Experimental Research: Cause effect relationship, Development of Hypothesis, Data collection, Numerical and Graphical Data Analysis: Sampling, Observation, Surveys, Inferential Statistics, and Interpretation of Results.

Unit 4

Preparation of Dissertation and Research Papers, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion. References, Citation and listing

system of documents, Intellectual property rights (IPR), Ethics of Research- Scientific Misconduct- Plagiarism

Unit 5

Selection of a case study research work for critical analysis. (The case study work may be a book, 3 – 5 articles, a dissertation, or technical report on a topic of interest.)

Case study proposal: A description of the case study and reasons/rationale for the choice. Briefly summarize the case study research and explain why it was selected for analysis.

Critical Review: Identify the conceptual, methodological, and other relevant criteria used in the study research; and identify the "lessons learned," through the analysis of this case study research, for own research design.

Presentation: Talk on the case study to the class that addresses key learnings or findings, significant dilemmas or issues of interest, and/or other points. The purpose of the talk/presentation is to share one's work with others and deepen our understanding of case study research methods.

Paper submission: to propose a case study research project of their own. The paper should describe the phenomenon under investigation, the theoretical background in which this study will be grounded, and the key questions to be investigated.

Text Books:

1. Davis, M., Davis K., and Dunagan M., "Scientific Papers and Presentations", 3rd Edition, Elsevier Inc.
2. Bordens, K. S. and Abbott, B. B., "Research Design and Methods – A Process Approach", 8thEdition, McGraw-Hill, 2011

References

3. C. R .Kothari, Research Methodology-Methods and Techniques , Second revised edition, New Age International Publishers.

CO – PO Affinity Map

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	-	2	2	2	-
CO2	3	3	3	3	3	-	1	-	-	-	2	-
CO3	1	3	2	2	2	2	2	-	2	-	2	-
CO4	1	1	1	2	1	2	1	-	3	-	3	-
CO5	-	1	1	2	-	3	3	-	3	2	3	-

Semester 5

LIFE SKILLS III 1 0 2 2

Team Work: Value of Team work in organisations, Definition of a Team, Why Team, Elements of leadership, Disadvantages of a team, Stages of Team formation. Group Development Activities: Orientation, Internal Problem Solving, Growth and Productivity, Evaluation and Control. Effective Team Building: Basics of Team Building, Teamwork Parameters, Roles, Empowerment, Communication, Effective Team working, Team Effectiveness Criteria, Common characteristics of Effective Teams, Factors affecting Team Effectiveness, Personal characteristics of members, Team Structure, Team Process, Team Outcomes.

Facing an Interview: Foundation in core subject, Industry Orientation/ Knowledge about the company, Professional Personality, Communication Skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced Grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, Critical reasoning: A course on verbal reasoning. Listening Comprehension advanced: An exercise on improving listening skills.

Reading Comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Specific Training: Solving campus recruitment papers, National level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In Mathematics). Lateral Thinking problems. Quick checking of answers techniques; Techniques on elimination of options, Estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

TEXTBOOKS:

1. A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.
2. Adair J (1986) - "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
3. Gulati S (2006) - "Corporate Soft Skills", New Delhi, India: Rupa& Co.
4. The Hard Truth about Soft Skills, by Amazon Publication.

REFERENCES:

1. Speed Mathematics, Secrets of Lightning Mental Calculations, by Bill Handley, Master Mind books;
2. The Trachtenberg Speed System of Basic Mathematics, Rupa& Co., Publishers;
3. Vedic Mathematics, by Jagadguru Swami Sri BharatiKrsnaTirthayi Maharaja, MotilalBanarsidass Publ.;
4. How to Ace the Brainteaser Interview, by John Kador, Mc Graw Hill Publishers.
5. Quick Arithmetics, by Ashish Agarwal, S Chand Publ.;
6. Quicker Maths, by M tyra& K Kundan, BSC Publishing Co. Pvt. Ltd., Delhi;
7. More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.
8. The BBC and British Council online resources
9. Owl Purdue University online teaching resources
10. www.thegrammarbook.com online teaching resources
11. www.englishpage.com online teaching resources and other useful websites.

ARTIFICIAL INTELLIGENCE

3 0 0 3

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2: Understand basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning

CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent systems

CO4: Explore the current scope, potential, limitations, and implications of intelligent systems.

CO5: Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

CO6: Experiment with an AI model for simulation and analysis.

Unit 1

What is Artificial Intelligence? – The AI Problems – The Underlying Assumption – What is an AI technique – Criteria for Success.

Problems, Problem Spaces and Search – Defining Problem as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the design of Search Programs.

Unit 2

Heuristic Search Techniques - Generate – and – Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction - Means - Ends Analysis. Knowledge Representation issues – Representations and Mapping - Approaches to knowledge Representation – Issues in knowledge Representation – The Frame Problem. Using Predicate Logic – Representing simple facts in Logic – Representing Instance and Isa Relationship – Computable Functions and Predicates – Resolution – Natural Deduction.

Unit 3

Representing Knowledge Using Rules – Procedural versus Declarative knowledge – Logic Programming – Forward versus Backward Reasoning – Matching – Control Knowledge.

Symbolic Reasoning under Uncertainty – Introduction to Non-monotonic Reasoning – Augmenting a Problem Solver – Implementation: Depth - First Search.

Statistical Reasoning – Probability and Baye's Theorem – Bayesian Networks – Fuzzy Logic.

Unit 4

Game Playing - The Minimax Search Procedure – Adding Alpha-Beta Cutoffs.

Understanding – What is Understanding? What makes Understanding hard?

Unit 5

Common Sense – Qualitative Physics – Commonsense ontology – Memory Organization - Expert Systems – Representing and Using Domain knowledge – Expert System Shells – knowledge Acquisition - Components of an AI program.

TEXTBOOKS:

1. Artificial Intelligence (Second Edition) – Elaine Rich, Kevin knight (Tata McGraw-Hill)
2. A Guide to Expert Systems – Donald A. Waterman (Addison-Wesley)

REFERENCES:

3. Principles of Artificial Intelligence – Nils J. Nilsson (Narosa Publishing House)
4. Introduction to Artificial Intelligence – Eugene Charnaik, Drew McDermott (Pearson Education Asia)

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	2	-	1	-	-	-	-	-	-

MACHINE LEARNING 3-0-0-3

CO1: Have a good understanding of the fundamental ideas of machine learning: data, model selection, model complexity, etc.

CO2: Understand the strengths and weaknesses of many popular machine learning approaches.

