26605199

THE NATIONAL COLLEGE BASAVANAGUDI, BANGALORE AUTONOMOUS

DEPARTMENT OF COMPUTER SCIENCE

Master of Science in Computer Science Regulations, Scheme & Syllabi

Semesters I to IV

Revised w.e.f.

Academic Year 2019-2020 and onwards

Department of Post Graduation Studies Computer Science

M.Sc Computer Science

A Post graduate studies, **M.Sc(Computer Science) Course** is an excellent opportunity for making career in software industry or related fields. This program is intended to enhance their existing academic foundations with comprehensive understanding of the use and application of information technology. The programme focuses on Design and Analysis of Algorithm, Advance Data Management, Enterprise Software Development, Android, Cloud Computing, Python, Networks, Software Testing, Data Mining , Big Data Analytics and Internet of Things.

Regulations for the Two Years (FOUR Semesters) Post-Graduate Course Eligibility:

(a) A candidate, who has passed the three years B.Sc. Examination of any recognized University or equivalent thereto with Computer Science as one of the core subjects, shall be eligible for admission to M.Sc Computer Science Course.

b) A General merit candidate should have secured at least 50% marks in aggregate and 55% in the Computer Science subjects in the degree course. For candidates belonging to SC/ST/BT and OBC, it is relaxed to 45% both in aggregate marks and marks secured in Computer science.

c) Completed 20 years of age at the time of admission or will complete this age on or before 31st December of the year of admission.

Duration of the Course:

The course of study of P.G. Degree shall extend over a period of two academic years, each year comprising two semesters, each semester comprising sixteen weeks of class work. The terms and vacations shall be as notified by the college from time to time.

Medium of Instruction:

The medium of instruction and Examination shall be English only.

Attendance:

Each semester shall be taken as a unit for the purpose of calculating attendance.

A student shall be considered to have satisfied the requirement of attendance for the semester, if he/she has attended not less than 75% of the number of classes in theory and practicals separately, in each of the subjects.

A student who fails to satisfy the above conditions shall not be allowed to take the End Semester Examinations.

Marks for attendance under CIA [Continuous Internal Assessment] will be awarded in proportion to the attendance over 75%.

End Semester Examination:

Notification for the End Semester Examination will be issued 30 days before the commencement of the examination.

Students are required to pay the prescribed fee and submit the application form at the office of the Controller of Examinations (COE) within the dates notified.

Students, who do not pay the prescribed end semester examination fee for any semester, shall repeat the semester.

A student who has failed in a subject can attempt the same 3 times.

Practical examination will be conducted before the commencement of the theory examination.

Results:

Provisional Results of each semester will be announced within Fifteen days after the completion of the examinations.

Semester Marks Cards will be issued within 15 days of the announcement of results.

Request for Re-valuation should be made within 5 days from the date of declaration of result along with the fee notified by the Controller of Examinations. *Students who have cleared a minimum of 4 papers of I & II semester together shall be eligible for III Semester.*

Process of Assessment:

Examinations are conducted with utmost care in the college. The College conducts two centralized tests in a semester for 30 marks in each subject. The end semester examination is conducted for 70 marks in each subject. Practical examinations are conducted for 100 marks. 30 marks are allotted for internal assessment which takes into consideration marks obtained at the tests, practical tests, attendance and assignments. One minor project and two seminars are valued for 50 marks each. The internal assessment is calculated on the basis of the following points:

Attendance – 5 Marks Assignments- 5 Marks Internal assessment (Two) tests – 20 Marks Total – 30 marks

The Institution monitors student progression by continuous evaluation of performance and attendance. The faculty guides students to ensure their progress at each stage.

The Internal Assessment marks must be displayed in the Department Notice Board and a copy of the same should be sent to Controller of Examinations, at least one week before the commencement of the End Semester Examination.

The attendance of the students is strictly monitored. The attendance status is announced at the end of every month. Parents of students having a shortage of attendance are informed by the class teachers. Students who do not have a minimum of 75% of attendance are not permitted to take the final examination.

Mode of Assessment:

There shall be a double valuation by Internal and External teachers. Average marks of both Valuers should be taken as the marks secured for each paper. If the difference between the two Valuers exceeds 15% of the maximum marks of the paper, there shall be a third valuation by a Board. Board should comprise of the Chairperson of the Department, Paper setter and an external member. Marks awarded by the Board shall be final.

Minimum to pass 50%: Theory 35/70 IA 15/30, Practicals 35/70 IA 15/30 M.Sc CS Programme Outcome

The M.Sc Programme enables:

- To analyze, design and develop computing solutions by applying foundational concepts of Computer Science.
- To apply software engineering principles and practices for developing quality software for scientific and business applications.
- To adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems.
- To help software professionals who are already employed to further their knowledge in their respective domains.
- To enhance the Designing & Analysis skills.
- To facilitate software professionals to take lead roles.
- To understand and assimilate knowledge and skills to apply in their industry.
- To introduce contemporary theoretical concepts about the processes, standards and practices in software development life cycle.

M.SC Course Matrix

	First Semester M.Sc					
Code	Name of the Course	Hours		Marks	Credits	
			IA	Exam	Total	
C1	Object Oriented Analysis and Design	4	30	70	100	4
C2	Design and Analysis of Algorithms	4	30	70	100	4
C3	Database Management Systems	4	30	70	100	4
C4	Python	4	30	70	100	4
C5	Statistics	4	30	70	100	4
L1	Python Lab	6	30	70	100	4
L2	Database Management Systems Lab	6	30	70	100	4
S 1	Complementary skills - I	2	15	35	50	2
			Tota	l Credit	750	30

Second Semester M.Sc							
Code	Name of the Course	Hours		Marks		Credits	
			IA	Exam	Total		
C6	Software Testing	4	30	70	100	4	
C7	Data Mining	4	30	70	100	4	
C8	Enterprise Application Development	4	30	70	100	4	
C9	Operating Systems and Network Programming	4	30	70	100	4	
C10	Elective 1	4	30	70	100	4	
C10	Cryptography and Security	4	30	70	100	4	
C10	Artificial Intelligence	4	30	70	100	4	
C10	Advanced Computer Networks	4	30	70	100	4	
L3	Enterprise Application Development Lab	4	30	70	100	4	
L4	Network Programming and Design Lab	4	30	70	100	4	
S2	Complementary skills - II	2	15	35	50	2	
			Tota	ll Credit	750	30	

Third Semester M.Sc						
Code	Name of the Course	Hours		Marks		Credits
			IA	Exam	Total	
C11	Big Data Analytics	4	30	70	100	4
C12	Web Application Development with Android	4	30	70	100	4
C13	Elective 2	4	30	70	100	4
C13	Machine Learning	4	30	70	100	4
C13	Embedded Systems	4	30	70	100	4
C13	User Interface Design	4	30	70	100	4
C14	Elective 3	4	30	70	100	4
C14	Big Data Platform	4	30	70	100	4
C14	Compiler Design	4	30	70	100	4
C14	Performance Modeling	4	30	70	100	4
C14	Social Networks	4	30	70	100	4
L5	Android Lab	4	30	70	100	4
L6	Big data Practical Lab	4	30	70	100	4
S 3	Complementary skills – III	2	15	35	50	2
OE	Open to the students of Other Disciplines	2	15	35	50	2
			Tota	l Credit	700	28

	Fourth Semester	M.Sc				
Code	Name of the Course	Hours	Marks			Credits
			IA	Exam	Total	
C15	Internet of Things	4	30	70	100	4
L7	Internet of Things Lab	4	30	70	100	4
P1	Project work	8	60	140	200	8
			Tota	l Credit	400	16

First Semester

	I Semester – M.Sc Computer Science							
Code	Name of the Course	Hours/ Week		Marks		Credits	Lab	
			IA	Exam	Total			
C1	Object Oriented Analysis and Design	4	30	70	100	4	Y	
C2	Design and Analysis of Algorithms	4	30	70	100	4	Y	
C3	Database Management Systems	4	30	70	100	4	Y	
C4	Python	4	30	70	100	4	Y	
C5	Statistics	4	30	70	100	4	Ν	
L1	Python Lab	6	30	70	100	4	Y	
L2	DBMS (Database Management Systems) Lab	6	30	70	100	4	Y	
S 1	Complementary skills - I	2	15	35	50	2	Ν	
		1	Tota	al Credit	750	30		

C1: OBJECT ORIENTED ANALYSIS AND DESIGN

Lecture Hrs : 54Internal Marks : 30Exam Marks : 70Description:This course describes fundamental principles of object-oriented
modeling, requirements development, analysis, and design. Topics include specification
of software requirements; object-oriented analysis approaches, including dynamic and
static modeling with the Unified Modeling Language.

Course Objectives: To teach the students a solid foundation on object-oriented principles, How to use it for the purpose of specifying and developing software. Understanding the insight and knowledge into analyzing and designing software using different object-oriented modeling techniques.

Learning Outcome: Possess an ability to practically apply knowledge software engineering methods, such as object-oriented analysis and design methods with a clear emphasis on UML. Have a working ability and grasping attitude to design and conduct object-oriented analysis and design experiments using UML, as well as to analyze and evaluate their models. Have a capacity to analyze and design software systems, components to meet desired needs.

Unit-I SDLC, Modeling Concepts and Class Modeling

Software, software development life cycle, brief overview of life cycle models, Agile methodology. Overview of Object Orientation, OO development, OO themes; Evidence for usefulness of OO development; OO modeling history. Modeling as Design Technique: Modeling; abstraction; The three models.

Object and class concepts; Link and associations concepts; Association ends Generalization and inheritance; Advanced object and class concepts; Aggregation; Abstract classes; Multiple inheritance.

Unit - II State Modeling and Interaction Modeling

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency;

Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

Unit - III System Conception and Analysis

System Conception: Devising a system concept; elaborating a concept; preparing a problem statement.

Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. Application Analysis: Application interaction model; Application class model; Application state model

Unit-IV System Design

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions.

Unit-V Class Design:

Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recording downwards, Refactoring; Design optimization; Reification of behavior. Unit-VI Patterns and Design Patterns 9 Hours

9 Hours

9 Hours

9 Hours

9 Hours

REFERENCES BOOKS

- 1. Michael Blaha, James Rumbaugh, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education / PHI, 2005.
- 2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, "Pattern-Oriented Software Architecture, A System of Patterns", Volume 1, John Wiley and Sons, 2006.
- 3. The Object-Oriented Thought Process (Developer's Library) 4th Edition by Matt Weisfeld Weisfeld (Author) Publisher: Addison-Wesley Professional; 4 edition (March 23, 2013).
- 4. Object Oriented Analysis and Design a Complete Guide 2020 Edition Kindle Edition by Gerardus Blokdyk (Author) Publisher: 5STARCooks (23 September 2019).
- Object-Oriented Analysis and Design (Undergraduate Topics in Computer Science) July 20, 2011 by Sarna Ramnath (Author), BrahmaDathan (Author) Publisher: Springer; 2011 edition (July 20, 2011).
- Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development Paperback – 30 Sep 2015 by Larman Craig (Author) Publisher: Pearson Education; Third edition (30 September 2015).

2. Design And Analysis Of Algorithms

Lecture Hrs: 54

Internal Marks: 30

Descriptions: This course explains various Algorithm design strategies such as divide and conquer, dynamic programming, greedy algorithms, backtracking and branchbound. Computational complexity of sorting and searching algorithm. Recurrence equations. Asymptotic notations for complexity classes.

Course Objectives: This course aims to introduce the classic algorithms in various domains, and techniques for designing efficient algorithms.

Learning Outcome: Apply design principles and concepts to algorithm design. Have the mathematical foundation in analysis of algorithms. Understand different algorithmic design strategies. Analyze the efficiency of algorithms using time and space complexity theory.

Unit-I

Introduction: Algorithm, Study of Algorithms, Analysis of Algorithms, Priori Analysis, Posteriori Analysis, Differences between Analysis and Profiling, Space Complexity, Time Complexity, Operation Counts, Step Counts, Asymptomatic Notations, Big-Oh-Notation, Omega Notation, Theta Notation, Insertion Sort, Horner's Method of Evaluating polynomial at given point.

Unit - II

Divide And Conquer: Introduction, Control Abstraction for divide and conquer method, Maxmin problem, Linear Search, Binary search, Sorting, Merge Sort, Quick Sort, Multiplication of Two long Intergers, Strassen's Matrix Multiplication.

Unit - III

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

Unit-IV

Dynamic Programming: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

Unit-V

Decrease-And-Conquer Approaches, Space-Time Tradeoffs: Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching.

Unit-VI

Backtracking: General method, n - Queen's problem, Sum of subsets problem, graph coloring problem, Hamiltonian cycle. Approximation Algorithms for NP-Hard Problems - Traveling Salesperson Problem, Knapsack Problem, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems

9 Hours

9 Hours

9 Hours

9 Hours

9 Hours

9 Hours

Exam Marks: 70

REFERENCES BOOKS

- 1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
- 2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
- 3. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.
- 4. Algorithms by <u>Jeff Erickson</u> (Author) **Published in:** (June 13, 2019).
- 5. Algorithms Illuminated (Part 3): Greedy Algorithms and Dynamic Programmingby Tim Roughgarden (Author) Publisher: Soundlikeyourself Publishing, LLC (May 1, 2019).
- 6. Introduction to the Design and Analysis of Algorithms Paperback 29 Sep 2011by <u>Anany Levitin</u> (Author) Publisher: Pearson; 3 edition (29 September 2011).
- 7. Design and Analysis of Algorithms Paperback 15 Dec 2014 by <u>S.</u> <u>Sridhar</u> (Author) Publisher: Oxford University Press (15 December 2014).

C3. DATABASE MANAGEMENT SYSTEMS

Lecture Hrs : 54

Internal Marks : 30

Descriptions: This course introduces database design and creation. Emphasis is on data dictionaries, normalization, data integrity, data modeling, and creation of simple tables, queries, reports, and forms. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.

Course Objectives: Define program-data independence, data models for database systems, database schema and database instances. Recall Relational Algebra concepts, and use it to translate queries to Relational Algebra. Identify Structure Query Language statements used in creation and manipulation of Database. Identify the methodology of conceptual modeling through Entity Relationship model.

Learning Outcome: Student will understand the different issues involved in the design and implementation of a database system. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models. To understand and use data manipulation language to query, update, and manage a database. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency.

