



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. TECH - INFORMATION TECHNOLOGY

(Applicable for batches admitted from 2020-2021)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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COURSE STRUCTURE

I Year – I SEMESTER						
S. No	Course Code	Courses	L	T	P	Credits
1	HS	Communicative English	3	0	0	3
2	BS	Mathematics - I (Calculus And Differential Equations)	3	0	0	3
3	BS	Applied Physics	3	0	0	3
4	ES	Programming for Problem Solving using C	3	0	0	3
5	ES	Computer Engineering Workshop	1	0	4	3
6	HS	English Communication Skills Laboratory	0	0	3	1.5
7	BS	Applied Physics Lab	0	0	3	1.5
8	ES	Programming for Problem Solving using C Lab	0	0	3	1.5
Total Credits			19.5			

I Year – II SEMESTER						
S. No	Course Code	Courses	L	T	P	Credits
1	BS	Mathematics – II (Linear Algebra And Numerical Methods)	3	0	0	3
2	BS	Applied Chemistry	3	0	0	3
3	ES	Computer Organization	3	0	0	3
4	ES	Python Programming	3	0	0	3
5	ES	Data Structures	3	0	0	3
6	BS	Applied Chemistry Lab	0	0	3	1.5
7	ES	Python Programming Lab	0	0	3	1.5
8	ES	Data Structures Lab	0	0	3	1.5
9	MC	Environment Science	2	0	0	0
Total Credits			19.5			



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II Year – I SEMESTER						
S.No	Course Code	Courses	L	T	P	Credits
1	BS	Mathematics III	3	0	0	3
2	IT	Object Oriented Programming through C++	3	0	0	3
3	IT	Operating Systems	3	0	0	3
4	IT	Database Management Systems	3	0	0	3
5	IT	Discrete Mathematics and Graph Theory	3	0	0	3
6	IT	Object Oriented Programming through C++ Lab	0	0	3	1.5
7	IT	Operating Systems Lab	0	0	3	1.5
8	IT	Database Management Systems Lab	0	0	3	1.5
9	SO	Skill Oriented Course I 1) Animations- 2D Animation 2) Distributed Technologies- NoSQL	0	0	4	2
10	MC	Constitution of India	2	0	0	0
Total Credits			21.5			

II Year – II SEMESTER						
S.No	Course Code	Courses	L	T	P	Credits
1	BS	Statistics with R	2	0	2	3
2	IT	Principles of Software Engineering	3	0	0	3
3	IT	Automata Theory and Compiler Design	3	0	0	3
4	ES	Java Programming	3	0	0	3
5	HS	Managerial Economics and Financial Accountancy	3	0	0	3
6	IT	UML Lab	0	1	2	2
7	IT	FOSS Lab	0	0	2	1
8	ES	Java Programming Lab	0	0	3	1.5
9	SO	Skill Oriented Course II 1) Animations- 3D Animation OR 2) Distributed Technologies- MongoDB	0	0	4	2
Total Credits			21.5			
10	Minor	Object Oriented Programming through C++ [§]	3	0	2	3+1
11	Honors	Any course from the Pool, as per the opted track	4	0	0	4

§- Integrated Course



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III B. Tech – I Semester						
S.No	Course Code	Courses	Hours per week			Credits
			L	T	P	C
1	PC	Computer Networks	3	0	0	3
2	PC	Design and Analysis of Algorithms	3	0	0	3
3	PC	Data Mining Techniques	3	0	0	3
4	Open Elective/Job Oriented	Open Elective-I Open Electives offered by other departments/ DevOps (Job Oriented course)	3	0	0	3
5	PE	Professional Elective-I 1. Artificial Intelligence 2. Agile Software Process 3. Distributed Systems 4. Advanced Unix Programming	3	0	0	3
6	PC	Data Mining Techniques with R Lab	0	0	3	1.5
7	PC	Computer Networks Lab	0	0	3	1.5
8	SO	Skill Oriented Course - III 1.Animation course: Animation Design OR 2. Continuous Integration and Continuous Delivery using DevOps	0	0	4	2
9	MC	Employability Skills-I	2	0	0	0
10	PR	Summer Internship 2 Months(Mandatory) after second year(to be evaluated during V semester	0	0	0	1.5
Total credits						21.5
11	Minor	Computer Networks [§]	3	0	2	3+1
12	Honors	Any course from the Pool, as per the opted track	4	0	0	4