CO3: Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

CO4: Be able to design and implement various machine learning algorithms in a range of real-world applications.

CO5: Develop the ability to evaluate and interpret the results of the algorithms

CO6: Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

Unit 1

Introduction to Machine learning: Supervised learning, Unsupervised learning, some basic concepts in machine learning, Review of probability,

The log-sum-exp trick, Feature selection using mutual information, Linear Regression

Unit 2

Computational Learning theory- Sample complexity, ε- exhausted version space, PAC learning, agnostic learner, VC dimensions, Sample complexity.

Bayesian Learning, curse of dimensionality, over fitting.

Parametric Estimators - estimator bias and variance, active learning

Unit 3

Dimensionality reduction, Clustering – choosing the number of clusters, Spectral clustering, Evaluating cluster quality. Margin and generalization (EM) algorithm, EM, regularization

Unit 4

Non-parametric methods – KNN

Linear discrimination - Support vector machine (SVM) and kernels,

Classification errors, regularization, logistic regression,

Unit 5

Model selection, Model selection criteria, Description length, feature selection, Combining classifiers, Bagging, boosting, Random Forest. Markov models, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, Probabilistic inference, Current problems in machine learning.

TEXTBOOKS:

5. Kevin P. Murphey, "Machine Learning, a probabilistic perspective", The MIT Press, 2012.
6. Tom Mitchael, "Machine Learning", McGraw Hill, 1997.
7. Ethem Alpaydin,"Introduction to Machine learning", PHI learning, MIT Press, 2010, 2nd edition
8. John D. Killeher, Brian Mac, Namee, AoiFE D'Arcy, Fundamental of Machine Learning for Predictive Data Analytics, 2015 MITpress
9. Alex Smola and SVN. Viswanathan, "Introduction to Machine Learning", Cambridge University Press, 2008.
10. ShaiShalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press,2014.

CO4	2	2	3	-	-	-	2	-	-	-	-	-	-	-	-
CO5	2	3	3	-	2	-	-	-	-	-	-	-	-	-	-
CO6	2	1	3	2	-	2	2	2	2	2	1	2	-	-	-

CLOUD COMPUTING 3-0-0-3

COURSE OUTCOMES

CO1: Understand the fundamental ideas behind cloud computing and different types of cloud services – Delivery models, Deployment models

CO2: Learn the virtualization and its role in cloud computing

CO3: Learn different features of containers and their orchestration in cloud

CO4: Learn storage technologies, networking, application development and deployment in the cloud
CO5: Understand the role of cloud computing in IoT, Bigdata and machine learning domains

SYLLABUS

UNIT 1

Introduction- Cloud computing at a Glance Historical Development, Building Cloud Computing Environments, Computing Platform and Technologies, Principles of Parallel and Distributed Computing, Elements of parallel and Distributed Computing.

UNIT 2

Virtualization and Cloud Computing Architecture: Introduction, Characteristic of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Technology Examples, Cloud reference model, Types of the Cloud.

UNIT 3

Containers, Docker Architecture, Docker Engine, Docker Images, Docker Hub, Kubernetes,

UNIT 4

Storage options in cloud, Cloud SQL, Application development and deployment in cloud, Cloud API,

UNIT 5

Monitoring and load balancing,Cloud Networking, Cloud in machine learning, bigdata analytics and IoT

TEXTBOOK:

Rajkumar Buyya, Christian Vecchiola and ThamariSelvi S, “Mastering in Cloud Computing”, McGraw Hill Education (India) Private Limited, 2013.
Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier Science, 2013, 1st Edition, Print Book ISBN :9780124046276, eBook ISBN :9780124046412

REFERENCES:

Anthony T Velte, “Cloud Computing: A practical Approach”, Tata McGraw Hill, 2009.
Halper Fern, Kaufman Marcia, Bloor Robin and Hurwit Judith, “Cloud Computing for Dummies”, Wiley India, 2009.
Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009

CO – PO Affinity Map

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO															
CO1	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	3	-	1	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	-	1	1	3	-	-	-	-	-	-	-		-	-

CO5	1	1	1	1	3	-	-	-	-	-	-	-	-	-	-

CLOUD COMPUTING LAB 0 0 3 1

COURSE OUTCOMES
CO1: Familiarize widely used cloud platforms
CO2: Create and configure virtual machines
CO3: Learn how to create containers and its orchestration
CO4: Development, deployment and monitoring of cloud applications
CO5: Understand the storage and networking options in cloud

SYLLABUS

Create accounts in AWS and Google cloud, Explore the various services offered by Amazon and Google, Virtualization concept in Virtualbox, Create and configure Virtual machine, Host a web server in the virtual machine, Create containers using docker, Kubernetes and orcherstation of containers, Structured and unstructured storage in the cloud, CloudSQL, Application development and deployment in cloud, Load balacing and monitoring of cloud applications. Various networking options in cloud, Case study- private cloud setup using openstack

REFERECES:

1. https://www.qwiklabs.com/
2. https://sites.google.com/google.com/gcp-teachingresources/home?pli=1&authuser=1
3. Cloud Computing : A hands on Approach, Arshdeep Bagha - Vijay Bagha Madisetti , 2013,
4. Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier Science, 2013,

CO – PO Affinity Map															
PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO															
CO1	-	-	1	-	3	-	-	-	-	-	-	-	-	-	-
CO2	1	-	1	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	1	-	3	-	1	-	-	-	1	-	-	-	-
CO4	-	-	1	2	3	-	1	-	-	-	1	-		-	-
CO5	-	1	1	-	3	-	-	-	-	-	-	-	-	-	-

MACHINE LEARNING LAB

Logistic regression, Estimation, Dimensionality reduction
Evaluation measures

- Supervised Learning
  - Find-s algorithm
  - Candidate elimination algorithm- algorithm implementation
  - Naïve Bayes algorithm- algorithm implementation
  - Decision tree algorithm

    - Nearest Neighbor algorithm- algorithm implementation
    - SVM algorithm- using simulation tool
- Unsupervised Learning
    K means algorithm - algorithm implementation
    - EM algorithm
    - HMM
- Instance based learning
    - Locally weighted regression algorithm

MIOR PROJECT **4 Credits**

Preamble:

Data Scientists, employ techniques and theories drawn from many fields within the broad areas of mathematics, statistics, information science, and computer science, in particular from the subdomains of machine learning, classification, cluster analysis, data mining, databases, and visualization to derive actionable insights and help meet specific business needs and goals. The goal of this Minor Project course is to help the student apply the theories and important tools they studied in this program to practice data science and mobilize the students for the next semester Major Project course.