Unit-I DBMS Architecture

Basics of DBMS, Three-level schema Architecture, Centralized and Client/server Architectures, Data Models-Conceptual, Representational and Physical data models, Data Independence- logical and physical.

Unit - II Relational data model

Concept of a Relation Different types of Constraints, Relational algebra concepts. Functional Dependencies, Normalization concepts: First, Second, Third normal forms, Boyce-codd normal form. SQL: Data Definition Language, Data Manipulation Language, Query-Sub queries, Nested Queries.

Unit - III Data Storage, Indexing, query processing and Physical 9 Hours design

Disk storage: Secondary storage devices, buffering of blocks, Primary file organizations, hashing techniques, parallelizing disk access using RAID technology. Indexing: Single Level indexing multilevel indexing. Algorithms: Algorithms for external sorting, select and join operations, project and set operations.

Unit-IV Distributed Databases

Basic Concepts, data fragmentation, replication and allocation, types of distributed database design, query processing in distributed databases. **9 Hours**

Unit-V Query Optimization

Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Choice of Evaluation Plans, Materialized views Advanced Query Optimization: Motivation, Query Processing Phases, and Logical Query Optimization.

Unit-VI NoSQL Database

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Exam Marks: 70

9 Hours

9 Hours

9 Hours

Definition of NOSQL, History of NOSQL and Different NOSQL products, Exploring MongoDBBasics: NOSQL Storage architecture, CRUD operations with Mongo DB, Querying, Modifyingand Managing NOSQL Data stores, Indexing and ordering data sets(Mongo DB/Couch DB/Cassandra).Advanced NOSQL ,NOSQL in CLOUD, Parallel Processing with Map Reduce, Big Data with Hive. Working with NOSQL.

REFERENCES BOOKS

- 1. Elmasri and Navathe: "Fundamentals of Database Systems" pearson education 2013.
- 2. Database System Concepts 6th Ed., by Silberschatz, Korth and Sudarshan Publisher: McGraw Hill Education; 6 edition (16 March 2010).
- 3. "Professional NOSQL" by ShashankTiwari, 2011, WROX Press The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing ,by Eelco PluggeTim Hawkins, Peter MembreyApress 2010.
- 4. Advanced Relational Database Management System [Print Replica] by Dr. Ms. Manisha Bharambe (Author), Mrs. Veena Gandhi (Author), Ms. Rupali Nankar (Kothawade) (Author).
- 5. Database Management Systems by Ramakrishnan and Gehrke, McGraw Hill Publisher McGraw Hill Edition 3 Publish Year July 2014.

PYTHON PROGRAMMING

Lecture Hrs : 54

Internal Marks:30

Description: This is an introductory course designed for any student interested in using computation to enhance their problem solving abilities. No prior experience in programming is necessary. Students will use their problem solving abilities to implement programs in Python. Prerequisites: None.

Course objectives:

- 1. Describe the core syntax and semantics of Python programming language.
- 2. Discover the need for working with the strings and functions.
- 3. Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- 4. Indicate the use of regular expressions and built-in functions to navigate the file system.
- 5. Infer the Object-oriented Programming concepts in Python.

Course Outcomes:

- 1. Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
- 2. Express proficiency in the handling of strings and functions.
- 3. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
- 4. Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

Unit-I

Installing Python, Simple program using Python, Expressions and Values, Variables and Computer Memory, error detection, Multiple line statements, Designing and using functions, functions provided by Python, Tracing function calls in memory model, omitting return statement. Working with Text: Creating Strings of Characters, Using Special Characters in Strings, Creating a Multiline String, Printing Information.

Unit - II

9 Hours

Selections, Loops, Controlling Loops Using Break and Continue, A Boolean Type, Choosing Statements to Execute, Nested If Statements , Remembering the Results of a Boolean Expression Evaluation , A Modular Approach to Program Organization, Importing Modules, Defining Your Own Modules, Testing Code Semi automatically Grouping Functions Using Methods, Standard modules and important modules.

Unit - III

9 Hours Functional programming, Objects and Classes, More on Strings and Special Methods, decorators, Calling Methods the Object Oriented Way, Exploring String Methods, Underscores, Repeating Code Using Loops: Processing Items in a List, Processing Characters in Strings, Processing Lists Using Indices, Repetition Based on User Input.

Unit-IV

Storing Collections of Data Using Lists: Storing and Accessing Data in Lists, modifying Lists, Operations on Lists, Slicing Lists, Aliasing, List Methods, Working with a List of Lists. Multidimensional Lists, Tuples, Sets and Dictionaries. Object Oriented Programming, Inheritance and Polymorphism, Files, reading and writing to text files

Exam Marks: 70

and Exception Handling.

Unit-V

9 Hours

Creating Graphical User interface (Tinker): Building a Basic GUI, Models, Views, and Controllers, Customizing the Visual Style Introducing few more Widgets Object-Oriented GUIs.

REFERENCE BOOKS

- 1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, ISBN:978-0-13-274718-9, 2013 2.Exploring Python, Timothy A. Budd, Indian edition, McGraw Hill education, ISBN-13: 978-0-07- 132122-8.
- 2. Kenneth A. Lambert , B.L Juneja , "Fundamentals of Python Programming", Cengage Learning,ISBN:978-81-315-2903-4, 2015.
- 3. Charles Dierbach. "Introduction to Computer Science Using Python: Computational Problem-Solving Focus", Wiley,ISBN:978-81-265-5601-4,2015.
- 4. Practical Programming: An introduction to Computer Science Using Python, second edition, Paul Gries, Jennifer Campbell, Jason Montojo, The Pragmatic Bookshelf, 2013.
- 5. Python Programming: An Introduction to Computer Science, 3rd Ed. 3rd Editionby John Zelle (Author) Publisher: Franklin, Beedle & Associates; 3rd edition (August 8, 2016)
- 6. Learning Python, 5th Edition Fifth Editionby Mark Lutz (Author) Publisher: O'Reilly Media; Fifth edition (July 9, 2013)

Internal Marks : 30

Lecture Hrs : 54 Description

A course dealing with statistical concepts including measures of central tendency and dispersion, probability distributions, the Central Limit Theorem, Sampling, Estimation, Hypothesis testing, Analysis of Variance, Correlation and Regression analysis, Multiple **Regression and Statistical Forecasting.**

Objective

- > Describe the structure and characteristics of statistical data.
- Calculate and interpret measures of central tendency and variability in statistical data.
- Assess the strength of association between sociological variables;
- Determine whether observed statistical patterns and associations are generalizable to the larger social world.
- > Achieve a basic understanding of statistical and database computer software.
- > Identify and carryout basic statistical analyses used in sociological inquiry; Become a critical consumer who can assess the validity of the data, graphs, charts, and statistics you encounter in academic books, journal articles, newspapers, television, and other media sources.

Outcome

- Explain basic statistical concepts such as statistical collection, species characteristics, statistical series, tabular and graphical representation of data, measures of central tendency, dispersion and asymmetry, correlation and regression analysis, time series analysis.
- > apply knowledge to solve simple tasks using computer (MS Excel)
- > Independently calculate basic statistical parameters (mean, measures of dispersion, correlation coefficient, indexes).
- > based on the acquired knowledge to interpret the meaning of the calculated statistical indicators
- Choose a statistical method for solving practical problems.

Unit-I

10 Hours

BASIC STATISTICS 1. Notion of Probability, Conditional Probability and Independence, Bayes' Theorem, Rules of Probability, Random Variables, Joint Distributions, Mathematical Expectation, Chebychev's inequality. **10 Hours**

Unit - II

Discrete Distribution: Bernouli, Binomial, Geometric, Negative Binomial, Poisson, Hypergeometric, Multinomial Distributions. Continuous Distributions: Uniform, Exponential, Gamma, Normal, Weibull, Beta, Distribution of function of Random variables.

Exam Marks : 70

Unit - III

Data types, Measurement levels, Continuous and categorical variables. Sampling mean and variance, Sampling distributions based on normal, Estimation, Properties of point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.

Unit-IV

10 Hours

14 Hours

Hypothesis testing, Single and multiple sample case, Chi-square tests, Goodness of fit test, non-parametric tests, Wilcoxon rank sum and sign rank tests, Kruskal-Wallis test, Friedman f test, Rank correlation coefficient.

Unit-V

Introduction to linear modeling, Simple Regression, Correlation, Multiple Regression, Assumptions of Linear Regression – diagnosis and remedies.

REFERENCES BOOKS

- 1. Statistics for Management Paperback 27 Jan 2017by I. Levin Richard (Author), H. Siddiqui Masood (Author), S. Rubin David (Author), Rastogi Sanjay (Author) Publisher: Pearson Education; Eighth edition (27 January 2017).
- 2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition (Springer Series in Statistics) Hardcover – 19 Apr 2017 by Trevor Hastie (Author), Robert Tibshirani (Author), Jerome Friedman (Author).
- 3. An Introduction to Statistical Learning: with Applications in R (Springer Texts in Statistics) Hardcover 29 Sep 2017 by Gareth James (Author), Daniela Witten (Author), Trevor Hastie (Author).
- 4. Using R for Introductory Statistics by John Verzani Publisher: Chapman & Hall.
- 5. Basic Statistical and Modeling Procedures Using SAS (http://wwwpersonal.umich.edu/~kwelch/b600/2015/B600_Statistical_Procedures_2015.pdf).
- SAS/STAT® 9.1 User's Guide. Cary, NC (https://support.sas.com/documentation/onlinedoc/91pdf/sasdoc_91/ stat_ug_7313.pdf).

	L1: PYTHON LAB
Lab H	Hours : 54 Internal Marks : 15 Exam Marks: 35
Cours	se Objectives/Course Description
\triangleright	Learn Syntax and Semantics and create Functions in Python.
	Handle Strings and Files in Python.
	Understand Lists, Dictionaries and Regular expressions in Python.
	Implement Object Oriented Programming concepts in Python
Learn	Ing Outcome
	control and functions
	Demonstrate proficiency in handling Strings and File Systems
	Create run and manipulate Python Programs using core data structures like
, r	Lists.
\succ	Dictionaries and use Regular Expressions.
\succ	Interpret the concents of Object-Oriented Programming as used in Puthen
1	Program to solve the quadratic equation $ax^{**2} + bx + c = 0$ using math module
1.	2 + bx + c = 0 using main module.
2.	Program to accept a string and display all its permutation using functions.
3.	Implement a program to search an element using linear search.
4.	Implement a program to sort given numbers using Selection Sort.
5.	Implement a program to perform stack operations using class and objects.
6.	Program to generate EMI Calculator for given term by accepting rate of interest,
	term and Principal as input. Display the output by using format specifies.
7.	Program to perform multi-dimensional list multiplication.
8.	Program to generate the prime numbers between m and n and calculate the
	processing time of using time module.
0	Program to calculate total income of a Wife and Husband call by reference
9.	Frogram to calculate total income of a whe and husband can by reference.
10.	Implement a Python Program to check whether the given string is palindrome
	or not using built in string manipulation methods.
11.	Implement a Python Program to read a word and prints the number of letters,
	vowels and percentage of vowels in the word using dictionary.

	L2: Data E	Base Manage	ement Syst	tems LAB
Lab I	Hours : 54	Internal Ma	rks : 15	Exam Marks: 35
Cours The co Learn Upon variou struct	Se Objectives/Cour ourse is designed to ning Outcome completion of the ous database operatory cure, setting credent	se Description provide a practical course, the student tion like creating ials to table using s	exposure to the s s acquire the kn g, updating, ins ql quires.	students. owledge able to perform serting, modifying table
1.	The Student Detail primary keys are u STUDENT(Regno: i a) Create the above b) Insert 5 values. c) Remove the exist e) Add values to ph f) Change the data	DataBase has a tab nderlined. nt ; name:string; Do e table. ting attribute "marl oneno column and type of reg_no from	le with following DB:date; marks:ir ks" from table. display all the tu int to string.	attributes and the 1t) ples in the table.
2.	Library DataBase title:string; author: a) Create the above b) Enter atleast 5 th c) Display the differ d) List the details o e) Arrange the tupl	has a table with string; publisher:st table . uples and display th rent publishers from f all the books who es in the alphabetic	following record ring; yearpub:int ne table. m the list. se price ranges b cal order of the bo	ds LIBRARY(bookid:int ; ; price:int) etween 100 and 300. pok title.
3.	Following is the Er DOB:date; dept:stri a) Create the above b) Insert atleast 5 t c) Display number d) Find the sum of s e) Find the sum and f) Find the highest g) Increase the sala	nployee Salary tabl ing; sal:real) table. uples. of employees in eac salaries of all emplo d average of salarie and lowest salary. ary of employee wo	le EMPSAL(empo ch department. oyees. s of employee of rking for Departr	ode:int; empname:string; a each dept. nent A by 1000 rs
4.	Consider the Ins Address:string) CA int; Date:date; PARTICIPATED(Dr a) Create the above b) Insert atleast 5 t c) Update damage reportno from 12 t	surance Database R(Regno:string; Mo location: string) iverID:string; Regn tables by specifyin uples into each tab amount for car w o 20000.	PERSON(Drive odel:string; year:i OWNS(Driverl o:string; Reportn og primary and fo le rith a specific re	rID:string; Name:string; nt) ACCIDENT(Reportno: D:string; Regno:string) no:int ; Damageamt: int) reign keys. gno in the accident with

d) Find the total number of people who owned cars that are involved in accident in 2002

e) Find the number of accidents in which car belongs to a specific model were involved.

5. Create the following tables PROJECT(Projectno:int;Projectname:string;ProjectLocation:string) DEPARTMENT(Departmentno:int;DeptName:string;DeptManager:strin) EMPLOYEE(Empid:int;Projectno:int;Departmentno:int;Ename:string;Ea ddress:string;Edod:date)

a) Create the above tables.

b) Insert atleast 5 tuples into each table.

c) For every project located in Jayanagar ,list the Project number , Department number and Dept Manager

d) Find the names of the employees who work on all projects controlled by deptno=203.

e) Make a list of project numbers for project that involve an employee whose name is AAA either who works as worker or manager of the department that controls CS project.