§- Integrated Course



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III B. Tech – II Semester						
S.No	Course Code	Courses	Hours per week			Credits
			L	T	P	
1	PC	Machine Learning	3	0	0	3
2	PC	Big Data Analytics	3	0	0	3
3	PC	Cryptography and Network Security	3	0	0	3
4	PE	Professional Elective-II 1.Mobile Computing 2.MEAN Stack Development 3. Design Patterns 4.Scripting Languages	3	0	0	3
5	Open Elective/ Job Oriented	Open Elective-II Open Electives offered by other departments	3	0	0	3
6	PC	Big Data Analytics lab	0	0	3	1.5
7	PC	Machine Learning using Python Lab	0	0	3	1.5
8	PC	Cryptography and Network Security Lab	0	0	3	1.5
9	SO	Skill Oriented Course - IV 1.Data Science: Natural Language Processing OR 2.Video Analytics	0	0	4	2
10	MC3201	Employability skills-II	2	0	0	0
Total credits						21.5
Industrial/Research Internship(Mandatory) 2 Months during summer vacation						
11	Minor	Data Structures and Algorithms ^s	3	0	2	3+1
12	Honors	Any course from the Pool, as per the opted track	4	0	0	4
Minor course through SWAYAM			-	-	-	2

§- Integrated Course



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IV B. Tech –I Semester						
S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	PE	Professional Elective-III 1.Cloud Computing 2. Artificial Neural Networks 3. Internet of Things (IoT) 4.Cyber Security & Forensics	3	0	0	3
2	PE	Professional Elective-IV 1. Deep Learning Techniques 2. Social Networks Analysis 3. Advanced Databases 4.MOOCs-NPTEL/SWAYAM	3	0	0	3
3	PE	Professional Elective-V 1.Block-Chain Technologies 2.M-Commerce 3.Ethical Hacking 4.MOOCs-NPTEL/SWAYAM	3	0	0	3
4	Open Elective /Job Oriented	Open Elective-III Open Electives offered by other departments	2	0	2	3
5	Open Elective /Job Oriented	Open Elective-IV Open Electives offered by other departments	2	0	2	3
6	HS	Universal Human Values 2: Understanding Harmony	3	0	0	3
7	SO	PYTHON: Deep Learning OR Secure Coding Techniques OR APSSDC offered Courses	0	0	4	2
8	PR	Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluated during VII semester)	0	0	0	3
Total credits						23
11	Minor	Software Engineering ^{\$} / any other from PART-B (For Minor)	3	0	2	3+1
12	Honors	Any course from the Pool, as per the opted track	4	0	0	4
Minor course through SWAYAM			-	-	-	2

\$- Integrated Course



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IV B. Tech –II Semester						
S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	Project	Major Project Work, Seminar Internship	-	-	-	12
Total credits						12

Note:

1. ***For integrated courses:*** Theory and laboratory exams will be conducted separately, and the student concern will get credits if successfully completes both theory and laboratory. Only external exam will be conducted for Laboratory component. Credit based weightage shall be considered while awarding the grade.
2. ***For MOOC courses:*** Based on the students interest, student can register and complete a 12 week course one year in advance, by prior information to the concern.