Course Objectives:

CO-01: Provide opportunities to identify real world problems.

CO-02: Conduct thorough literature review on the problem domain.

CO-03: Specialize data science methods, applications and tools.

CO-04: Demonstrate independence and originality in thought and application.

CO-05: Provide opportunity to work as a team and evaluate the developed product/algorithm

both from individuals' and teams' perspective.

CO – PO Affinity Map

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	3	-	2	3	1	3
CO2	3	3	3	3	2	2	2	-	2	-	-	2
CO3	3	2	3	3	3	1	-		-	-	-	2
CO4	2	1	1	1	1	3	-	-	3	-	3	3
CO5	2	2	1	1	1	3	-	-	3	-	3	2

Semester 6

BIG DATA ANALYTICS AND VISUALIZATION 3-0-0-3

COURSE OUTCOMES

CO1: Understand the basic concepts in Big Data Analytics and gain the ability to choose the right solution for a task involving big data, including databases, architectures and cloud services.

CO2: Understand the different methods to analyze and visualize the big data.

CO3: Develop the skillset to build effective solutions for Big Data issues using Hadoop and its Eco-System.

CO4: Get insights into different data visualization techniques and standard tools.

CO5: Understanding of real life issues faced by different organizations and its effective solutions through case studies.

UNIT 1

Introduction to Big Data, Types of Digital Data, Characteristics of Big Data, Evolution of Big Data, Definition of Big Data, Data Appliance, Challenges with Big Data, Big data sources, Best practices in Big Data Analytics, Introduction to Data Modelling

UNIT 2

Introduction to elementary data analysis: Measures of center: Mean, Median, Mode, Variance, Standard deviation, Range, Normal Distribution : Center, Spread, Skewed Left, Skewed Right, Outlier, Correlation Patterns, Magnitude and Direction in relationship, Introduction to Bayesian Model

UNIT 3

History of Visualization, Goals of Visualization, Types of Data Visualization: Scientific Visualization, Information Visualization, Visual Analytics, Impact of visualization, Big Data Visualization Tools: Tableau, Google Chart

UNIT 4

Introduction to Big Data Processing and Apache Hadoop, Installation and Configuration of Hadoop in Ubuntu, HDFS Concepts, MapReduce Framework, Anatomy of a Map Reduce Job Run, Job Scheduling, Shuffle and Sort, Task Execution

UNIT 5

Introduction to Hadoop Eco System, Apache Hive, Apache Mahout, Apache Pig, Case studies: Analyzing big data with twitter, Big data for Ecommerce, Big data for blogs.

TEXTBOOKS:

1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", Wiley, 2015
2. Frank J Ohlhorst, “Big Data and Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
3. Tom White, “ Hadoop: The Definitive Guide” Third Edition, O’reily Media, 2012.

REFERENCES:

1. Michael C. Reingruber, William W. Gregory “The Data Modeling Handbook: A Best-Practice Approach to Building Quality Data Models”, Wiley QED publications, First Edition.
2. Philip Bobko, “Correlation and Regression: Applications for Industrial Organizational Psychology and Management”, First Edition

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	3	-	2	-	-	-	-	-	1	-	-	-	-
CO4	1	1	-	2	3	-	-	-	-	-	-	-		-	-
CO5	-	2	2	2	1	1	-	-	-	1	1	-	-	-	-

BIG DATA ANALYTICS AND VISUALIZATION LAB

0-0-3-1

COURSE OUTCOMES

CO1: Get familiar with standard tools and frameworks used in the analysis and visualization of Big Data

CO2: Acquire a clear understanding of the architectural concepts of Hadoop and MapReduce paradigm

CO3: Learn the Java concepts required for developing MapReduce programs

CO4: Get familiar with the usage and applications of programming tools PIG&HIVE in Hadoop echo system

CO5: Learn how to effectively use the data visualization tools Tableau/Google Chart

SYLLABUS

Installation and Configuration of Hadoop in two operating modes (Pseudo distributed & Fully distributed), Use web based tools to monitor the Hadoop setup, Perform the different file management tasks in HDFS, Run a basic WordCount program to understand MapReduce paradigm, Stop word elimination using MapReduce, Mining of large dataset to find the average, max and min values using MapReduce, TeraSort benchmark comparison for YARN, Setting up Hadoop cluster in AWS, Install PIG on Hadoop and write Pig Latin scripts to sort, group, join, project and filter your data, Install Hive on Hadoop and use it to create, alter and drop databases, tables, views, functions and indexes, Use Tableau/Google chart to visualize a dataset of your choice.

REFERENCES:

1. https://hadoop.apache.org/docs/current/
2. https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html
3. https://pig.apache.org/
4. https://hive.apache.org/
5. https://www.tableau.com/

CO – PO Affinity Map

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO															

CO1	1	-	1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	-	1	2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	3	2	-	1	-	-	-		-	-	-	-
CO4	-	1	2	2	3	-	1	-	-	-	1	-		-	-
CO5	-	1	2	2	3	-	1	-	-	-	1	-	-	-	-

BIG DATA ANALYTICS LAB 0 0 2 1

Hadoop Installation, Single entry mode, configuration, setting up Name Node and Data Node, executing sample Program
Map Reduce introduction, Word Count, Number sum and Tera Sort program execution and performance analysis
Real time data handling in Hadoop, with cluster performance monitoring with Ganglia.
Hadoop configuration with Hive and data processing , Integrating R with Hadoop and visualizing Large data sets.

Major Project (Optionally leading to Paper Publication) 10 credits

Preamble:

Data Scientists, employ techniques and theories drawn from many fields within the broad areas of mathematics, statistics, information science, and computer science, in particular from the subdomains of machine learning, classification, cluster analysis, data mining, databases, and visualization to derive actionable insights and help meet specific business needs and goals. The goal of this Major Project course is to help the student experienced in industrial/research projects by applying the skills they acquired by the different courses in this program, to solve real world problems.

Course Objectives:

CO-01: Apply the skills a student acquired through the different courses in this program to design software solutions for real world problems.

CO-02: To expose the student to the industry-standard project practices, under time and deliverable constraints.

CO-03: Provide opportunity to work as a team and evaluate the developed product/algorithm both from individual's and team's perspective.

CO-04: Train the student to write and publish research papers.

CO-05: Demonstrate independence and originality in thought and application and communicate among software professionals to demonstrate the knowledge and principles.