6. Consider the following DataBase of students enrolment in courses and books adopted for each course. STUDENT(Regno: string; Name:string; major: string; DOB: date) COURSE(Courseno: int; Coursename:string; Dept:string) ENROLL(Regno: Marks:int) string, Courseno:int: Semester: int: BOOK_ADOPTION(courseno:int; Semester:int: Bookisbn:int) TEXT(bookisbn:int; booktitle:string; Publisher: string; Author:string)

a) Create the above tables.

b) Enter atleast 5 tuples.

c) Demonstrate how you add a new textbook to the DataBase and make this book adapted by some department.

d) Produce a list of textbooks(courseno,bookisbn,booktitle) in alphabetical order for courses offered by CS department.

e) List any department that has all its adopted books published by a specific Publisher.

7. Create the following table ITEM(itemcode: int; itemname: string; price:decimal(10)) PURCHASE(itemcode:int; quantity: int)

a) Create the above tables

- b) Insert atleast 5 tuples in each table.
- c) Demonstrate Inner-Join operation on these tables.
- 8. Create two tables P and Q as P(id: int; name: string) Q(id: int; name :string) a) Create the above tables.
 - b) Insert tuples into P and Q tables
 - c) Display all records of both P and Q tables.

d) Demonstrate the set Operation CARTESIAN PRODUCT on these two tables.

9. An Inventory DataBase has the following table ITEM(itemcode: int; itemname: text; price: number(10,2)) PURCHASE(itemcode:int; quantity:int)

a) Create table with the above attributes.

b) Enter atleast 5 tuples into the tables.

c) List the items purchased.

d) Display the total items purchased.

e) List the items which are not purchased by anyone.

10. Create the table by properly specifying primary key and foreign keys AUTHOR(authored:int; name:string ; city: string; country:string) PUBLISHER(publisherid:int; name:string; city:string; country:string) CATALOG(bookid: int; title: string; authored: int; publisher: int; category: int; year: int;price: int) CATEGORY(categoryid : int; description : string) ORDERDETAILS(orderno:int; bookid:int; quantity:int)

a) Create the above tables.

b) Insert tuples for each table

c) Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2010.

e) Demonstrate how you increase the price of books published by a specific publisher by 10%.

11. Bank DataBase, create the following tables BRANCH(Branchname : string; Branchcity :string; Assets: decimal(12,2)) CUSTOMER(customername: string; street: string; city: string) LOAN(loanno: int ; branchname: string FK; amount:int) BORROWER(customername: string FK; loanno:int FK) ACCOUNT(accno:int PK;branchname:string FK;balance:decimal(8,2)) DEPOSITOR(Name:string;Accno:int FK)

a) Create the above tables.

b) Insert atleast 5 tuples into each table.

c) Find all customers who have atleast 2 accounts at the main branch.

d) Find all customers who have A/c to all the branches located in a specific day.

12. Create Department , Employees , Locations and Jobs tables

a) Write a query to find the name(first_name,last_name) and the salary of the employees who have a higher salary than the employee whose last_name="maiya".

b) Write a query to find the name(first_name,last_name) of all the employees who works in the IT department

c) Write a query to find the name(first_name,last_name) of the employees who have a manager and worked in a USA department.

d) Write a query to find the name(first_name,last_name) and salary of the employees whose salary is equal to the minimum salary for their job grade

S1. COMPLEMENTARY SKILLS - I

Lecture Hrs : 27

Internal Marks : 15

Exam Marks: 35

- 1. Learning to Learn
 - a. New skills
 - b. New concepts
 - c. Continuous learning
 - d. Learning teams and learning organization
- 2. Communication Skills
 - ability to read, write, and speak clearly and effectively
 - communication with colleagues, superiors, clients, vendors, and others
 - e. Language skills
 - f. Oral communication
 - In person
 - Telephone
 - Video calls
 - g. Written communication
 - Email
 - Online chat
 - Social networks
 - A variety of instant messaging apps
- 3. Technical writing Documentation Patterns
- 4. Public Speaking and Presentation
 - a. Preparation
 - b. Presentation
 - c. Use of various tools
- 5. Stress Management Life Style and Health

Second Semester

	Second Semester – M.Sc Computer Science							
Code	Name of the Course	Hours/ Week		Marks		Credits	Lab	
			IA	Exam	Total			
C6	Software Testing	4	30	70	100	4	N	
C7	Data Mining	4	30	70	100	4	Y	
C8	Enterprise Application Development	4	30	70	100	4	Y	
C9	Operating Systems and Network Programming	4	30	70	100	4	Y	
C10	Elective 1 (one of the following)	4	30	70	100	4	Y	
	Cryptography and Security							
	Artificial Intelligence							
	Advanced Computer Networks							
L3	Enterprise Application Development Lab	4	30	70	100	4	Y	
L4	Network Programming and Design Lab	4	30	70	100	4	Y	
S2	Complementary skills - II	2	15	35	50	2	Ν	
		-	Tota	al Credit	750	30		

Internal Marks : 30

Lecture Hrs : 54 Description

This course presents the knowledge about Testing background such introduction of Bug , cause of Bug, how it effect on cost of project, role of STLC cycle realities of software testing. study of types of testing this subject enlighten the Configuration testing, Compatibility testing, Usability testing, Testing the documentation, Testing for software security, Web site testing and quality assurance.

Objective

- Describe test case design.
- Describe various level of test.
- Different testing management process;
- > Tools on controlling and monitoring testing.
- > Usability and different prototypes.

Outcome

After completing the course, students will able to:

- Formulate problem by following Software Testing Life Cycle.
- Design Manual Test cases for Software Project.
- Identify the realistic problem for different category of software.
- > Use automation testing tool students will be able test the software.

Unit-I INTRODUCTION

Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester"s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.

Unit - II TEST CASE DESIGN

Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

Unit - III LEVELS OF TESTING

The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing. **Unit-IV TEST AMANAGEMENT** 9 Hours

Exam Marks : 70

9 Hours

9 Hours

The National College, Autonomous, Basavanagudi, Bengaluru-04

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

Unit-V CONTROLLING AND MONITORING

Software test automation – skills needed for automation – scope of automation – design and architecturefor automation – requirements for a test tool – challenges in automation

- Test metrics and measurements –project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews –Developing a review program – Components of Review Plans– Reporting Review Results. – evaluatingsoftware quality – defect prevention – testing maturity model.

Unit-VI

The purpose of usability testing, Importance, Prototypes, Kinds of tests, Developing and conducting the Test.

REFERENCES BOOKS.

- 1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing Principles and Practices", Pearson education, 2006.
- 2. Aditya P.Mathur, "Foundations of Software Testing", Pearson Education, 2008.
- 3. Web Application Testing And Security Testing Techniques Design: Develop New Software Testing Techniques Based on Combinatorial Testing Techniques October 24, 2011 by Wenhua Wang (Author), Yu Lei (Author) Publisher: LAP LAMBERT Academic Publishing (October 24, 2011).
- 4. Instant Approach to Software Testing: Principles, Applications, Techniques, and Practices (English Edition) Paperback – October 14, 2019 by Dr Anand Nayyar (Author).
- 5. Concise Guide to Software Testing (Undergraduate Topics in Computer Science) October 1, 2019 by Gerard O'Regan (Author) Publisher: Springer; 1st ed. 2019 edition (October 1, 2019).
- 6. Software Quality Assurance and Testing for Beginners Paperback May 9, 2019 by Nitin C Shah (Author).

C7: DATA MINING

Lecture Hrs: 54 **Description**

Internal Marks : 30

This course discusses techniques for preprocessing data before mining and presents the concepts related to data warehousing, online analytical processing (OLAP), and data generalization. It presents methods for mining frequent patterns, associations, and correlations. It also presents methods for data classification and prediction, dataclustering approaches, and outlier analysis **Objective**

- Interpret the contribution of data warehousing and data mining to the decisionsupport level of organizations.
- Evaluate different models used for OLAP and data preprocessing.
- Categorize and carefully differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, and cluster and outlier analysis.
- > Design and implement systems for data mining.
- Evaluate the performance of different data-mining algorithms.

Outcome

After completing the course, students will able to:

- Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors. Learning objectives include:
- Building basic terminology.
- > Learning how to gather and analyze large sets of data to gain useful business understanding.
- > Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions.
- > Describing and demonstrating basic data mining algorithms, methods, and tools
- Identifying business applications of data mining

Unit - I

Introduction to Data Warehousing and Data Mining: Component and Processes, ETL, Data Mart, Decision Support system, Executive Information system. What is Data Mining? Motivating Challenges; The origins of data mining, Data Mining Tasks. 9 Hours

Unit - II

Data: Types of Data; Data Quality; Data Preprocessing; Measures of Similarity and Dissimilarity. Exploring Data: OLAP, Multidimensional Data Analysis, Data cube model.Visualization.

Unit - III

Classification: Preliminaries; General approach to solving a classification problem, Decision tree induction, ID3, CD4, CART Algorithms, Rule-based classifier; Nearestneighbor classifier. 9 Hours

Unit-IV

Association Analysis: Problem Definition, Frequent Item set generation; Rule Generation, Compact representation of frequent item sets, Alternative methods for

9 Hours

generating frequent item sets. FP-Growth algorithm, Evaluation of association patterns, Effect of skewed support distribution, Sequential patterns. **Unit-V** 9 Hours

Cluster Analysis: Overview, K-means, Agglomerative hierarchical clustering, DBSCAN, Overview of Cluster Evaluation.

Unit-VI

9 Hours

Further Topics in Data Mining: Multidimensional analysis and descriptive mining of complex data objects; Spatial data mining, Multimedia data mining; Text mining. Applications: Data mining applications, Additional themes on Data mining; Social impact of Data mining; Trends in Data mining.

REFERENCES BOOKS.

- 1. Introduction to Data Mining, Global Edition Paperback 31 May 2019by Pang-Ning Tan (Author), Michael Steinbach (Author), Vipin Kumar (Author), Anuj Karpatne (Author) Publisher: Pearson Education; 2 edition (31 May 2019)
- Data Mining: Concepts and Techniques 3rd Edition. Authors: Jiawei Han Micheline Kamber Jian Pei ISBN: 9780123814791eBook ISBN: 9780123814807 Imprint: Morgan KaufmannPublished Date: 22nd June 2011
- 3. Data Mining and Data Warehousing: Principles and Practical Techniques 1st Edition by Parteek Bhatia (Author) Publisher: Cambridge University Press; 1 edition (June 27, 2019).
- 4. Head First Data Analysis: A Learner's Guide To Big Numbers, Statistics, And Good Decisions 1st Edition by Michael Milton (Author) Publisher: O'Reilly Media; 1 edition (August 7, 2009).
- 5. Introduction to Data Mining Paperback 10 Jul 2016 by Pang-Ning Tan (Author), Michael Steinbach (Author), Vipin Kumar (Author)Publisher: Pearson Education; First edition (10 July 2016).

C8. ENTERPRISE APPLICATION DEVELOPMENT

Lecture Hrs : 54 Internal Marks : 30

Exam Marks: 70

Description

This course discusses various web application development language starting from Fundamental of CSS, Bootstrap, Java scripts, HTML followed by advance tools like J2EE architecture and syntactic construction, Servlets, sessions, JDBC ,JSP, JSTL, XML, RMI, Web services.

Objective

This course aims at imparting expertise in Web Application Development using J2EE tools. Students will learn to write applications using the various IDE's and mostly Eclipse and Netbeans. As part of the course, students will build GUI applications and connect to JDBC, create Web applications using server side programming languages – servlets, jsp and Enterprise applications using Session Bean, Entity Bean and Message Driven Bean.

Outcome

After completing the course, students will able to:

- > Implement a code in JDBC to communicate with database.
- > Develop web applications using Servlets and JSP.
- Integrate Servlets, JSP and JDBC and build a web application.
- > Build Enterprise Applications using Session Bean, Entity Bean and MDB.

Unit - I

CSS: Selectors , Integrating CSS, CSS background, text, CSS fonts, links, lists, tables, CSS box model, CSS border, margin, padding, CSS grouping/Nesting, CSS positioning, CSS floating, CSS pseudo-class & element, CSS image, opacity.

Unit - II

Bootstrap 4: Why Use Bootstrap?, Bootstrap 4 CDN, BS4 Container, BS4 Grids, BS4 Colors, BS4 Tables, BS4 Images, Jumbotron, Alerts, Buttons, Button Groups, BS4 Badges, BS4 progress Bars, Pagination, List Groups, Cards, Dropdowns, Collapse, BS4 Navs, Carousel, Modal, Utilities, Media Objects.

Unit - III

Java Script: Integrating JavaScript with HTML, JS statements, JS objects, JS operators, JS functions, JS validations, HTML DOM, Dom events, DOM nodes, JS string, JS date, JS RegExp, JS window, JS screen, JS location, JS history, JS navigator, JS pop ups, JS timing, JS cookies.

Unit-IV

Introduction to J2EE and Web Containers: Need for Enterprise Programming, J2EE Advantage, Enterprise Architecture Type, Architecture of J2EE, Introducing J2EE containers, Types of J2EE Technologies.

Understanding the HTTP Protocols, Introducing Web Applications and Web Containers Web Application Life Cycle, Creating a Web Application, EJB Centric Application.

Unit-V

9 Hours

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9 Hours

9 Hours

9 Hours

M.Sc CS

Servlet, Sessions and Database Connectivity: Introduction to Servlet, Servlet Life Cycle, Java Servlet API, Servlet Context, Servlet Collaboration, Introduction to Session Management, Session Tracking mechanism, Understanding JDBC ,JDBC architecture , JDBC drivers.

Unit-VI

9 Hours

JSP, RMI and Web services: JSP Introduction, Life Cycle, JSP API, JSP Scripting elements, Implicit Objects, JSP Directive Elements, JSP Exceptions, Action Elements.

Understanding RMI, RMI Architecture, Stubs and Skeletons. Web services: Introduction, Architecture, Components-SOAP,WSDL and UDDI, SOAP Web services, RESTful Web services.

REFERENCES BOOKS.

- 1. Java 2 Enterprise Edition 1.4 (J2EE 1.4) Bible , Publisher: Wiley (2003).
- 2. Java Server Programming Java EE7 (J2EE1.7) Black Book Author Name Kogent Learning Solutions Inc.ISBN 13 9789351194170 Release Date March 2014.
- 3. Practical Enterprise Application Development June 14, 2019 by Francesco Marchioni (Author).
- 4. Kotlin for Enterprise Applications using Java EE: Develop, test, and troubleshoot enterprise applications and micro services with Kotlin and Java EE Paperback – November 30, 2018 by Raghavendra Rao K (Author) Publisher: Packt Publishing (November 30, 2018).
- 5. Learning Bootstrap Book by Aravind Shenoy and Ulrich Sossou Publisher: Packt Publishing (December 23, 2014).
- 6. Mastering Java EE 8 Application Development Paperback August 9, 2019 by Kapila Bogahapitiya (Author), Sandeep Nair (Author).