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SUGGESTED COURSES FOR HONORS PROGRAM

<p>POOL1- AI & ML</p> <ol style="list-style-type: none"> 1. Mathematics for Machine Learning 2. Text Mining and Time Series Analysis 3. Natural Language Processing 4. Reinforcement Learning 	<p>POOL2- Systems Engineering</p> <ol style="list-style-type: none"> 1. Internet of Things 2. Data Communications and Information Coding Theory 3. Service Oriented Architectures 4. Design of Secure Protocols 5. Network Coding
<p>POOL3- Information Security</p> <ol style="list-style-type: none"> 1. Principles of Cyber Security 2. Computational Number Theory 3. Cryptanalysis 4. Elliptic Curve Cryptography 5. Introduction to Quantum Computing and Quantum Cryptography 6. Public Key Infrastructure and Trust Management 7. Information Security Analysis and Audit 8. Cloud and IoT Security 9. Web Security 10. Block Chain Architecture Design and Use Cases 	<p>POOL4 – Data Science</p> <ol style="list-style-type: none"> 1. Data Visualization 2. Statistical Foundations for Data Science 3. Mining Massive Data Sets 4. Medical Image Data Processing



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SUGGESTED COURSES FOR MINOR ENGINEERING IN IT

Note:

1. Any **THREE** courses (*Any FOUR courses in case of MOOCS*) need to be studied from PART-A.
2. Any **ONE** course (*If it is in Regular Mode*) need to be studied from PART-B.
3. **TWO**, NPTEL courses of **EIGHT** week duration covering a total of 4 credits (offered by the department of CSE/IT only), Student can register at any time after the completion of II B.Tech. I Sem.
4. Students can pursue suggested MOOC Courses via NPTEL from II B.Tech II Sem and onwards, by prior information to the concern.
5. If sufficient numbers of students are not opted, as per the guidelines, dept can suggest students to pursue under MOOCS. In this case, department/students can select course such that there will not be any duplication.

Eligibility for Minor in IT:

PART A						
Regular Mode				MOOCS*		
S.No	Subject	L-T-P	Credits	Course available in NPTEL	NPTEL Link	Credits
1	Operating Systems	3-0-2	4	Operating Systems	https://onlinecourses.swayam2.ac.in/cec21_cs20/preview	As recommended by the NPTEL (Dept need to verify the credits and suggest)
2	Data Structures and Algorithms	3-0-2	4	Data Structure and algorithms using Java	https://nptel.ac.in/courses/106105225	
3	Software Engineering	3-0-2	4	Software Engineering	https://onlinecourses.swayam2.ac.in/cec21_cs21/preview	
4	Computer Networks	3-0-2	4	Computer Networks	https://onlinecourses.swayam2.ac.in/cec22_cs05/preview	
5	Database Management Systems	3-0-2	4	Data Base Management System	https://onlinecourses.nptel.ac.in/noc22_cs51/preview	

* If sufficient number of students are not available to offer, can pursue under MOOCS



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PART B						
S.No	Subject	L-T-P	Credits	Course available in NPTEL	NPTEL Link	Credits
1	Object Oriented Programming through C++	3-0-2	4	Programming in C++ (Two Credits)	https://onlinecourses.nptel.ac.in/noc21_cs02/preview	As recommended by the NPTEL (Dept need to verify the credits and suggest)
2	Data Analytics using Python	3-0-2	4	Data Analytics with Python	https://nptel.ac.in/courses/106107220	
3	Artificial Intelligence	4-0-0	4	Artificial Intelligence: Knowledge Representation And Reasoning	https://nptel.ac.in/courses/106106140	
				OR		
				An Introduction to Artificial Intelligence	https://onlinecourses.nptel.ac.in/noc22_cs56/preview	
4	Unix and Shell Programming	3-0-2	4			
5	Cloud Computing	4-0-0	4	Cloud computing	https://onlinecourses.nptel.ac.in/noc22_cs20/preview	
				OR		
				Cloud Computing and Distributed Systems (TWO Credits)	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	

* If sufficient number of students are not available to offer, can pursue under MOOCS



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II Year – II Semester		L	T	P	C
		2	0	2	3
STATISTICS WITH R					

COURSE OBJECTIVES:

After taking the course, students will be able to

- Use R for statistical programming, computation, graphics, and modeling,
- Write functions and use R in an efficient way,
- Fit some basic types of statistical models
- Use R in their own research,
- Be able to expand their knowledge of R on their own.