CO – PO Affinity Map

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	1	1	2	3	2	3
CO2	3	3	3	3	2	3	1	3	2	-	2	2
CO3	3	2	3	3	3	2	2	2	-	-	3	2
CO4	2	1	1	1	1	3	3	-	-	2	2	3
CO5	2	2	1	1	1	3	3	-	-	2	2	3

Electives

TIME SERIES ANALYSIS 3 0 0 3

COURSE OUTCOMES

CO1 To get introduced to the overview of time series analysis and importance of its properties.

CO2 Describe the regression, type and importance of regression and role of model selection in time serious analysis.

CO3 Explain about the covariance and prediction about time serious data and its models.

CO4 Classify different types of spectral representation and estimation of time serious analysis.

CO5 Overview about multivariate and spatial time serious and its higher applications.

Unit:1

Overview - signal vs noise, graphics;Stationary processes-ensemble, random walk vs trend, periodicity, linear process;Estimators-mean, ACF, PACF, variogram;Properties-covariance of covariance, normality.

Unit:2

Regression-models for trend, differencing, backshift operator B;Harmonic regression-periodogram, signal processing, novel asymp;Nonparametric regression-smoothing, periodic functions;Model selection-AIC, BIC, SIC, bias-variance trade-of;ARMA models-polynomial approximation, causality, notation.

Unit:3

Covariances-identification;Prediction-recursion;Estimation-MLE, LS, forward-backward;State-space models-Kalman filter;Properties-equivalence with ARMA, nonlinear models;Switching models-hidden Markov models (HMM).

Unit:4

Hilbert spaces-infinite dimension, L2, martingale;Spectral representation-integral representation, Wolddecomposition;Periodogram-discrete Fourier transform (DFT);Spectral estimation-linear filters.

Unit:5

Multivariate time series-VAR, cross-correlation, trans function, spectral regr;Cointegration-principal components;Seasonality-X-11, regression models, seasonal differencing;Wavelets-multiresolution analysis;Spatial time series-kriging, spatial AR models.

TEXTBOOK:

1. R. H. Shumway and D. S. Stoffer (2006), Time series analysis and its applications (With R Examples, Second Edition). Springer, New York.

REFERENCES:

2. http://www-stat.wharton.upenn.edu/~stine/

3. “Time Series Analysis” by James Douglas Hamilton.

4. “The Analysis of Time Series: An Introduction” by Chris Chatfield.

5. “Forecasting: Principles and Practice” by Rob J. Hyndman and George Athanasopoulos.

6. “Introduction to Time Series Analysis and Forecasting” by Douglas C. Montgomery, Cheryl L. Jennings, and Murat Kulahci.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	1	-	1	-	-	1	-	-	-	-

INTRODUCTION TO IOT 3 0 0 3

Course Objective: Students will be able understand and explore the interconnection and integration of the physical world and the cyber space. They will also be able to design & develop IOT Devices.

Course Outcome:

- Able to understand the application areas of IoT
- Able to understand data analytics in IoT
- Able to understand building blocks of IoT and their protocols

Unit 1: Introduction 10 Hours

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Unit 2: Fundamental devices in IoT 7 Hours

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, Smart City IoT Architecture.

Unit 3: Protocols for IoT 8 Hours

IP as the IoT Network Layer, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Unit 4: Data and Network Analytics in IoT 10 Hours

An Introduction to Data Analytics for IoT, Machine Learning, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, IT and OT Security Practices.

Unit 5: Implementing IoT 10 Hours

IoT Physical Devices and Endpoints. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Connecting Raspberry Pi via SSH.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014. (ISBN: 978-8173719547).

2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	2	-	-	-	-	-	-	-	-	-	-

EMBEDDED SYSTEMS **3 0 0 3**

COURSE OUTCOMES

CO1: Comprehend the specifications of embedded systems for hardware and software architecture.

CO2: Analyze and develop software programs for the embedded systems.

CO3: Assess the design specifications Embedded Systems, related frameworks and Embedded Systems resource chains.

CO4: Design the breadboard test circuit including microcontroller design and device control.

CO5: Construct embedded devices utilizing RTOS concepts in real-time.

Unit 1
An Overview of Embedded System - What is an Embedded System? – Categories of Embedded Systems – Requirements of Embedded Systems - Challenges and issues in Embedded Software Development – Trends in Embedded Software Development - Applications of Embedded Systems.

Unit 2
Hardware Fundamentals for the Software Engineer - Gates – Timing Diagrams – memory – Microprocessors – Buses – DMA – Interrupts - Other Common Parts – Built-ins on the microprocessor – Interrupts - Microprocessor Architecture – Interrupt Basics – The Shared Data Problem – Interrupt Latency.

Unit 3
Survey of Software Architectures - Round Robin – Round Robin with Interrupts – Function Queue Scheduling Architecture – Use of real time operating system. RTOS, Tasks, Scheduler, Shared data reentrancy - priority inversion, mutex binary semaphore and counting semaphore – Selecting an Architecture - Introduction to Real Time Operating Systems - Tasks and Task states – Tasks and Data – Semaphores and Shared Data – Message Queues mailboxes and pipes – Timer functions – Events – Memory management – interrupt routines in an RTOS environment.

Unit 4
Basic Design Using a Real Time Operating System - Overview – Principles – Encapsulating Semaphores and Queues – Hard Real - Time Scheduling Considerations – Saving memory space – saving power - Embedded Software Development Tools - Host and Target Machines – inker/Locators for Embedded Software – Getting Embedded software into the target systems.

Unit 5
Debugging Techniques - Testing on Host Machine – Instruction Set simulators – The assert Macro – Using Library Tools - Future Trends in Embedded Systems - System on a chip (SOC) – Smart Cards and the cashless society – Security in Embedded System.

TEXTBOOKS:

1. Dr.K.V.K.K. Prasad &Vikas Gupta – Programming for Embedded Systems – Wiley 1st edition 2002
2. David E. Simon – An Embedded Software Primer- Pearson Education Asia – 1999

REFERENCES:

1. Caroline Yao &Quing Li – Real Time Concepts for Embedded Systems
2. Kirk Zureli - C Programming for Embedded Systems

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO															
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	1	-	-	-	-	1	1	-	-	-

NON-RELATIONAL DATABASE 3 0 0 3

Objective: To study basic concepts of database systems, relational and non-relational databases and graph databases.

COURSE OUTCOMES

CO1: To understand the concept of how NoSQL databases differ from relational databases from a practical perspective.

CO2: Master the basic concepts of designing NoSQL database management system.

CO3: Be familiar with selecting a particular NoSQL database for specific use cases.