C9. OPERATING SYSTEMS AND NETWORK PROGRAMMING

Internal Marks : 30

Lecture Hrs : 54 Description

This course discusses various aspect of different operating system which includes distributed and network operating systems also covers inter process communication using signals, pipes, message queue, semaphores and socket programming using C programming language on Linux platform

Objective

This course aims at imparting practical skill on network programming using inter process communication with the extensive use of various networking program based on signals, pipes, FIFO, semaphores and socket.

Outcome

After completing the course, students will able to:

- > Implement small program to demonstrate operating system function
- Develop program using system calls.
- > Demonstrate program on inter process communication.
- Build communication programs between client machine and server machine using sockets.

Unit – I INTRODUCTION

Definition of operating system, system goals, System View and User View, Types of operating systems, components of operating systems, services, system structure-simple and layered approach.

Unit - II DISTRIBUTED & NETWORK OPERATING SYSTEMS

Introduction to distributed systems, advantages, Network OS; Remote login; remote file transfer. Distributed OS- data migration, computation migration, process migration, communication, communication protocols.

Unit - III CASE STUDIES

Single User System – MS-DOS, Multi User System – Windows, Linux.

Unit-IV INTERPROCESS COMMUNICATION: Signals, Pipe and 9 Hours Fifo

Concept of process, fork() function, signals-signal() function, SIGINT, SIG_DFL, SIGQUIT, SIGHUP and SIGALRM parameters, kill() function. Open signals. Pipes-creation of pipes, parent and child communication using pipes, FIFOS-creation, producer consumer example.

Unit-V INTERPROCESS COMMUNICATION: Message Queues, 9 Hours Semaphores and Shared Memory

Message queues-creation, information about message queue, sending and receiving message queues, sense of priority, Semaphores-creation, getting and setting semaphore values, semop() function. Shared memory-creation, attaching and detaching shared memory.

Unit-VI ELEMENTARY SOCKETS

Introduction to Socket Programming –Introduction to Sockets, Types of sockets Socket address Structures, Byte ordering functions, address conversion functions, Elementary TCP Sockets , socket, connect, bind, listen, accept, read, write, close functions

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Exam Marks: 70

9 Hours

9 Hours

9 Hours

,Examples. **REFERENCES BOOKS.**

- 1. Operating Systems Concepts Silberschatz, Galvin and Gagne. W. Richard Stevens, Bill Fenner, Andrew M.Rudoff "UNIX NETWORK PROGRAMMING" Vol-I, PHI publications Publisher: Wiley; 8 edition (July 29, 2008).
- 2. The C Odyssey Unix by MeetaGandhi, ThilakShattyand, Rajiv Shah (Bbp publications) Date Published Sep 29, 2017.
- 3. Beej's Guide to IPC. : (<u>www.ecst.csuchico.edu/~beej/guide/ipc/</u>).
- 4. Beej's Guide to Network Programming.(<u>www.ecst.csuchico.edu/~beej/guide/net/</u>).
- 5. Principles of Operating Systems 18 Jun 2014 by Naresh Chauhan (Author) Publisher: Oxford University Press (18 June 2014).
- 6. Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code by Lewis Van Winkle (Author) Publisher: Packt Publishing; 1 edition (May 13, 2019).
- 7. TCP/IP Sockets in C: Practical Guide for Programmers (The Morgan Kaufmann Practical Guides Series) 2nd Edition, by Michael J. Donahoo (Author), Kenneth L. Calvert (Author) Publisher: Morgan Kaufmann; 2 edition (March 2, 2009).

C10. ELECTIVE 1 (Any One of the Following)

C10. CRYPTOGRAPHY AND NETWORK SECURITY

Lecture Hrs : 54

Internal Marks : 30

Exam Marks: 70

Description

This Course focuses towards the introduction of network security using various cryptographic algorithms and understanding network security applications. It also focuses on the practical applications that have been implemented and are in use to provide email and web security.

Objective

- To understand the fundamentals of Cryptography
- > To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- > To understand the various key distribution and management schemes.
- > To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

Outcome

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

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- > Evaluate security mechanisms using rigorous approaches, including theoretical
- Compare and Contrast different IEEE standards and electronic mail security

Unit – I

Introduction: Security Trends, The OSI Security Architecture ,Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.

Unit - II

Block Ciphers and the Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles, Groups, Rings, and Fields, Modular Arithmetic, The Euclidean Algorithm.

Unit - III

Confidentiality Using Symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generatio 9 Hours

Unit-IV

Public-Key Cryptography and RSA:Principles of Public-Key Cryptosystems, The RSA Algorithm.

Digital Signatures and Authentication Protocols : Digital Signatures, Authentication Protocols, Digital Signature Standard.

Unit-V

Electronic Mail Security - Pretty Good Privacy, S/MIME.

IP Security: IP Security Overview , IP Security Architecture, . Authentication Header. **Unit-VI** 9 Hours

9 Hours

9 Hours

9 Hours

Web Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction. System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Firewalls. **REFERENCES BOOKS.**

- 1. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill Tata McGraw-Hill Education, 2003.
- 2. William Stallings, "Cryptography and Network Security Principles and Practices", Prentice Hall of India Publisher: Pearson; 6 edition (March 16, 2013).
- 3. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc Publisher: Wiley; Second edition (2007).
- 4. Security in Computing (5th Edition) 5th Editionby Charles P. Pfleeger (Author), Shari Lawrence P fleeger (Author), Jonathan Margulies (Author) Publisher: Prentice Hall; 5 edition (February 5, 2015).
- 5. Cryptography and Network Security: Principles and Practice (7th Edition) 7th Edition by William Stallings (Author) Publisher: Pearson; 7 edition (March 5, 2016).
- 6. Network Security Essentials: Application And Standards, 6Th Edition 6th Edition by Stallings (Author) Publisher: Pearson India; 6th edition (October 6, 2016).
- 7. Network Security Monitoring: Basics for Beginners. A Practical Guide Paperback October 17, 2017 by Robert Collins (Author).

C10. ARTIFICIAL INTELLIGENCE

Lecture Hrs: 54

Internal Marks: 30

Exam Marks: 70

Description

This course provides an introduction to the fundamentals of artificial intelligence. It contains a theory component about the concepts and principles that underlie modern AI algorithms, and a practice component to relate theoretical principles with practical implementation. The course divides into four parts. The first part of the course discusses search algorithms (BFS, DFS, UCS, A*, Min-Max trees). The

second part of the course discusses probability as a mathematical tool, Bayesian networks and hidden Markov models. The third part of the course overviews machine learning algorithms both supervised and unsupervised. An introduction to learning by reinforcement is included as well. The last part concerns logic and planning algorithms such as value iteration for MDP. Along the course we highlight

Application domains such as robotics (e.g. particle filters for perception) and natural language processing.

Objective

The objective is to give an overall idea about the field without delving into advanced details whenever possible.

Outcome

- List the objectives and functions of modern Artificial Intelligence.
- > Categorize an AI problem based on its characteristics and its constraints.
- > Understand and implement search and adversarial (game) algorithms.
- > Understand mathematical models such as belief networks and Markov decision processes and apply them to a range of AI problems.
- Have a glance at machine learning algorithms and extracting knowledge models from data.
- Learn different logic formalisms and decision taking in planning problems.
- Learn how to analyze the complexity of a given problem and come with suitable optimizations.
- Demonstrate practical experience by implementing and experimenting with the learnt algorithms.

Unit-I

Introduction: Definition, A.I Applications, A.I representation, Properties of internal representation, heuristic search techniques, Best-first search, mean and end analysis, A* and AO* algorithms.

Knowledge Representation: Predicate calculus, predicate and arguments, ISA hierarchy, frame notation, resolution, natural deduction, fuzzy logic, structure knowledge representations.

Unit - II

Planning: Hierarchical Task Networking planning, planning and acting in Nondeterministic domains. Natural Language Processing: Introduction, understanding pragmatics, syntactic, semantic analysis, RTN, ATN, understanding sentences.

Unit - III

Pattern Recognition: Introduction, the recognition and classification process, learning

9 Hours

9 Hours

classification natterns recognizing	and understanding speech	<u>ו</u>		
Unit-IV	, and and erstanding speech	1.	9 H	ours
Learning: Learning as induction solving concept learning.	matching algorithms, leas	rning in ge	neral pro	blem
Unit-V			9 H	ours
Neural Networks: Introduction, architecture and application	perception-qualitative	analysis,	neural	net
Unit-VI			9 H	ours
Expert Systems: Utilization and fur	nctionality, architecture of	expert syste	em, knowl	edge

REFERENCES BOOKS.

- 1. Artificial Intelligence: A Modern Approach Paperback Import, 1 Jul 2019 by Stuart Russell (Author), Peter Norvig (Author) Publisher: Pearson; 4 edition (1 July 2019)
- 2. Dan W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems", PHI 2007.
- 3. E.Charnaik and Mc Dermott, "Introduction to Artificial Intelligence", Pearson Education – 2nd Edition 1985.
- 4. ARTIFICIAL INTELLIGENCE Third Edition Paperback 1 Jul 2017by Kevin Knight (Author), Elaine Rich (Author), B. Nair (Author) Publisher: McGraw Hill Education; 3 edition (1 July 2017).
- 5. Artificial Intelligence Meets Augmented Reality Paperback 2019 by Chitra Lele (Author) Publisher: BPB Publications; 1st edition (2019).
- Artificial Intelligence 3e: A Modern Approach Paperback 2015 by Russell (Author) Publisher: Pearson Education India; 3 edition (2015).
C10. ADVANCED COMPUTER NETWORKS

Internal Marks : 30

Lecture Hrs : 54 Description

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

Types of networks (LAN, MAN, WAN and Wireless networks) and their protocols. <mark>Objective</mark>

- > Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer
- Networking area.
- Introduce the student to advanced networking concepts.
- Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Outcome

- > Independently understand basic computer network technology.
- > Understand and explain Data Communications System and its components.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
- Identify the different types of network devices and their functions within a network
- > Understand and building the skills of sub netting and routing mechanisms.
- Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Unit-I: Introduction and Layered Network Architecture

Introduction to Computer Networks, Classification and Benefits of networks. Basics of Telecommunication: Channels, Analog & Digital signals and lines, Bandwidth & Bit-rate, Distortion & Noise, Transmission error, Synchronization, Multiplexing, PSTN architecture, Modulation, Modems, Switching techniques. Layered Network Architecture: Introduction to layered architecture; Characteristics And benefits, OSI model and TCP/IP model, and their comparison.

Unit - II: Point - to- Point Protocols and Links

Introduction, The Physical Layer: Channels and Modems, Error Detection and Correction codes: Character parity, CRC, Hamming code, Convolution code, ARQ: Retransmission Strategies, Framing

Unit – III: Multi-Access Communication

Introduction: Satellite Channels, Multi-drop Telephone Lines, Multi-tapped Bus. Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing (Ethernet LAN, IEEE 802.3), Collision-free protocols: Bit-map protocol and Token-ring protocol

Science

Exam Marks: 70

9 Hours

9 Hours

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(IEEE 802.5), Multi-Access Reservations, Packet Radio Networks, Repeaters, Bridges, Switches and Routers 9 Hours

Unit-IV: Routing in Data Networks

Introduction – Main Issues in Routing, WAN – An Overview, Interconnected Network Routing. Optimal Routing and Topological Design, Characterization of Optimal Routing. Static and Dynamic routing algorithms: Shortest Path Routing, Flooding, Flow-based routing, Distance Vector routing, Link-state routing. Broadcasting and multicasting.

Unit-V: Internet Protocol

IPv4 addresses: classes, Public and Private addresses, class full address, classless address, IPv6 addresses: address space, structure, Subnetting and Masking, IP Header / Frame.

Unit-VI: Flow Control and Congestion control

Introduction: Difference between Flow control and Congestion control, measures of Congestion control. Main Objectives of Flow and Congestion Control. Means of Flow Control: Window Flow Control, Rate Control Schemes, Congestion control Algorithms: Leaky bucket algorithm, Token bucket algorithm, Choke packets, Load shedding. **REFERENCES BOOKS.**

- 1. Data Networks by DimitriBertsekas and Robert Gallager, Second **Edition, Pearson Education (1992).**
- 2. Computer Networks by Andrew S. Tanenbaum, 6thEdition, PHI **Publications 2003.**
- 3. Computer Networks, Pearson New International EditionPearson New International EditionBy: Andrew S. Tanenbaum, David J. Wetherall Published: 23rd July 2013Publisher: Pearson Education Limited.
- 4. Data Communications and Networking by Behrouz A. Forouzan, Fourth Edition, McGraw-Hill publications; 4 edition (1 July 2017).
- 5. IP Routing Fundamentalsby Mark Sportack (Author) Publisher: Cisco **Press (March 1, 1999)**
- 6. Routing TCP/IP, Volume 1 (2nd Edition) 2nd Edition by Jeff Doyle Jennifer DeHaven Carroll Publisher: Cisco Press; 2 edition (October 29, 2005)
- 7. Advanced Computer Networks 2013 by Sanjay Sharma Publisher: S.K. Kataria & Sons; Reprint 2013 edition (2013).
- 8. Network Programmability and Automation: Skills for the Next-Generation Network Engineer 1st Editionby Jason Edelman, Scott S. Lowe, Matt Oswalt Publisher: O'Reilly Media; 1 edition (March 3, 2018).

9 Hours

L3: ENTERPRISE APPLICATION DEVELOPMENT LAB

Lab Hours : 54

Internal Marks : 15

Exam Marks: 35

Course Objectives/Course Description

The course is designed to provide a practical exposure to the students.

Learning Outcome

Upon completion of the course, the students acquire the knowledge to build the logic and develop a solution for a problem statement. Using Java Scripts, CSS, J2EE, XML and Web services

- **1** Design a simple jsp file to take a text input "color" and demonstrate request.getparameter
- 2 Design a simple login page using jsp and validate a user in java class file using
- **3** Write a servlet program to display the server DATE and TIME.
- 4 Write a servlet program to get the hobbies of a person demonstrating
- **5** Write a servlet program to demonstrate GET and POST method
- **6** Write a servlet program to demonstrate RESPONSE OBJECTS.
- 7 Write a servlet program to insert student information to the database by taking input from the console by connecting to MYSQL database using servlets.
- **8** Write a servlet program to retrieve data from a database "telephone directory" by talking either phone number or name as input
- **9** Write a servlet program to illustrate SESSION.
- **10** Write a servlet program to illustrate COOKIES.