COURSE OUTCOMES:

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

- List motivation for learning a programming language
- Access online resources for R and import new function packages into the R workspace
- Import, review, manipulate and summarize data-sets in R
- Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- Perform appropriate statistical tests using R , Create and edit visualizations with R

UNIT-I:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II:

R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Example: A Binary Search Tree.

UNIT-III:

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set

Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files,

UNIT-IV:

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.



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UNIT-V:

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis,

Nonlinear Models, Splines- Decision- Random Forests,

TEXT BOOKS:

- 1) The Art of R Programming, Norman Matloff, Cengage Learning
- 2) R for Everyone, Lander, Pearson

REFERENCE BOOKS:

- 1) R Cookbook, Paul Teetor, Oreilly.
- 2) R in Action, Rob Kabacoff, Manning

EXPERIMENTS:

- 1) Write a R program to take input from the user (name and age) and display the values. Also print the version of R installation.
- 2) Write a R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91.
- 3) Write a R program to create three vectors a,b,c with 3 integers. Combine the three vectors to become a 3×3 matrix where each column represents a vector. Print the content of the matrix.
- 4) Write a R program to find row and column index of maximum and minimum value in a given matrix.
- 5) Write a R program to combine three arrays so that the first row of the first array is followed by the first row of the second array and then first row of the third array.
- 6) Write a R program to create an array using four given columns, three given rows, and two given tables and display the content of the array.
- 7) Write a R program to create a data frame from four given vectors.
- 8) Write a R program to find Sum, Mean and Product of a Vector, ignore element like NA or NaN.
- 9) Write a R program to create a list containing a vector, a matrix and a list and remove the second element.
- 10) Write a R program to merge two given lists into one list.
- 11) Write a R program to create an ordered factor from data consisting of the names of months.
- 12) Plot the density and distribution functions for Normal approximation to the Binomial distribution.
- 13) Take any dataset, Visualize Tables, charts and plots. Compute visualising Measures of Central Tendency, Variation, and Shape. Box plots, Pareto diagrams. Also, find the mean median standard deviation and quantiles of a set of observations.
- 14) Take any dataset. Calculate the correlation between two variables. Draw the scatter plots. Use the scatter plot to investigate the relationship between two variables.



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15) The sales of a company for each year are shown in the table below.

x (year)	2015	2016	2017	2018	2019
y (sales in lakhs)	12	19	29	37	45

a) Find the least square regression line $y = a x + b$.

b) Use the least squares regression line as a model to estimate the sales of the company in 2021.

16) Find the least square regression line for the following set of data $\{(-1, 0), (0, 2), (1, 4), (2, 5)\}$ Plot the given points and the regression line in the same rectangular system of axes



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II Year – II Semester	L	T	P	C
	3	0	0	3
PRINCIPLES OF SOFTWARE ENGINEERING				

Course Objectives:

This course is designed to:

- Give exposure to phases of Software Development, common process models including Waterfall, and the Unified Process, and hands-on experience with elements of the agile process
- Give exposure to a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, traceability, and version control
- Give exposure to Software Design techniques

Course Outcomes:

Students taking this subject will gain software engineering skills in the following areas:

- Transform an Object-Oriented Design into high quality, executable code
- Skills to design, implement, and execute test cases at the Unit and Integration level
- Compare conventional and agile software methods

UNIT I

The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths, How It All Starts. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.

UNIT II

Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge , Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

UNIT III

Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modelling, Requirements Modeling for WebApps.