CO4: Must be able to Identify what type of NoSQL database to implement based on business requirements

Unit 1:

Database Management System – introduction, history of database, management systems-characteristics of dbms, definition, objectives, merits and demerits, entity relationship model, concurrency control.

Environment systems – definition, designing databases, hierarchical data model, network data model

Unit 2:

RDBMS – relational data model, techniques & components of relational data model, definition of relational terms, features, 12 rules for a fully RDBMS.

Unit 3:

NOSQL Systems-Introduction to NoSQL, Disadvantages of NoSQL technology, NOSQL Systems, weakness of RDBMS, Key-value database-Key values database, More elements of key values database, Properties of Key-value store

Unit 4:

Columnar Databases - Characteristics of a columnar database, Concepts of columnar databases

Document databases with MongoDB - Implement a document database with Mongo DB, MongoDB.

Unit 5:

Graph Databases - Graph databases, graph traversal and graph problems, graph data structures edge list, adjacency matrix, properties of graph model.

Implementation and systems - Reliable, maintainable and scalable, Different information systems

Text:

1. Advanced Data Management: For SQL, NoSQL, Cloud and Distributed Databases By Lena Wiese

Reference:

1. Getting Started with Nosql by Gaurav Vaish.

NoSQL for Dummies by Adam Fowler.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	1	1	-	-	-	2	-	-	-	-	-	-	-
CO3	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	1	2	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PATTERN RECOGNITION 3-0-0-3

OBJECTIVE

The objective of this course is to equip students with mathematical and statistical techniques used in pattern recognition and enable students to develop machine learning algorithms for real life problems.

COURSE OUTCOMES

CO1: Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms and applications of PR system

CO2: Understand the basic methods of feature extraction, feature evaluation, analyse and relate research in the pattern recognition area.

CO3: Understand and apply both supervised and unsupervised classification methods to develop PR system in real-world data

CO4: Apply pattern recognition techniques to real-world problems such as object detection and recognition

CO5: Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers

CO6: Summarize, analyze, and relate research in the pattern recognition area verbally and in writing

Introduction to Pattern Recognition- Tree Classifiers Getting our feet wet with real classifiers- Decision Trees: CART, C4.5, ID3- Random Forests-Bayesian Decision Theory Grounding our inquiry- Linear Discriminants Discriminative Classifiers: the Decision Boundary, Separability, Perceptrons, support Vector Machines, Parametric Techniques Generative Methods grounded in Bayesian Decision Theory, Maximum Likelihood Estimation- Bayesian Parameter Estimation. Non-Parametric Techniques- Kernel Density Estimators- Nearest Neighbor Methods - Unsupervised Methods Exploring the Data for Latent Structure - Component Analysis and Dimension Reduction- The Curse of Dimensionality, Principal Component Analysis, Fisher Linear Discriminant, Locally Linear Embedding, Clustering, K-Means,. Expectation Maximization, Mean Shift, Classifier Ensembles, Bagging, Boosting / AdaBoost.

Text Books

1. Duda, Hart and Stork, Pattern Classification, Second Edition, Wiley, 2001.
2. T.M. Mitchell, Machine learning, Mc Graw-Hill, New York, 1997.

3. S. Theodoridis, K. Koutroumbas, Pattern recognition, Academic Press, 1999.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	3	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	2	-	-	1	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	1	-	1	-	-	1	-	-	-	-
CO6	1	-	2	1	1	-	1	-	2	1	1	1			

DIGITAL IMAGE PROCESSING 3-0-0-3

COURSE OUTCOMES

CO1: To enable students to learn the fundamental concepts of a digital image processing and its working protocols.

CO2: To understand image enhancement techniques in spatial and frequency domain so as to devise algorithms or mathematical models for real time image enhancement problems.

CO3: To enable students implement algorithms for handling intensive image restoration problems.

CO4: Development of segmentation algorithms used to detect and extract the region of interest from images.

CO5: Interpretation and use of feature extraction and image representation techniques to carry out image labeling and automatic image understanding.

UNIT-1

Introduction and Fundamentals of Image Processing: Origins of Digital Image Processing – Examples - Fundamental Steps in Digital Image Processing - Elements of Visual Perception - A Simple Image Formation Model - Basic Concepts in Sampling and Quantization.

UNIT-2

Representing Digital Images- Zooming and Shrinking Digital Images - Some Basic Relationships between Pixels - Linear and Nonlinear Operations - Connectivity and Relations between Pixels- Simple Operations- Arithmetic, Logical, Geometric Operations.

UNIT-3

Image Enhancement in the Spatial Domain and Frequency Domain: Some Basic Gray Level Transformations - Histogram Processing – Basics of Spatial Filtering - Smoothing Filters-Mean, Median, Mode Filters - Edge Enhancement Filters – Sobel, Laplacian, Robert, Prewitt filter, Contrast Based Edge Enhancement Techniques.

UNIT-4

Design of Low Pass Filters - High Pass Filters- Edge Enhancement - Smoothening Filters in Frequency Domain. Butter Worth Filter, Homomorphic Filters in Frequency Domain- Comparative Study of Filters in Frequency Domain and Spatial Domain.

UNIT-5

Edge Detection - Line Detection - Curve Detection - Edge Linking and Boundary Extraction - Thresholding Algorithms- Region Based Segmentation - Region Growing – Connected Components Labeling - Region Growing and Region Adjacency Graph (RAG), Split and Merge Algorithms - Morphology - Dilation, Erosion, Opening and Closing.

TEXTBOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, ”*Digital Image Processing*”, Third Edition, Addison Wesley, 2007.

REFERENCES

2. Arthur R. Weeks, Jr., “*Fundamentals of Electronic Image Processing*”, First Edition, PHI,1996.

3. Milan Sonka, Vaclav Hlavac and Roger Boyle, ”*Image processing, Analysis, and Machine Vision*”, Third Edition, Vikas Publishing House, 2007.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	1	-	1	-	-	1	-	-	-	-

WIRELESS COMMUNICATIONS AND NETWORKS 3 0 0 3

CO1: Understand the working of a wireless systems, basics of wireless communication, including the features and operation of protocols, antennas, and various propagation modes in wireless communication.

CO2: Explain the basic physical and technical settings of modulation techniques and features of analog and digital data including transmission methods.

CO3: To lay a basic foundation on IEEE wireless communication standards such as WLAN-802.11, Bluetooth, WiMax and satellite communication.

CO4: Understand the concept of Adhoc network and types of routing protocols supporting wireless communications and simulate protocols such as AODV, TORA, DSDV in NS2 or NS3.