L4: NETWORK PROGRAMMING AND DESIGN LAB

Lab Hours : 54

Internal Marks : 15

Exam Marks: 35

Course Objectives/Course Description

The course is designed to provide a practical exposure to the students. Learning Outcome

Upon completion of the course, the students acquire the knowledge to build the logic and develop a solution for a Network related problem statement using C on Linux and windows platform and also algorithm like dynamic programming and backtracking analysis of time complexity.

PART - A

- 1 Write a program to establish communication between parent and Child process using open Signals.
- **2** Write a Program to accept 'M' value in Child Process and send to Parent Process, Generate 5 Factorial of 'M' in Child Process. Accept 'N' value in Parent Process Send to Child, Generate Fibonacci Series number up to 'N'. Use two PIPES for Communication (Using Two PIPES).

OR

Write a Program to establish communication between Parent and Child process using two PIPES.

- **3** Write a Program to accept Your Name, Reg_no and Three Subjects marks in Parent process and send these details to Child process by using Message Queue. In Child process Calculate total Marks and Average and display the details.
- 4 Write a Program to accept 'N' numbers in Parent Process and Sort them in Child process, Synchronize using Semaphore (Using SETVAL() and GETVAL())
- **5** Write a Program to accept two Matrices in Parent process and Find the Sum of the Matrices in Child process ,Synchronize using Semaphore(Use semop()Function)
- **6** Write a program to accept n values in parent process and store I store in shared memory in child process retrieve the values of n nuof n number and generate prime numbers.
- **7** Design TCP iterative Client and Server application to Reverse the given input sentence.
- **8** Design TCP Client and Server application to transferfile.
- **9** Design UDP Client and Server Application to Reverse the given input Sentence.

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- **10** Design UDP Client and Server Application in which from Client sends filename to Server and in Server display the file Contents.
- **11** Write a program to implement chat functionality by using FIFO.

PART - B

- **12** Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- **13** C program to evaluate a given polynomial by reading its coefficients in an array.
- **14** Write a program to Compute the transitive closure of a given directed graph using Warshall's algorithm.
- **15** Write a program to solve knapsack problem using greedy method.
- **16** From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
- **17** Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
- **18** Print all the nodes reachable from a given starting node in a digraph using BFS method.
- **19** Check whether a given graph is connected or not using DFS method
- **20** Write a program to solve sum of sub set using backtracking.
- **21** Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
- **22** Implement N Queen's problem using Back Tracking.
- **23** Implement graph coloring using Back Tracking.

1. COMPLEMENTARY SKILLS - II

Lecture Hrs : 27

Internal Marks : 15

Exam Marks: 35

- 1. Time Management Personal Software Process (PSP)
- 2. Project Management
 - a. PERT concepts
 - b. Planning, monitoring and controlling a project
 - c. Project management tools
- 3. Team work
 - a. Willingness and ability to learn from other people.
 - b. Willingness to teach other people.
 - c. Offering constructive feedback, instead of only criticizing.
 - d. Teaching, mentoring, and knowledge sharing

Third Semester

Third Semester – M.Sc Computer Science								
Code	Name of the Course	Hours/ Week		Marks		Credits	Lab	
			IA	Exam	Total			
C11	Big Data Analytics	4	30	70	100	4	Y	
C12	WebApplicationDevelopment with Android	4	30	70	100	4	Y	
C13	Elective 2 (one of the	4	30	70	100	4	Y	
	following)							
	Machine Learning							
	Embedded Systems							
	User Interface Design							
C14	Elective 3 (one of the	4	30	70	100	4	Y	
	following)							
	High Performance							
	Computing and Cloud							
	Compiler Design							
	Performance Modelling							
	Social Networks							
L5	Android and User Interface	4	30	70	100	4	Y	
	Lab							
L6	Big data Practical Lab	4	30	70	100	4	Y	
<u>S3</u>	Complementary skills – III	2	15	35	50	2	Ν	
OE	Open to the students of	2	15	35	50	2	Ν	
L	Other Disciplines							
	1. Web Page Design							
			Tota	al Credit	700	28		

Exam Marks: 70

C11. INTRODUCTION TO BIG DATA ANALYTICS

Internal Marks : 30 Lecture Hrs : 54

Description

This course will cover the basic concepts of big data, methodologies for analyzing structured and unstructured data with emphasis on the relationship between the Data Scientist and the business needs.

Obiective

- ➢ introduce students the concept and challenge of big data (3 V's: volume, velocity, and variety).
- teach students in applying skills and tools to manage and

analyze the big data.

Outcome

- > understand the concept and challenge of big data and why existing technology is inadequate to analyze the big data;
- collect, manage, store, query, and analyze various form of big data; and
- > gain hands-on experience on large-scale analytics tools to solve some open big data problems; and
- understand the impact of big data for business decisions and strategy

Unit-I

9 Hours

Preparatory: Data Science landscape, relevance and importance of data analytics, Data sources: Social data - from organizations like WHO and social sites like face book. Government data - like data.gov.in, Data from own organization, Data formats: Structured, Semi-structured, Unstructured, Excel for presentation and simple visualization of structured data. Raw and Processed Data, Components of Tidy Data, Downloading Files, Reading Local Files, Reading Excel Files, Reading XML, Reading JSON, Reading from MySQL, Reading from HDF5, Reading from The Web, Reading From APIs. 9 Hours

Unit - II

Data preparation / Mugging: Subsetting and Sorting, Summarizing Data, Handling missing values, Creating New Variables, Reshaping Data, Merging Data.

Unit - III

Data Exploration: Exploratory Graphs

Unit-IV

Data Modelling: Data grouping, frequency, and aggregation, Handling missing data, Text manipulation and format conversion, Assertions and logical operations

Unit-V

Analysis: Mathematical functions, Sampling, Relationship between variables, Rank and percentile Time series analysis, Descriptive statistical measures, Confidence level, Analysis of variance, Correlation Covariance, Regression, Moving average

Unit-VI

Visualisation Comparison among items, Comparison over time, Relationship - two variables and three variables, Distribution - histogram, line chart, scatter chart, 3D area

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9 Hours

9 Hours

9 Hours

chart, Composition - static and changing over time

REFERENCES BOOKS

- 1. Python Data Science Handbook: Essential Tools for Working with Data 1st Edition, Kindle Edition by Jake VanderPlas (Author) Publisher: O'Reilly Media; 1 edition (21 November 2016).
- 2. Python for Data Analysis, 2nd Edition by Wes McKinney Released October 2017Publisher(s): O'Reilly Media, Inc.
- 3. Getting Started with Data Science: Making Sense of Data with Analytics (IBM Press) 1st Edition, Kindle Edition by Murtaza Haider (Author) Publisher: IBM Press; 1 edition (14 December 2015).
- 4. Introducing Data Science: Big Data, Machine Learning, and more, using Python tools 1st Edition by Davy Cielen (Author), Arno Meysman (Author), Mohamed Ali (Author) Publisher: Manning Publications; 1st edition (May 23, 2016).

C12. WEB APPLICATION DEVELOPMENT WITH ANDROID

Lecture Hrs: 54

Internal Marks: 30

Exam Marks: 70

Description

Students learn how to develop applications for mobile devices, including Android smart phones. Students are introduced mobile platforms, mobile application development environments, mobile device input methods, as well as developing applications for two popular mobile platforms. Students will design and build a variety of Apps throughout the course to reinforce learning and to develop real competency.

Objective

Upon completion of this course, you will be able to:

- Build your own Android apps
- ≻ Explain the differences between Android[™] and other mobile development environments
- ➤ Understand how Android[™] applications work, their life cycle, manifest, Intents, and using external resources
- ➤ Design and develop useful Android[™] applications with compelling user interfaces by using, extending, and creating your own layouts and Views and using Menus.
- Take advantage of Android's APIs for data storage, retrieval, user preferences, files, databases, and content providers
- > Tap into location-based services, geo coder, compass sensors, and create rich map-based applications
- Utilize the power of background services, threads, and notifications.
- Use Android's communication APIs for SMS, telephony, network management, and internet resources (HTTP).
- Secure, tune, package, and deploy Android[™] applications

Outcome

- Explain mobile devices, including their capabilities and limitations.
- Use current mobile platforms and their architectures.
- > Develop mobile applications on a popular mobile platform.
- > Evaluate development with another mobile platform.

Unit-I

9 Hours

9 Hours

Introduction to Android: Scenario before Android- Midlets, Symbian, Android SDK features, OHA, Android Software Stack, Externalized Resources & APK, ADT Plugin, Android Application Architecture.

Unit - II

Getting Started: Types of Android Application, Android Development Tools, Android Manifest.xml, Components comprising an Android Application 9 Hours

Unit - III

Application & Activities: Application priority, Activity stack, Application LifeCycle Intents & Broadcast Receivers: Explicit & implicit Intents, Subactivities, Broadcasting Intents, Broadcast Receivers, Intent Filters & their categories, Intent Resolution, Pending Intents, Permissions.

Unit-IV

9 Hours

Building User Interface: Fundamental android UI design, Introducing Layouts, Fragments-Landscape, portrait fragments, Fragment Manager, Fragment Lifecycle, Android widget toolbox, Views, Adapter-Array Adapter & SimpleCursor Adapter Unit-V 9 Hours

Data Persistence & Shared Preferences: Content Provider, Content Resolver, Cursor, SQLite Database, Shared Preferences.

Unit-VI

Telephony & Email: SMS , Telephone Manager, Callstate Change, Service Change, Data Connectivity.

REFERENCES BOOKS.

- 1. Professional Android 4 Application Development by Reto Meier, Wiley India Pvt Ltd, May2012.
- 2. Beginning Android 4 Application Development by Wei-Meng Lee, Wiley India Pvt Ltd 2012.
- 3. Android in Action by W. Frank Ableson , Manning Publications; 3 edition (20 November 2011)
- 4. Learning Android by Marko Gargenta , O'Reilly Media Publisher: O'Reilly Media; 1 edition (March 31, 2011).
- 5. Android Programming for Beginners: Learn all the Java and Android skills you need to start making powerful mobile applications December 31, 2015. by Packt Publishing (December 31, 2015).
- 6. Hello Android: Introducing Google's Mobile Development Platform, Fourth Edition 2015 by Ed Burnette Publisher: Shroff/Pragmatic Bookshelf
- 7. Android Practical Books, Android Phones & Tablets Development: Android,SQL Lite, Firebase & Unity Paperback – October 4, 2019 by Sujit Kumar Mishra
- 8. Android Studio IDE Quick Reference: A Pocket Guide to Android Studio Development Paperback – July 31, 2019by Ted Hagos (Author). Publisher: Apress; 1st ed. edition (July 31, 2019).
- 9. Red Is the Android: Legend from the Starship Warden Paperback June 21, 2019 by Craig Martelle (Author), James M. Ward (Author)
- 10. Android Smartphones Made Easy: The Beginners Guide Made For Beginners (Computers Made Easy) Paperback – July 28, 2019by James Bernstein (Author)

C13. ELECTIVE 2 (Any One of the Following) C13. MACHINE LEARNING

Lecture Hrs : 54

Internal Marks: 30

Exam Marks: 70

Description

The course is intended for both undergraduate and graduate students in computer science and related fields such as engineering and statistics. The course addresses the question how to enable computers to learn from past experiences. It introduces the field of machine learning describing a variety of learning paradigms, algorithms, theoretical results and applications.

Objective

To provide students with an in-depth introduction to two main areas of Machine Learning: supervised and unsupervised. We will cover some of the main models and algorithms for regression, classification, clustering and Markov decision processes. Topics will include linear and logistic regression, regularization, MLE, probabilistic (Bayesian) inference, SVMs and kernel methods, ANNs, clustering, and dimensionality reduction. The module will use primarily the Python programming language and assumes familiarity with linear algebra, probability theory.

Outcome

Upon Completion of this course the student will be able to:

- > List the objectives and functions of modern Artificial Intelligence.
- > Categorize an AI problem based on its characteristics and its constraints.
- > Understand and implement search and adversarial (game) algorithms.
- Understand mathematical models such as belief networks and Markov decision processes and apply them to a range of AI problems.
- Have a glance at machine learning algorithms and extracting knowledge models from data.
- > Learn different logic formalisms and decision taking in planning problems.
- Learn how to analyze the complexity of a given problem and come with suitable optimizations.

Unit-I Introduction:

Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses

Unit - II Decision Tree Learning:

Decision Tree Learning: Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Overfitting, noisy data, and pruning.

Unit - III Computational Learning Theory:

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training. Sample complexity for finite hypothesis spaces. PAC results for learning conjunctions, kDNF,

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9 Hours

9 Hours

and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension. 9 Hours

Unit - IV Rule Learning- Propositional and First-Order:

Rule Learning- Propositional and First-Order: Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming) and Foil. Learning recursive rules. Inverse resolution, Golem, and Progol.

Unit - V Artificial Neural Networks:

Artificial Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

Unit-VI Support Vector Machines:

Quadractic separators.

Maximum margin linear Support Vector Machines: programming solution to finding maximum margin separators. Kernels for learning non-linear functions. Clustering and Unsupervised Learning:Learning from unclassified data. Clustering. Hierarchical Aglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabeled data.

REFERENCES BOOKS

- 1. Mitchell, T. (1997). Machine Learning, McGraw Hill.
- 2. Christopher M. Bishop (2006) Pattern Recognition and Machine Learning, Springer ISBN 0-387-31073-8.
- 3. Yoshua Bengio (2009). Learning Deep Architectures for AI.
- 4. Aharon, M, M Elad, and A Bruckstein. 2006. "K-SVD: An Algorithm for Designing Overcomplete Dictionaries for Sparse Representation." Signal **Processing, IEEE Transactions.**
- 5. Machine Learning, 1st Edition, Sergios Theodoridis, Hardcover ISBN: 9780128015223, Academic Press, Published Date: 27th March 2015.
- 6. Deep Learning from Scratch: Building with Python from First Principles 1st Edition, by Seth Weidman (Author) O'Reilly Media; (9 September 2019).
- 7. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 1st Edition by Aurélien Géron O'Reilly Media; 1 edition (April 18, 2017).
- 8. Neural Networks and Deep Learning: A Textbook 1st ed. 2018 Edition, Kindle Editionby Charu C. Aggarwal (Author) Springer; 1st ed. 2018 edition.

9 Hours

13. EMBEDDED SYSTEMS

Lecture Hrs : 54 Description

Internal Marks : 30

JT

This is a course to explore in Embedded Systems hardware and firmware. The

Architecture and instruction sets of the ARM processor will be discussed. The course uses a bottom-up approach in gradually building and optimizing Embedded System Software. This course introduces basic RTOS principles and Embedded Software Development process.

Objective

To provide sufficient Knowledge to understand the Embedded systems design, Embedded programming and their operating system

Outcome

Upon Completion of this course the student will be able to:

- To provide in-depth knowledge about embedded processor, its hardware a software
- > To explain programming concepts and embedded programming in C and
- assembly language
- To explain real time operating systems, inter-task communication and an embedded software development tool

Unit-I

Introduction To Embedded Systems: Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

Unit - II

Devices and Buses For Devices Network: I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '12C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

Unit - III

Programming Concepts and Embedded Programming In C, C++: Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

Unit-IV

Real Time Operating Systems Part – 1: Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organization.

Exam Marks: 70

9 Hours

9 Hours

9 Hours

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9 Hours

Implementation – I/O Subsystems . Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics) Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks.

Unit-VI

Unit-V

9 Hours

Real Time Operating Systems Part – 2: Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS – Understanding Case Definition – Multiple Tasks and their functions – Creating a list of tasks – Functions and IPCs – Exemplary Coding Steps.

REFERENCES BOOKS.

- 1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes
- 2. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
- 3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001.
- 4. Frank Vahid and Tony Givargis, Embedded Systems Design A unified Hardware Software Introduction, John Wiley, 2002.
- 5. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003.
- 6. Real-Time Embedded Systems1st Edition Design Principles and Engineering Practices by Authors: Xiaocong Fan 28th January 2015.
- 7. Embedded and Real-Time Operating Systems reprint of the original 1st ed. 2017 Editionby K.C. Wang (Author).

C13. USER INTERFACE DESIGN

Internal Marks : 30

Lecture Hrs : 54

Description

In this course, students will learn how to design a User Interface that utilizes the latest in Mobile Design Patterns. Students will create solutions for suggested user tasks, applying knowledge gained through the observation of several categories of design patterns used in contemporary apps and websites.

Objective

- Gaining factual knowledge (terminology, classifications, methods, trends). Important emphasis
- Learning fundamental principles, generalizations, or theories.Important emphasis
- > Learning to apply course material (to improve thinking, problem solving, and decisions). Important emphasis
- > Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course (that is, user interface design and implementation).

Outcome

Upon Completion of this course the student will be able to:

- Students have the logical, algorithmic, and mathematical capability to model and analyze real-world problems in different application domains, to devise the problem-solving schemes accordingly, and to validate the correctness and effectiveness of the schemes.
- Students have a solid understanding of the theoretical, the operational, and the implementation underpinnings of the modern computing infrastructure to be able to effectively utilize the whole spectrum of the modern computing including computer hardware. software, programming infrastructure. environments, operating systems, and networking environments.
- > Programming and system integration. Students are capable of programming using mainstream programming languages, can conduct fine softwareengineering practices to implement problem-solving schemes as correct, efficient, and well-structured programs, and can integrate the programs into the computing infrastructure as functional information systems.
- Students are knowledgeable in important related subject areas in business, engineering, science, or mathematics, and are capable of conducting interdisciplinary work by applying their knowledge and skills in computer science to these domains or applying their knowledge and skills in these domains to computer science.

Unit-I: Introduction

Definition of user interface, GUI,CUI, usability, goals and measures, motivations, universal usability, guidelines and principles.

Unit – II: Interaction Styles

Direct Manipulation-Introduction and Discussion, Menu Selection, Form fill-in and Dialog boxes.

Exam Marks: 70

9 Hours

Unit – IV: Creating Meaningful Icons and Images

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Icons-kinds of Icons, characteristics of Icons, choosing Icons, choosing and creating Images, Drawing Images.

Interaction Devices-select the proper device based controls-Joystick, Graphics tablet., touch screen, light pen ,mouse, keyboard ,guidelines for selecting proper device based

Unit-V: Color Models and Choosing the proper colors

Color- color Models, Color Uses, possible problems with color, choosing color, Choosing the color for textual graphics screen.

Unit-VI: Usability Testing

Unit - III: Interaction Devices

controls.

The purpose of usability testing, Importance, Prototypes, Kinds of tests, Developing and conducting the Test.

REFERENCES BOOKS

- 1. Designing the User Interface: Strategies for Effective Human-Computer Interaction, 26 Feb 2009 by Ben Shneiderman (Author), Catherine Plaisant (Author), Maxine Cohen (Author), Steven Jacobs (Author)
- 2. The Essential Guide to user Interface Design: An Introduction to GUI Design Principles and Techniques, 2ed 2002by Wilbert O.Galitz (Author)
- 3. Usability Engineering 1st Edition by Jakob Nielsen (Author) Publisher: Morgan Kaufmann; 1 edition (September 23, 1993)
- The Design of Everyday Things: Revised and Expanded Edition Paperback 5 Nov 2013 by Don Norman (Author) Basic Books; 2 edition (5 November 2013)
- 5. About Face 2.0: The Essentials of Interaction Design Paperback 1 Apr 2003 by Alan Cooper (Author), Robert Reimann (Author) John Wiley & Sons; 2nd Revised and Updated ed. edition (1 April 2003).
- 6. UX UI design A Complete Guide 2019 Edition Publisher: 5starcooks

9Hours

9Hours

C14. ELECTIVE 3 (Any One of the Following) C14.BIG DATA PLATFORM

Internal Marks : 30

Lecture Hrs : 54 Description

The module provides a solid foundation in High Performance Computing (HPC) and its role in science and engineering. After introducing the major scientific application areas and basic concepts of parallel computing, it outlines the hardware design of modern HPC platforms and the parallel programming models that they support. This introductory course in Cloud computing is intended to teach both the systems concepts essential to understand how and why Cloud computing works, as well as their manifestation through Cloud platforms and technologies from service providers such as Amazon, Microsoft and Google. Students will learn parallel and distributed systems concepts like virtualization, task and data parallelism, distributed coordination and synchronization, and performance analysis. They will also get a practitioners view by learning programming models and Cloud application design patterns using web services, asynchronous applications, Map/Reduce, elastic **Objective**

- Fundamental concepts in High Performance Computing
- Shared memory programming (OpenMP)
- Message passing programming (MPI)
- Hardware, compilers and performance programming
- High performance networking Computation grids and escience
- Cloud architecture.
- Cloud deployment model.
- Virtualization technology.
- Hadoop distributed file system.
- Map reduction program.

Outcome

Upon Completion of this course the student will be able to:

- At the end of the module, a student will have an understanding of role of HPC in science and engineering.
- > The most commonly used HPC platforms and parallel programming models.
- The means by which to measure analyze and assess the performance of HPC applications and their supporting hardware.
- Mechanisms for evaluating the suitability of different HPC solutions to common problems found in Computational Science.
- Importance of various cloud computing service and there implementation
- > Able to understand the virtualization technologies and there implementation
- Write map reducing program to analyze weather forecast data

Unit-I HPC: Introduction

Definition of HPC, Applications of HPC ,Parallel workstation ,HPC role, Grid computing, Network computing and grid computing concepts ,Cloud computing, super computing, Examples of HPC, Clusters, HPC is a pragmatic discipline, Software Optimization, High Performance problem, Two types of parallelism, Distributed systems, scalar versus vector pipelining, multiprocessing system.

09 Hours

Exam Marks : 70

The National College, Autonomous, Basavanagudi, Bengaluru-04

Unit - II Concept of Parallel Computing

Introduction to cluster, definition of cluster, evolution of computing, scalable parallel computer architecture model, granularity and its types, Cluster computers and its architecture, Clusters classifications, Components of clusters, Resource management and Scheduling(RMS), packages of RMS such as LSF (Load Share Facility) and CODINE, programming environment and tools, Application, Message Passing System(MPI), heterogeneous clusters.

Unit – III Cloud Computing Basics

A brief history of cloud computing, origins, definition of cloud, simple model of cloud, Scaling concepts, Horizontal and vertical scaling, Cloud computing, overview, key characteristics, cloud delivery models, Cloud services and their platform's classification and examples, Infrastructure as a service, Platform as a service, Software as a service, Business Process as a service, Managing the cloud. SOA-Service oriented architecture and web services, SOA concepts, factors, Business process and its elements, Protocol of SOA showing the relationship of each protocol and its function

Unit-IV Server and Storage Virtualization

Introduction to Virtualization, Need of Virtualization in cloud computing, Load balancing and virtualization, The Google cloud, Understanding Hypervisors, Technique of Hypervisor, Types of Hypervisors, Virtual machine types, VMware's sphere cloud company infrastructure model, Process or Application Virtual machine, Operating system Virtualization, Storage Virtualization – Basic approach, Types of Virtualization, para virtualization, full virtualization).

Unit-V Hadoop

Data, Data Storage and Analysis, Comparison with Other Systems, RDBMS, Grid Computing, Volunteer Computing, , A Brief History of Hadoop, The Apache Hadoop Project, Map Reduce, A Weather Dataset, Data Format , Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop, Map and Reduce, Compiling and Running, The Hadoop Distributed File system, The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Data nodes, The Command-Line Interface, Basic File system Operations, Hadoop File systems Interfaces, Job trackers and Task trackers.

Unit-VI Map Reduce Types and Formats.

Data storage and analysis, Comparison of RDBMS and Map reduce, introduction to map reduce, Map reduce in Hadoop, Examples of map reduce, phases in map reduce, Features of the map reduce. Yarn in Hadoop, Function of Yarn, Yarn Architecture, workflow of an Application in Yarn, Features of Yarn, Yarn versus Map reduce.

REFERENCES BOOKS

- 1. Hands-On Azure for Developers Paperback 2018 by Kamil Mrzyglod (Author), Ingram short title (2018).
- 2. Essentials of Cloud Computing: A Holistic Perspective (Texts in Computer Science) Hardcover – August 28, 2019 by Chellammal Surianarayanan (Author), Pethuru Raj Chelliah (Author), Publisher: Springer; 1st ed. 2019 edition (August 28, 2019).

M.Sc CS 09 Hours

09 Hours

09 Hours

09 Hours

- 3. Cloud Computing: A Comprehensive Guide to Cloud Computing Paperback July 29, 2019 by Austin Young (Author), July 29, 2019.
- 4. Cloud Computing: A to Z of Cloud Computing Paperback July 9, 2019 by Nobert Young (Author), July 9, 2019.
- 5. Cloud Computing Solutions Architect: A Hands-On Approach: A Competency-based Textbook for Universities and a Guide for AWS Cloud Certification and Beyond Hardcover – July 4, 2019 by Arshdeep Bahga (Author), Vijay Madisetti (Author).
- 6. Cloud Computing: Master the Concepts, Architecture and Applications with Real-world examples and Case studies by Kamal Kant Hiran (Author), Ruchi Doshi (Author), Temitayo Fagbola (Author), Mehul Mahrishi (Author), Dr Maria-Alexandra Paun (Foreword), Deepak Modi (Foreword), Sushil Choudhary (Foreword) Publisher: BPB Publications (April 20, 2019).

C14. COMPILER DESIGN

Internal Marks : 30

Lecture Hrs : 54 Description

To introduce the major concept areas of language translation and compiler design.

To enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table. To extend the knowledge of parser by parsing LL parser and LR parser. To provide practical programming skills necessary for constructing a compiler.

Objective

- > To write programs with concepts in assembling, parsing and compiling the target code for execution.
- > To survey the systems and methods of compilation.
- > To practice basic FOSS tools for compiler writing and expose the latest techniques and advances in compiler.
- > To verify and use concurrent, embedded and distributed compilation tools and techniques.

Outcome

Upon Completion of this course the student will be able to:

- > To write symbol tables, different types of grammars to solve problem of parsing.
- > To design and write simple compiler using FOSS tools.
- > To practice compiler tools in basic, concurrent, distributed and embedded environments.
- > To survey and use latest trends and advances in compilers

Unit-I

Introduction to Compilers: Overview, Structure, implementation. Programming Language Grammars: Inter Language grammars, derivation, reduction, syntax tree, ambiguity, regular grammars & expressions.

Unit-II

Scanning and Parsing Techniques: The Scanner, parser, translation, elementary symbol table organization, structures.

Unit - III

Memory Allocation: Static and dynamic memory allocation, array allocation and access, allocation for strings, structure allocation, common & equivalence allocation. Introduction to Compilation of expressions.

Unit - IV

Compilation of Control Structures: Control transfers, procedural calls, conditional execution, iteration control constructs. Error detection, indication & recovery.

Unit-V

Compilation of I/O Statements: Compilation of I/O list, compilation of FORMAT list, IOSUB, file control.

Unit-VI

Code Optimization: Major issues, optimizing transformations, local optimizations, program flow analysis, Global Optimization, writing compilers.

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M.Sc CS

Exam Marks: 70

9 Hours

9 Hours

9Hours

9 Hours

9 Hours

REFERENCES BOOKS

- 1. COMPILER CONSTRUCTION by Dhamdhere D M and Bettina Paterson 20 September 2002.
- 2. Theory and Practice of Compiler Writing Feb 1986by Jean Paul Tremblay (Author), Paul Gordon Sorenson (Author) McGraw-Hill Education (ISE Editions) (1 February 1986).
- 3. Compiler Design (Gtu) 1 Jan 2012 by Alfred V. Aho (Author) Pearson Education; First edition (1 January 2012).
- 4. THE ESSENCE OF COMPILERS 2004 by Robin Hunter (Author) Publisher: Pearson Education (2004).
- 5. The Compiler Design Handbook: Optimizations and Machine Code Generation, Second Edition 7 Dec 2007 by Y.N. Srikant (Author), Priti Shankar (Author) Taylor and Francis; 2 edition (7 December 2007).
- 6. THE COMPILER DESIGN HANDBOOK OPTIMIZATION Paperback 2007 by SRIKANT Y.N. ET.AL (Author) CRC /MBS (2007).
- 7. Compilers, 2e Paperback 2013 by Aho (Author) Pearson Education India; 2 edition (2013).