CO5: Must be able to simulate or implement a real word wireless communication system.

Introduction to Wireless Systems: Brief History of Wireless Communication. Transmission Fundamentals: Time Domain, Frequency Domain, Bandwidth vs. Data Rate – Channel Capacity - Transmission Media –Protocols and TCP/IP Suite: TCP/IP Protocol Architecture - OSI Model. Antennas and WavePropagation: Antennas, Propagation Modes, Fading in the q

Modulation Techniques: Signal Encoding, Digital Data - Analog Signal, Analog Data -Analog Signal, Analog Data - Digital Signal, Frequency Hopping Spread Spectrum (FHSS),Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access (CDMA).

Wireless Networking: Satellite Communications- Capacity Allocation – Frequency Division, Time Division, WiMax and IEEE 802.16 Broadband Wireless Access Standards. WirelessLAN Technology: Infrared, Spread Spectrum, Narrowband LANS- Wi-Fi and IEEE 802.11Standard, Bluetooth and IEEE 802.15 Standard.

Wireless Routing Protocols: Infrastructure, AdHoc Networks, ProActive vs.ReActive,Dynamic Source Routing(DSR), AdHoc On Demand Distance Vector(AODV),Temporarily Ordered Routing Algorithm(TORA), Destination Sequenced DistanceVector(DSDV). Case Study using NS2 / NS3.

TEXTBOOK / REFERENCES:

1. William Stallings,"*Wireless Communication and Networks*", Pearson Education, ThirdEdition, 2002.

2. Jochen Schiller, "*Mobile Communications*", Pearson Education, Second Edition, 2003.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	2	2	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	2	2	1	-	2	-	1	1	1	-	-	-

MULTIMEDIA AND GRAPHICS 3 0 0 3

CO1: Understand the concept of multimedia terms such as multimedia, integration, interactive, HTML, and authoring and qualify the characteristics of multimedia: nonlinear versus linear content.

CO2: Describe several different environments in which multimedia might be used, and several different aspects of multimedia building blocks that provide a benefit over other forms of information presentation.

CO3: Utilization of different multimedia building blocks with all the features such as creation of text, image, digital audio and video with different types of format of each.

CO4: Describe the primary multimedia delivery methods—the Internet, wireless, CD-ROM, and DVD—as well as cite the history of multimedia and note important projected changes in the future of multimedia.

Unit 1
Introduction: What is Multimedia? – Introduction to making Multimedia - Media Skills – Macintosh and Windows Platforms – Basic software tools.

Unit 2
Making instant Multimedia – Multimedia Authoring tools.

Unit 3
Multimedia Building Blocks: Text – Sound – Images.

Unit 4
Multimedia Building Blocks: Animation – Video.

Unit 5
Multimedia and the Internet: The Internet and how it works – Tools for World Wide Web – Designing for the World Wide Web.

TEXTBOOK:

Tay Vaughan – Multimedia (Making it work) - Tata McGraw Hill – ISBN-0-07-047276-9

REFERENCES:

Nigel Chapman – Digital Multimedia – Wiley – ISBN – 81-265-0489-7

John F. Koegel Buford – Multimedia Systems – PEARSON – ISBN – 81-78-08-162-8

CO – PO Affinity Map

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CO1	3	-	-	1	1	-	1	-	-	-	-	-	-	-	-
CO2	2	1	1	1	-	1	-	-	1	-	-	-	-	-	-
CO3	-	-	3	1	1	-	2	-	-	-	-	2	-	-	-
CO4	2	1	1	-	-	-	-	-	3	1	-	1	-	-	-

BIO INFORMATICS **3-0-0-3**

COURSE OUTCOMES

CO1 To get introduced to the basic concepts of Bioinformatics and its importance in Biological data analysis.

CO2 Describe the history, scope and importance of nucleic acids and role of molecular biology in Bioinformatics.

CO3 Explain about the methods to characterize and manage the different types of Biological data and its applications.

CO4 Classify different types of Bioinformatics software's.

CO5 Overview about biological macromolecular structures and structure prediction methods in Biocomputing, introduction to sequence alignments.

UNIT-1

Introduction to Bioinformatics**:** Definition - Importance and Uses of Bioinformatics-Information Technology - Systems Biology. Introduction to Nucleic Acids**:** DNA and RNA as Genetic Materials - Structure of Nucleic Acids - Nucleosides and Nucleotides - DNA Double Helix. Central Dogma of Molecular Biology - Nature of Genetic Code - Deciphering Genetic Code - Wobble Hypothesis -Universalities and Exceptions.

UNIT-2

Applications of Data Mining to Bioinformatics Problems - Biological Data – Databases -Protein Sequencing - Nucleic Acid Sequencing - Sequence to Structure Relationship. Bioinformatics Software**:** Clustal V - Clustal W 1.7 - RasMol – Oligo – Molscript – Treeview– Alscript - Genetic Analysis Software- Phylip.

UNIT-3

Bio-computing**:** Introduction to String Matching Algorithms - Database Search Techniques - Sequence Comparison and Alignment Techniques - Use of Biochemical Scoring Matrices – Introduction to Graph Matching Algorithms.

UNIT-4

Automated Genome Comparison and itsImplication - Automated Gene Prediction - Automated Identification of Bacterial Operons and Pathways - Introduction to Signaling Pathways and Pathway Regulation. Gene Arrays -Analysis of Gene Arrays.

UNIT-5

Machine Learning Methods in Bioinformatics - Hidden Markov models - Applications of HMM in gene identification and Profiles HMMs - Neural Networks and Support Vector machines.

TEXT BOOK:

1. Claverie J.M and Notredame C, "*Bioinformatics for Dummies*", SecondEdition,Wiley, 2003.

2. Pierre Baldi and SorenBrunak, "*Bioinformatics - The Machine Learning Approach*", SecondEdition, A Bradford Book, 2001.

REFERENCES:

3. RastogiS.C, Mendiratt N. and Rastogi P "*Bioinformatics: Concepts, Skills &Applications*", CBS Publishers & Distributors, 2004.

4. Fogel G.B. and Corne D.W, "*Evolutionary Computation in Bioinformatics*", MorganKaufmann, 2003.

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	1	-	1	-	-	1	-	-	-	-

SOFT COMPUTING **3 0 0 3**

Course Outcome

CO1: Describe and identify the strategies and functions of the soft computing in smart machines

CO2: Acknowledge the usefulness of a soft computing mechanism for a significant problem.

CO3: Address the advantages of various neural network architectures and their limitations.