C14 PERFORMANCE MODELING

Lecture Hrs : 54 Description

Internal Marks : 20

Exam Marks : 80

This course provides an introduction to the techniques and tools needed to construct and analyze performance models of computer systems and communication networks. Such skills are indispensable for research-related careers. After finishing this course, a student will: (1). Obtain the fundamental theoretical analysis techniques including probability, stochastic and queuing network techniques; (2). Be able to use several useful simulation and modeling tools (including both Matlab and NS2) to conduct basic performance modeling and network simulation tasks; and (3). Understand how to conduct their own performance analysis in the future by learning many classic examples of performance analysis in real-world computer and networking applications.

Objective

- 1. Review of probability and stochastic theory.
- 2. Basic queuing theory.
- 3. Performance simulation and modeling tools (such as NS2 and Matlab).
- 4. Discrete-time and continous-time simulation techniques.
- 5. Case study of performance evaluation of some real-world applications (such as BitTorrent simulation and evaluation, Internet worm modeling and simulation).

Outcome

Upon Completion of this course the student will be able to:

- 1. Students can queuing to analyze performance using different tool
- 2. Student can analyze different simulation model for checking performance
- 3. Can understand operation laws using predictive power method
- 4. Can understand Markovi chain for analyzing performance for different model

5. Can understand real time model like Google, Aloha, and Harder Chains for performance model

6. Can understand different Multi-server frame work

Unit-I: Introduction to Queuing

9 Hours

Queueing Theory Terminology, The Single-Server Network, Classification of Queueing Networks, Open Networks, Closed Networks, Sample Space and Events, Probability Defined on Events, Conditional Probabilities on Events, Independent Events and Conditionally Independent Events, Law of Total ProbabilityBayes Law, Discrete versus Continuous Random Variables, Expectation and Variance, 0 Joint Probabilities and Independence, Conditional Probabilities and Expectations, 2 Probabilities and Expectations via Conditioning, Linearity of Expectation, Normal Distribution, Sum of a Random Number of Random Variables

Unit - II Generating Random Variables for Simulation

Inverse-Transform Method , The Continuous Case , The Discrete Case , Accept-Reject Method , Discrete Case , Continuous Case , Some Harder Problems, Convergence , Strong and Weak Laws of Large Numbers , Time Average versus Ensemble Average ,

Motivation, Definition, Interpretation, Equivalence, Simulation, Average Time in System

Unit III - The Predictive Power of Simple Operational Laws: Little's Law and Other Operational Laws, Little's Law for Open Systems, Intuitions,

Little's Law for Closed Systems, Proof of Little's Law for Open Systems, Statement via Time Averages, Proof, Corollaries, Proof of Little's Law for Closed Systems, Statement via Time Averages, Proof, Generalized Little's Law, Examples Applying Little's Law, More Operational Laws: The Forced Flow Law, Combining Operational Laws, Device Demands, Readings and Further Topics Related to Little's Law, Modification Analysis: "What-If" for Closed Systems, Review, Asymptotic Bounds for Closed Systems, Modification Analysis for Closed Systems, More Modification Analysis Examples, Comparison of Closed and Open Networks

Unit-IV From Markov Chains to Simple Queues

Discrete-Time Markov Chains, Discrete-Time versus Continuous-Time Markov Chains, Definition of a DTMC, Examples of Finite-State DTMCs, Repair Facility Problem, Umbrella Problem, Program Analysis Problem, Powers of P: n-Step Transition Probabilities , Stationary Equations 135 8.6 The Stationary Distribution Equals the Limiting Distribution, Examples of Solving Stationary Equations, Repair Facility Problem with Cost, Umbrella Problem, Infinite-State DTMCs, Infinite-State Stationarity Result, Solving Stationary Equations in Infinite-State DTMCs, Exercises, Ergodicity Theory 148 9.1 Ergodicity Questions, Finite-State DTMCs, Existence of the Limiting Distribution, Mean Time between Visits to a State, Time Averages, Infinite-State Markov Chains, Recurrent versus Transient, Infinite Random Walk Example, Positive Recurrent versus Null Recurrent, Ergodic Theorem of Markov Chains Designing view layer classes. Macro level process. The purpose of a view layer interface. Prototyping the user interface, Case study.

Unit-V Real-World Examples: Google, Aloha, and Harder Chains Hours

Google's PageRank Algorithm , Google's DTMC Algorithm , Problems with Real Web Graphs, Google's Solution to Dead Ends and Spider Traps, Evaluation of the PageRank Algorithm Practical Implementation Considerations Aloha Protocol Analysis The Slotted Aloha Protocol ,The Aloha Markov Chain , Properties of the Aloha Markov Chain, Improving the Aloha Protocol, Generating Functions for Harder Markov Chains , The z-Transform , Solving the Chain , Readings and Summary , Exercises, Exponential Distribution and the Poisson Process, Definition of the Exponential Distribution, Memory less Property of the Exponential, Relating Exponential to Geometric via δ -Steps , More Properties of the Exponential , The Celebrated Poisson Process, Merging Independent Poisson Processes, Poisson Splitting, Uniformity, Exercises, Transition to Continuous-Time Markov Chains, Defining CTMCs, Solving CTMCs, Generalization and Interpretation, Interpreting the Balance Equations for the CTMC, Summary Theorem for CTMCs,

Unit-VI: Server Farms and Networks: Multi-server, Multi-queue Systems **9 Hours**

Server Farms: M/M/k and M/M/k/k ,Time-Reversibility for CTMCs M/M/k/k Loss System, M/M/k, Comparison of Three Server Organizations, Readings, Capacity Provisioning for Server Farms, Time-Reversibility and Burke's Theorem, More

9 Hours

9 Hours

9

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Examples of Finite-State CTMCs , Networks with Finite Buffer Space , Batch System with M/M/2 I/O , The Reverse Chain , Burke's Theorem , An Alternative (Partial) Proof of Burke's Theorem 290 16.5 Application: Tandem Servers 291 16.6 General Acyclic Networks with Probabilistic Routing , Jackson Network , Performance Modeling and Design of Computer Systems: Queueing Theory in Action Mor Harchol-Balter Frontmatter , Connection-Oriented ATM Network Example ,Closed Networks of Queues , VI Real-World Workloads: High Variability and Heavy Tails

REFERENCES BOOKS

- 1. Performance Modeling and Design of Computer Systems by Mor Harchol-Balter, Cambridge University Press 2013
- 2. Fundamentals Of Performance Modeling Michael K. Molloy. Michael K. Molloy. Published by Prentice Hall (1988)
- 3. Foundations of Software and System Performance Engineering: Process, Book by André B. Bondi, ©2015 |Addison-Wesley Professional.
- 4. The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling (Wiley Professional Computing) Hardcover – Import, 30 Apr 1991 by Raj Jain (Author) Publisher: John Wiley & Sons; 1 edition (30 April 1991).
- 5. Performance Modeling and Design of Computer Systems: Queueing Theory in Action 1st Edition by Mor Harchol-Balter (Author) Publisher: Cambridge University Press; 1 edition (February 18, 2013).

C14. SOCIAL NETWORKS

Lecture Hrs : 54 Description

Internal Marks : 30

Exam Marks: 70

Sociology is the scientific study of social organization — patterns in how humans behave in affiliations (ways of belonging to categories, groups and institutions) and interactions (various kinds of communication between humans). Sociologists in the social network tradition track affiliations and interaction by building and studying patterns they find in lists, graphs, and matrices. You have already encountered social networks in your own life.

Objective

- his course touches on social networks in four ways:
- > We begin with an introduction to the foundations of the social network perspective.
- > We master the techniques for measuring aspects of the structure of various kinds of networks: 1-mode networks, 2-mode networks, complete networks, ego networks, semantic networks, dyads, triads and groups.
- Third, we turn to the practical steps necessary for you to conduct social network research and use social network software.
- > We look at examples of social networking in politics, disease, online platforms such as Face book and Twitter, and surveillance.

Outcome

Upon Completion of this course the student will be able to.

- > Demonstrate an understanding of the theory of social networks by:
- Develop a command of the vocabulary and characterization of social networks by.
- Demonstrate competence in social network research by.

Unit-I

9 Hours

Mathematical Foundations: The fundamental concepts of graph theory and (elements of) matrix algebra, both of which are foundation fields for social networks. Software and Visualization: Introduced to the software, and learn how to visualize network data. Whole networks: This module is about characterizing the shape and structure of whole networks.

Unit - II

9 Hours

9 Hours

9 Hours

Ego-network Analysis: An introduction to ego-network analysis, including both data collection and analysis. We also discuss the concept of individual-level social capital. Advanced ego-network techniques, including longitudinal analysis.

Unit -III

Centrality: Introduction to the concepts and measurement of node centrality, including degree, closeness, betweenness and eigenvector centrality. Advanced measures of centrality including walk-based measures of centrality, induced centralities and group centralities. Centrality is contrasted with power.

Unit - IV

Cohesive Subgroups: Techniques for clustering networks to find communities and subgroups. Equivalence: Concepts of structural, automorphic and regular equivalence are discussed, along with the general enterprise of finding structural roles. Unit – V 9 Hours

Statistical Methods: An introduction to the special statistical methods used in network analysis to overcome autocorrelation and other challenges to classical statistical methods.

9 Hours

Network Dynamics: A series of techniques for analyzing changes in social networks over time. Survey Data Collection: A discussion of the special issues involved in collecting network data.

REFERENCES BOOKS

Unit-VI

- 1. The Panic Free Job Search: Unleash the Power of the Web and Social Networking to Get Hired Paperback March 22, 2012by Paul Hill (Author).
- 2. Social Networking for Career Success October 7, 2013 by Miriam Salpeter (Author) Learning express, LLC; 2 edition (October 7, 2013).
- **3.** Connecting Students to STEM Careers: Social Networking Strategies by Camille Cole (Author) International Society for Technology in Education (November 15, 2011).
- 4. Online Social Networks 1st Edition Human Cognitive Constraints in Facebook and Twitter Personal Graphs by Authors: Valerio Arnaboldi Andrea Passarella Marco Conti Robin Dunbar Published Date: 28th September 2015.
- 5. Introduction to Social Media Investigation 1st Edition A Hands-on Approach Authors: Jennifer Golbeck Published Date: 13th March 2015.

L5: ANDROID LAB Exam Marks: 35 Lab Hours : 54 **Internal Marks : 15 Course Objectives/Course Description** The course is designed to provide a practical exposure to the students. **Learning Outcome** Upon completion of the course, the students acquire the knowledge to build the Android application for smart phone. 1 Write a program for concatenation of two strings. 2 Write a program for Implicit Intents. 3 Write a program for calculator. 4 Write a program for implementing existing content provider. 5 Write a program for implementing menu. 6 Write a program for design and implement Registration form.(Registration Scroll View) 7 Write a program for list view. 8 Write a program for gallery. 9 Write a program for shared preference. 10 Write a program for database. 11 Write a program for concatenation of two strings using startActivity for result and toast. 12 Write a program for Fragment.

L6: BIG DATA PRACTICAL LAB

Lab Hours : 54

Internal Marks : 15

Exam Marks: 35

Course Objectives/Course Description The course is designed to provide a practical exposure to the students. Learning Outcome Upon completion of the course, the students acquire the knowledge to apply various analytics functions to extract useful information from BIG data set. 1 In "1.2 Two_Novels.ipynb" discussed in the class, you found that Huck's name is mentioned the least because the story is told in first person. Find counts of Huck as subject ('I') and object ('me') and add the plots to those of Jim, Tom, and Huck. 2 In the two novels, count the number of occurrences of other subject and object occurrences: he, his, she, her, they, them, we, us. Plot the cumulative counts. Look for patterns. 3 Draw similar plots for occurrences of names in Little Women. What pattern do you find? What do you infer from the plots? 4 For the two novels, a) Count the number of sentences by chapter. b) Lengths of chapters. c) Average length of sentences by chapter. d) Average length of words by chapter. 5 The following is the directory structure you now have: 5. /Data Analytics /Data /Notebooks Add subdirectories to reflect the following: /Data Analytics /Data /Notebooks /Pourakarmikas /PDF /TXT /REC Programmatically download the PDF files in URL-PK.txt and save them at /Data Analytics/Pourakarmikas/PDF 6 The cost of conducting census 2011 was ₹2,200 crore. How can we benefit from this massive work product? a) Download census data for the country. Understand the structure and data contents. Classify the data to various groups. What analyses can we do with the data? b) Create a table with the names of 100 most populous cities of the country, and (their population, and population density) in 2001 and 2011. Make a presentation on the variety of data (macro level summaries to micro 7

level details) available at http://censusindia.gov.in/. You can gather most of the information from the report of any one district of the country. Choose Bangalore District.

<u>16 Oct 2017</u>

- a) Read an electoral roll into a dataframe. Check its shape. Print the first 3 rows and the last two. What would be the choice index? Reindex the dataframe to what you identify as the best column to index.
- b) Extract age column as a series. Find various statistics for the ages of voters.
- c) Group by house and print the number of voters by the house.
- d) Read KA_Age-Data.xlsx into a daraframe. You will need to cleanse the file a little to read the data conveniently.
- e) Create appropriate index. Delete redundant columns. Rename columns as appropriate. Add 3 columns to show female ratio (women per 1000 men)
 overall, urban, and rural.
- f) Apply hierarchical index on section, house, and serial number of voters.
- g) Install Jupyter Lab in your PC and check in which browsers it works.

8 25 Oct 2017

Read 'SSLC Midterm 2017-18.xlsx' into a dataframe.

- a) add a column with average scores of each student.
- b) find various statistics for the table.
- c) what are your findings about the performance of the students and the teachers?

2. ../Data/Voters/voterREC/ has 227 voter lists for Basavanagudi Constituency. The Constituency has 7 wards. From the 227 files, create 7 files - one per ward by creating dataframes by part and concatenating by ward.

Tips:

- Read each file into a dataframe, find the ward of the part, and make a set of wards in the constituency.
- Create a dictionary with ward numbers as keys and empty dataframes as values. Thus, the dictionary will have one dataframe per ward.
- For each of the 227 voter lists, read and create a temporary DataFrame, find the ward number of voter list and refer to the DataFrame of the ward from wards dictionary, concat the temporary DataFrame to the ward DataFrame.
- Save each ward dataframe as excel file.
- **9** After an election, CEO publishes Form-20, giving the details of votes polled by booth by various candidates. This document does not have the count of voters per booth. The voters list gives the total voters. Extract necessary data from the two sources, create a dataframe by merging the two, add a column with calculated voter turnout percentage.

Tips:

➤ Make a dataframe with empty rows equal to the number of parts in the

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constituency with columns for part number and total voters.

- Voters with status '#','A', or 'O' are valid. Calculate the valid voters for each part and assign the values to the appropriate row in the empty dataframe.
- From "../Data/Form_20/AC170_Polled.xlsx" make a dataframe with total votes polled per part.
- Merge the two dataframes.
- Create a new column with turnout%.
- Calculate quantiles for turnout%.

10 <u>02 Nov 2017</u>

- a) 1From http://ceokarnataka.kar.nic.in/ClaimsObj.aspx download Form types 6, 7, 8, and 8A in spreadsheet format for Basavanagudi constituency.
- b) Reading the files, create dataframes with appropriate column names.
- c) Remove unwanted rows.
- d) Remove unwanted columns.
- e) Create new columns where needed.
- f) Attempt for the remaining constituencies of Bangalore.
- 11 Final data in various forms would be as follows:

Form 6:

Part	Date	Name	Relative	Reln	Status	Reason

Form 7:

Part	Serial	Name	Status	Reason

Form 8:

Part	Serial	Name	Status

Form 8A:

New	Name	Old Part	EPIC	Address	Status	Serial	Reason
Part							

Use 'apply' feature of dataframe to change contents of columns and also to create new columns

In all cases,

- ➤ Give one word status.
- ▶ Rreason would be applicable for rejections. For the rest, state 'NA'

> Check contradictions like - approved for inclusion, may be deleted

Take counts of inclusions, rejections, verification in progress for the 4 types of forms. What % of the total applications belong to each category of actions?

Compare the counts across the 28 constituencies. Do the results show any patterns? Can suggest some actions based on the results?

12 12 Nov 2017

13

claim_obj.db has 4 tables - form_6, form_7, form_8, and form_8A. The tables contain data extracted from the 'List of Claims and Objections' at CEO-KA website for the 28 constituencies of Bangalore for 01 Jan to 30 Oct 2017.

claim_obj-Jan_Oct_2017.xlsx has the set of results based on the data. Using data analytics tools, write scripts to create these tables based on the data in the tables.

Voter Enrolment Activities in Bangalore.docx discusses the findings. 16 Nov 2017

- a) Form 7 for deletion has the columns: Cosntituency, Part, Serial, Name, Reason, Status, and Remarks
- b) We want to check if the approved records are deleted.
- c) To query on CEO-KA website for a record we need: district and EPIC number OR district, constituency name, name, sex, and relative's name
- d) We have a copy of previous version of electoral rolls with the above columns.
- e) Merge the data to get EPIC# for the deleted voters.
- f) The electoral rolls table does not have section address, but have only section numbers.
- g) A section has several voters.
- h) The sections table has section number and section address.
- i) For field work, we want a voters' list which has a column for section address.
- j) Merge the data to get the voter lists with section addressees.
- k) Form 6 data does has part number, name and relative name.
- l) From the available data, create a dataframe to query CEO's site for the newly added records.

Lecture Hrs : 27

Internal Marks : 15

Exam Marks: 35

- 1. Systems Thinking and Critical Thinking
- 2. Conflict Management and Negotiation Skills
- 3. Leadership
- 4. Work Ethics
 - a. Meeting Skills
 - i. Preparing agenda
 - ii. Preparing for the meeting
 - iii. Participating
 - iv. Minutes of meeting
 - v. Action points and follow-up
 - vi. Six thinking hats

2. Social Skills

- a. Etiquettes and cultural sensitivity
- b. International sensitivity
- 3. Interview Skills
- 4. Adapting to a New Work Culture

OE. OPEN TO THE STUDENTS OF OTHER DISCIPLINES

WEBPAGE DESIGNING

Internal Marks : 15

Lecture Hrs : 27 Description

Word Press is the most popular Content Management System (CMS) available today. This hands-on course will teach you how to use the power of Word Press CMS to build modern, easy-to-navigate websites. Learn how to install setup and publish websites using the core functionality of the Word Press platform. You will also be introduced on how to customize themes, build e-commerce shops, and implement basic SEO into your Word Press website. Prerequisites: HTML and CSS or have similar working knowledge and experience.

Objective

- Students will learn a variety of techniques for word press development,
- > Design Web page using various reach and graphical user controls.
- Familiarity with the structure of a web application by creating several sample applications in class along with a final project to be created independently by the student.

Outcome

Upon Completion of this course the student will be able to.

- Students will be able to Create web page using word press
- Word Press website with blog.
- > Designing a user friendly website using colors, images, accessibility.
- > Will able to install a template, include plug-in,
- Create static pages, include images, use widgets, and

Unit-I: Introduction To CMS and Word press

Motivation f, Definitions (Content, ECM, CMS), When to Consider a CMS, Content Management & Life Cycle, Types of CMS, Open Source & CMS f, Overview of necessary skills, Components of a CMS, Benefits, Comparison of different OS CMS, Web Content Management (WCM) - Dynamic vs. Static Websites, Word Press as a CMS, necessity of Word Press, Assembling Pages, Content Management in Word Press, Planning Word Press Site: Organizing Categories, Site Layout and Design, Installation Process: Remote and Local Installing and Upgrading Word Press. Admin Area: Logging In, The Dashboard, Customizing Admin Screens, Basic Admin Settings- Tagline, Word Press Address (URL), Blog Address (URL), E-mail Address, Time zone, Personal Profile, Working with content: Post, Text Editor, Page, Media Content- Images and Galleries, Video, Audio, Other File Types, The Media Library, Links, Importing Content.

Unit – II: Basic Theme Development

Widgets, Menus, Multiple Menus, Sidebars, Pagination, Header and Background Images, Turning HTML into a Theme-Header ,Body ,Footer ,Template Tags ,Theme Files, Listing Comments, Including Additional Files, Navigation Menus-Custom Navigation Tag, Page Lists and Menus, Category Lists, Theme Functions : Enabling Widgets and Menus ,Enabling Featured Images, Custom Backgrounds and Headers, Short codes in Text

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9 Hours

9 Hours

Exam Marks: 35

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Department of Post Graduation Studies Computer Science

Loops, Multiple Loops, Accessing Post Information Outside the Loop, Adding Scripts and Style sheets, Theme Options and Frameworks, Distributing Themes, Creating Widgets and Plug-in, Creating a Template Tag, Hooks: Filters and Actions, Custom Content Types, Taxonomies, and Fields, Real World Skills: Admin Panel Customization, Moving to a new host, Automating backups.

- 1. WordPress Web Design For Dummies 3rd Edition, Kindle Edition by Lisa Sabin-Wilson Publisher: For Dummies; 3 edition (October 26, 2015).
- 2. Web Designer's Guide to WordPress: Plan, Theme, Build, Launch 1st Edition, Kindle Edition by Jesse Friedman (Author) Publisher: New Riders; 1 edition (6 August 2012).
- 3. HTML and CSS: Design and Build Websites 1st Edition by Jon Duckett (Author) Publisher: John Wiley & Sons; 1st edition (November 8, 2011).
- 4. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics Fourth Edition by Jennifer Robbins (Author) Publisher: O'Reilly Media; Fourth edition (August 24, 2012).
- 5. Designing with Web Standards (3rd Edition) 3rd Edition by Jeffrey Zeldman (Author), Ethan Marcotte (Author) Publisher: New Riders; 3 edition (October 25, 2009).

Fourth Semester

Fourth Semester – M.Sc Computer Science								
Code	Name of the Course	Hours/ Week	Marks			Credits	Lab	
			IA	Exam	Total			
C15	Internet of Things	4	30	70	100	4	Y	
L7	Internet of Things Lab	4	30	70	100	4	Y	
P1	Project work	8	60 140 200		200	8	Y	
	Total Credit 400							
Lecture Hrs : 54 Description

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

Internal Marks : 30

Objective

- Vision and Introduction to IoT.
- > Understand IoT Market perspective.
- > Data and Knowledge Management and use of Devices in IoT Technology.
- > Understand State of the Art IoT Architecture.
- Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Outcome

Upon Completion of this course the student will be able to.

- > Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- > Able to understand building blocks of Internet of Things and characteristics.

Unit-I: Unit-I Introduction to IOT

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 Architecture,Comparing IoT Architectures, A Simplified IoT Architecture,The core IoT Functional stack, IoT Data Management and compute stack.

Unit – II: Smart Objects

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensors Networks, Connecting Smart Objects, Communication Criteria ,IoT Access Technologies.

Unit - III :IP as the IoT Network Layer

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

Unit-IV:Data and Analytics for IoT

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

Unit-V: IoT Physical Devices

IoT Physical Devices and Endpoints-Arduino UNO:Introduction to Arduino,Arduino UNO,Installing the software,Fundamentals of Arduino Programming.IoT Physical Devices and Endpoints-RaspberryPi:Introduction to RaspberryPi,About the RaspberryPi Board:Hardware Layout,Operating Systems on RaspberryPi,Configuring RaspberryPi,Programming , Wireless Temperature Monitoring Syatem using Pi,Temperature Sensor,Accessing Temperature from sensors,Remote access to

M.Sc CS

Exam Marks: 70

10 Hours

10 Hours

10 Hours

12 Hours

12 Hours

RaspberryPi,Smart and Connected Cities,Smart city Use-Case Examples. **REFERENCES BOOKS**

- 1. Learning Internet of Things by Peter Waher 2015 Packt Publishing
- 2. Internet of Things with Python Publisher: Packt Publishing Limited (20 May 2016)
- 3. Designing the Internet of Things 1st Edition, Kindle Edition by Adrian McEwen (Author), Hakim Cassimally (Author) Publisher: Wiley; 1 edition (7 November 2013)
- 4. Internet of Things 1st Edition Authors: Jan Holler Vlasios Tsiatsis Catherine Mulligan Stamatis Karnouskos Stefan Avesand David Boyle Academic Press Published Date: 10th April 2014.
- 5. Practical Internet Of Things Security, Publisher: Packt 2016, Author: Russell, Brian.
- 6. Getting Started with the Internet of Things: Connecting Sensors And Microcontrollers To The Cloud (Make: Projects) 1st Edition, by Cuno Pfister (Author) Publisher: O'Reilly Media; 1 edition (June 5, 2011).

L7: INTERNET OF THINGS LAB					
Lab Hours : 54Internal Marks : 15Exam Marks: 35					
Course Objectives/Course Description The course is designed to provide a practical exposure to the students. Learning Outcome Upon completion of the course, the students acquire the knowledge and develop different applications using Baspherry IoT kit					
1	Overview of Raspberry Pi				
2	Exploring the different components of Raspberry pi				
3	Setting up of the board and booting the board				
4	Setting up of the board and booting the board				
5	Practice sessions on Python				
6	Practice sessions on Python with Django				
7	Sample application development using Raspberry Pi and Python				
8	Sample application development using Raspberry Pi and Python				
9	Designing Home Intrusion Detection – A case study				
10	Project Work				
11	Configuring and setting up the board for Home Intrusion Detection				
12	Project Work				
13	Programming Home Intrusion Detection				
14	Project Work				
15	Programming Home Intrusion Detection				
16	Project Work				
1/	Programming Home Intrusion Detection				
18	Project Work				
19	Designing Weather Monitoring System				
20	Project work				
21	Droiger Work				
22	Project Work				
23	Programming weather Monitoring System				
24	Programming Weather Monitoring System				
23	Project Work				
20	Programming Weather Monitoring System				
27	Project Work				
20					

P1:PROJECT WORK

Lab Hours : 108

Internal Marks : 60

Exam Marks: 140

Course Description: Students should develop Android project in a group of two members. They should implement their projects in college using ANDROID STUDIO. The students have to collect data outside practical hours. Project may be taken outside but must be implemented in the college. Internal marks can be awarded by the guide by evaluating the performance of the students during the course of project work.

Course Objectives: The course is designed to give a real-time development and industry exposure to the students.

Learning Outcome: The student experiences and learns the industry software development methodologies.

Scheme of Evaluation

Scheme of Evaluation for Internal Assessment

Two tests must be scaled down to 10 Marks each.

Sl.No.	Marks secured in the test	Marks to be allotted
1.	1 to 6	02
2.	7 to 12	04
3.	13 to 18	06
4.	19 to 24	08
5.	25 to 30	10

Attendance: 75% & Above

Sl.No.	Attendance secured in Percentage	Marks to be allotted
1.	96 - 100%	05
2.	91-95%	04
3.	86 to 90%	03
4.	81 to 85%	02
5.	75 to 80%	01

Theory

Sl.No.	Procedure	Max.Marks 30
1.	Average of two tests	20
2.	Assignments or Seminar	05
3.	Attendance	05

Practical

Programming Lab

Sl.No.	Procedure	Max. Marks 15
1.	Writing one program	04
2.	Execution of program	05
3.	Viva-voce	03
4.	Attendance	03

Sl.No.	Procedure	Max. Marks 15	Max. Marks 30			
1.	Demonstration & Presentation	04	08			
2.	Design and Coding	05	10			
3.	Viva-voce	03	06			
4.	Attendance	03	06			

Project Work

Scheme of Evaluation for End Semester Practical Examination Programming Lab

Sl.No.	Procedure	Max. Marks 35
1.	Writing two programs (one from each section)	10
2.	Execution of program	16(One program)
3.	Viva-voce	06
4.	Record	03

Project Work

Sl.No.	Procedure	Max. Marks 35	Max. Marks 70	
1.	Demonstration & Presentation	10	20	
2.	Design and Coding	15	30	
3.	Viva-voce	05	10	
4.	Project-Report	05	10	

QUESTION PAPER PATTERN

Internal Test – Theory – Computer Science								
Duration: One Hour]	Min. Ma	rks: 15		Max. Marks 30		
Answer any Fiv	e out of Six questio	ns			[5 x 6 = 30 Marks		
End Semeste	r Examination	– Theo	ry- Coi	nputer	· Scienc	е		
Duration: 3 H	lours	N	lin. Mai	rks : 35		Max. M	larks 70	
Ι	Answer any Sever	n out of	Nine qu	estions			10 x 7 = 70	
	×	*	*	*	*			