CO4: Use fuzzy logic and thinking in order to address insecurity and to resolve problems of engineering and genetic algorithms to substitute issues of optimization.

CO5: Find out numerous methods for solving technical and real-world problems with these models.

Unit 1

Basic Concepts - Single Layer Perception - Multilayer Perception - Supervised and Unsupervised Learning - Back Propagation networks - Kohnen's self-organizing networks - Hop field networks - Distance measures.

Unit 2

FUZZY sets, properties, Membership functions Fuzzy operations, Applications.

Unit 3

Classification and Regression Trees - Data Clustering Algorithms - Rule based Structure identification.

Unit 4

Neuro-Fuzzy Systems.

Unit 5

Evolutionary Computation - Survival of the Fittest - Fitness Computation – Crossover – Mutation – Reproduction - Rank space Method. Case Studies: Applications of soft computing.

TEXTBOOK/ REFERENCES:

1. Laurence Fausett,"Fundamentals of Neural Networks", Seventh Edition, Dorling Kindersley (India) P. Ltd 2006.

2. Satish Kumar - "Neural Networks – A Classroom Approach", Tata McGraw-Hill, 2004.

3. Timothy J.Rose, "Fuzzy Logic with Engineering Applications", Third Edition, John Wiley, 2010.

4. *J.S.R Jang,C.T Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Second Edition, Prentice Hall of India, 2002.*

5. *D.E.Goldberg "Genetic Algorithms in search, optimization and Machine learning", Second Edition, Addison Wesley, 2007.*

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO															
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-	-	-	1	-	-	-	-
CO4	2	1	3	-	-	-	-	-	-	-	1	-	-	-	-
CO5	1	2	3	1	2	1	-	-	-	-	1	-	-	-	-

Advanced Operating System and Distributed Computing 3 0 0 3

Objective: The aim of this course is to study, learn, and understand the main concepts of advanced operating systems. To introduce concepts related to distributed computing systems and Virtualization concepts.

Course Outcomes

CO1: Understanding the broad problem areas in Advanced Operating Systems.

CO2: Exposure to Virtualizing techniques.

CO3: Demonstrate understanding of different architectures used in Distributed OS and analyze their design issues.

CO4: To introduce fundamental principles of distributed systems, technical challenges and key design issues.

CO5: To impart knowledge of the distributed computing models and algorithms.

Unit 1

Overview of operating System, OS Structures - SPIN, Exokernel, L3 microkernel approach, Process and Threads, File and memory management, Disks, Microkernels.

Unit 2

Virtualization - Requirements For Virtualization, Type 1 and Type 2 Hypervisors, Techniques For Efficient Virtualization, Memory Virtualization, I/O Virtualization, Virtual Appliances, Virtual Machines on Multicore Cpus, Licensing Issues. Load Balancing.

Unit 3

Distributed Operating System – fundamentals, Distributed Objects and Middleware, Naming, Java RMI , Remote Procedure calls. Parallel Systems - Shared memory machines, Synchronization, Communication, Lightweight RPC, Scheduling, Shared memory multiprocessor OS, Mobile OS.

Unit 4

Fundamentals, Evolution of Distributed Computing Systems, System models, issues in design of Distributed Systems, Distributed computing environment, web based distributed model, computer networks related to distributed systems and web based protocols, Message Passing Distributed Shared Memory, Synchronization.

Unit 5

Distributed mutual exchange algorithms, Deadlock detection in distributed systems, checkpoint and rollback recovery, Distributed file servers; Distributed programming environments: Communication primitives.

Text books/Reference Books

1. Modern Operating Systems, Andrew S. Tanenbaum, ©2015 |Pearson
2. Distributed Operating Systems: Concepts And Design, Pradeep K. Sinha, Phi Learning Pvt Ltd
3. Distributed Systems: Principles and Paradigms / Andrew S. Tanenbaum, Maarten Van Steen, Pearson
4. **Distributed Computing: Principles, Algorithms, and Systems, Ajay D. Kshemkalyani, Mukesh Singha, Cambridge University Press.**

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	2	1	-	-	-	-	-	-	-	-	-

NATURAL LANGUAGE PROCESSING 3 0 0 3

COURSE OUTCOMES

CO1: Understand approaches to syntax and semantics, fundamental mathematical models and algorithms in the field of NLPincluding hidden Markov models,– Ngram Models and probabilistic models.

CO2: Devise solutions for a range of natural language components using existing algorithms, techniques and frameworks, including part-of-speech tagging, language modelling, parsing, context modelling and semantic role labelling

CO3: To give an overview of the major technologies in speech recognition and synthesis including tools for acoustic analysis.

CO4: To evaluate the outcomes of various language processing and representation models.

CO5: To get exposed to hands-on experience of using NLP tools and apply existing statistical and deep learning techniques to language applications such as machine translation.

Unit 1

Introduction: Words - Morphology and Finite State transducers - Computational Phonology and Pronunciation Modelling - Probabilistic models of pronunciation and spelling – Ngram Models of syntax - Hidden markov models and Speech recognition - Word classes and Part of Speech Tagging.

Unit 2

Context free Grammars for English – Parsing with Context free Grammar – Features and unification – Lexicalized and Probabilistic Parsing -Language and Complexity- Semantics: Representing meaning - Semantic analysis - Lexical semantics - Word sense disambiguation and Information retrieval.

Unit 3

Pragmatics: Discourse - Dialog and Conversational agents - Natural language generation, Statistical alignment and Machine translation: Text alignment – word alignment – statistical machine translation.

TEXTBOOK:

1. Daniel and Martin J H, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, PrenticeHall, 2009.

REFERENCES:

2. Manning C D and Schutze H, “Foundations of Statistical Natural Language processing“, First Edition, MIT Press, 1999.
3. Allen J, “Natural Language Understanding”, Second Edition, Pearson Education,2003.

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CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	1	-	1	-	-	1	-	-	-	-

TEXT MINING AND ANALYTICS 3 0 0 3

COURSE OUTCOMES

CO1: Be familiar with the basic methods for information extraction and retrieval of textual data

CO2: Understand the concept of apply text processing techniques to prepare documents for statistical modelling

CO3: Must be able to evaluate the performance of machine learning models for textual data

CO4: Master the concept of machine learning models for analyzing textual data and correctly

interpreting the results

Unit-1

Overview: Origins and challenges of NLPLanguage and Grammar-Processing Indian Languages-NLP Applications Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

Unit-2

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-3

Extracting Relations from Text: From Word Sequences to Dependency Paths:

Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles:

Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.

Unit -4

A Case Study in Natural Language Based Web Search:

InFact System Overview, The GlobalSecurity.org Experience.

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models:

Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems

Unit-5

Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures:

Introduction, Cohesion, CohMetrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.

Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling:

Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.

Evolving Explanatory Novel Patterns for Semantically-Based Text Mining:

Related Work, A Semantically Guided Model for Effective Text Mining.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.

2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishing company, 1995.

3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

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CO2	2	2	2	3	1	-	-	1	-	-	-	-	-	-	-
CO3	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

BUSINESS INTELLIGENCE 3-0-0-3

COURSE OUTCOMES

CO1: Understand the concepts of Business Intelligence & Data Warehouses and apply the principles of data warehouse modelling.

CO2: Must be able to construct frameworks of computerized decision support by using the concepts of data analytics and business intelligence (BI).

CO3: Understand the technologies and use tools that make up BI concepts like Data warehousing, Data reporting and use of Online analytical processing (OLAP)

CO4: Must be able to Identify the major ethical and legal issues of analytics.

Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, 3-tier data warehouse architecture, Data Marts Data integration: Basics of Data Integration (Extraction Transformation Loading)- Concepts of data integration need and advantages of using data integration. Introduction to common data integration approaches, Introduction to ETL using SSIS, Introduction to data quality, data profiling concepts and applications. Introduction to Multi-Dimensional Data Modeling-Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, OLAP operations, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, OLAP Servers – MOLAP, ROLAP, OLAP query model and query processing, indexing OLAP Data, Data Warehouse Implementation Introduction to business metrics and KPIs, creating cubes using SSAS. Basics of Enterprise Reporting- Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

TEXT BOOKS/ REFERENCES:

1. Loshin D, “Business Intelligence”, First Edition, Elsevier Science (USA), 2003.

2. Jiawei Han, MichelineKamber and Jian Pei, “Data mining concepts and Techniques”,Third Edition, Elsevier Publisher, 2006.

3. Biere M, “ Business intelligence for the enterprise”, Second Edition, IBM Press,2003.

4. Moss L T, Atre S, “Business intelligence roadmap”, First Edition, Addison-WesleyLongman Publishing Co., Inc. 2003.

CO – PO Affinity Map

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CO1	3	2	2	2	2	-	-	2	2	-	-	-	-	-	-
CO2	2	2	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

QUANTUM COMPUTING 3-0-0-3

COURSE OUTCOMES:

CO1	To gain a clear understanding of the fundamental concepts of quantum computing
CO2	To grasp the various mathematical and calculation based concepts of quantum computing
CO3	Development of a solid foundation on the security venues of quantum computing.
CO4	Understanding the algorithmic foundations and searching mechanisms
CO5	Acquainting the student with the error correction and fault tolerance related mechanisms of quantum computing

Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit, multiple qubits.

Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation

References

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	-	3	-	-	-	3	-	-	-	-	-
CO4	1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-

VISUAL PROGRAMMING USING C# 3 0 0 3

CO1: Understand in detail .Net Framework and its architecture as well as learn on the features of IDE Visual Studio.

CO2: Must be able to program in C# and work on basic console applications.

CO3: Must be able to build Window applications with event handling and MDI features.

CO4: Understand the working ADO.Net model and design and implement a database application

CO5: Understand the working of file systems, file types, directories and building an interactive windows application.

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Metadata-Interoperability-Assemblies-the .net Packaging system-CLR-MSIL , Introduction to Visual Studio.Net-C# Programming Concepts-Predefined Types- Value types and reference type, Classes and Objects, Constructors and methods , Conditional statements, loops, arrays , Collection classes: ArrayList , HashTable, Stack ,Queue, indexers and properties.

String class: methods and properties of string class, enumerations, boxing and unboxing, OOPS concepts: Encapsulation, data hiding, inheritance, interfaces, polymorphism, operator overloading, overriding Methods, Static Class members, Delegates and events. Exception Handling, garbage collector, generics and collection

Basics of Windows Programming- Event Driven Programming, Windows Forms, Using common controls-Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box. Components-timer, imagelist, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling.

Introduction to ADO.Net-Object Model- System. Data Namespace- Data Bound controls-Connected Mechanism-Disconnected mechanism-.Net Data Providers.

Files: System.IO, directory and file types, Stream readers and stream writers, working with binary data.

CO – PO Affinity Map

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3

CO															
CO1	3	1	1	-	2	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	1-	2	1	-	1	-	-	1	-	-	-	-
CO4	1	2	3	1	2	1	-	1	-	-	1	-	-	-	-
CO5	1	2	3	1	2	1	-	2	-	1	1	1			

DESIGN PATTERNS **3 0 0 3**

Objectives: Students will be able to develop design patterns to solve object oriented design problems.

Course Outcomes

CO1 Understand the appropriate roles of subtyping and inheritance, and use them effectively.

CO2 Identify the appropriate design patterns to solve object oriented design problems.

CO3 Develop design solutions using creational patterns.

CO4 Apply structural patterns to solve design problems.

CO5 Construct design solutions by using behavioral patterns.

Unit 1

Introduction to Design Patterns: Significance – Software Design and patterns – Model – View - Controller.

Unit 2

Observer Pattern - Decorator Pattern - Factory Pattern - Singleton Pattern - Command Pattern - Adapter and Facade Patterns - Template

Method Pattern - Iterator and Composite Patterns – The State Pattern – The Proxy Pattern – Compound Patterns.

Unit 3

GRASP Patterns and Anti-patterns. Case Study: Use of patterns in the Design of a Modern Web Framework.

TEXTBOOK:

Erich Freeman, Elisabeth Robson, Bert Bates and Kathy Sierra "Head First Design Patterns", O'Reilly Media Inc., October 2004.

REFERENCES:

1. *Erich Gamma, Richard Helm, Ralph Johnson and John M.* Vlissides*, "Design Patterns: Elements of Reusable Object Oriented Software", Second Edition, Addison Wesley, 2000*
2. *James W. Cooper, "Java Design Patterns: A Tutorial", Second Edition, Pearson Education, 2003.*
3. *Mark Grand, "Patterns in Java – A* Catalog *of Reusable Patterns Illustrated with UML", Wiley – Dream tech India, 2002*

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CO2	3	3	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	3	3	1	2	-	-	-	-	-	-	-	-	-	-
CO4	1	3	3	1	2	1	-	-	-	-	-	-	-	-	-
CO5	1	3	3	1	2	1	-	-	-	-	-	-	-	-	-