UNIT IV

Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, What Is a Component?, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component-Based Development.



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UNIT V

The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design, Design Evaluation, Elements of Software Quality Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing

Text Books:

- 1) Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
- 2) Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

Reference Books:

- 1) Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
- 2) Software Engineering, Ugrasen Suman, Cengage.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>



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II Year – II Semester		L	T	P	C
		3	0	0	3
AUTOMATA THEORY AND COMPILER DESIGN					

Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Contexts free Languages, PDA and TM
- To study the various phases in the design of a compiler
- To understand the design of top-down and bottom-up parsers
- To understand syntax directed translation schemes
- To learn to develop algorithms to generate code for a target machine

Course Outcomes:

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

- Ability to design, develop, and implement a compiler for any language
- Able to use LEX and YACC tools for developing a scanner and a parser
- Able to design and implement LL and LR parsers
- Able to design algorithms to perform code optimization in order to improve the performance of a program in terms of space and time complexity
- Ability to design algorithms to generate machine code

UNIT-I

Formal Language and Regular Expressions : Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.

UNIT-II

Context Free grammars and parsing : Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.

UNIT-III

Semantics: Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT-IV

Run time storage : Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

Code optimization : Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT-V

Code generation : Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.



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TEXT BOOKS:

- 1) Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008.
- 2) Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

REFERENCES:

- 1) Louden: “Compiler Construction, Principles & Practice”, 1st Edition, Thomson Press, 2006.
- 2) Tremblay J P, Sorenson G P: “The Theory & Practice of Compiler writing”, 1st Edition, BSP publication, 2010.
- 3) Theory of Computation, V. Kulkarni, Oxford University Press, 2013

e-Resources:

- 1) <https://nptel.ac.in/courses/106/104/106104028/>
- 2) <https://nptel.ac.in/courses/106/104/106104123/>



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II Year – II Semester		L	T	P	C
		3	0	0	3
JAVA PROGRAMMING					

Course Objectives:

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

Course Outcomes:

By the end of the course, the student will be

- Able to realize the concept of Object Oriented Programming & Java Programming Constructs
- Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords
- Apply the concept of exception handling and Input/ Output operations
- Able to design the applications of Java & Java applet
- Able to Analyze & Design the concept of Event Handling and Abstract Window Toolkit

UNIT I

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?., Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.



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UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by

Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New



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Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

Text Books:

- 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- 2) The complete Reference Java, 8th edition, Herbert Schildt, TMH.

References Books:

- 1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
- 2) Murach's Java Programming, Joel Murach

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105191/>
- 2) https://www.w3schools.com/java/java_data_types.asp



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DEPARTMENT OF INFORMATION TECHNOLOGY

II Year – II Semester	L	T	P	C
	3	0	0	3
MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY				

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making

UNIT I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics – Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT II

Theories of Production and Cost Analyses: Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets, Theories of the Firm & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson’s models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock



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Company – State/Public Enterprises and their forms.

UNIT IV

Introduction to Accounting & Financing Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

UNIT V

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Text Books:

- 1) A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

Reference Books:

- 1) Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd.
- 2) JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
- 3) N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd.
- 4) Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House Pvt Ltd
- 5) I.M Pandey, Financial Management, Vikas Publishing House Pvt Ltd
- 6) V. Maheswari, Managerial Economics, S. Chand & Company Ltd.



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II Year –I I Semester		L	T	P	C
		0	1	2	2
UNIFIED MODELING LANGUAGE (UML) LAB					

Course Objectives:

- To know the practical issues of the different object oriented analysis and design concepts
- Inculcate the art of object oriented software analysis and design
- Apply forward and reverse engineering of a software system
- Carry out the analysis and design of a system in an object oriented way

Course Outcomes:

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

- Know the syntax of different UML diagrams
- Create use case documents that capture requirements for a software system
- Create class diagrams that model both the domain model and design model of a software system
- Create interaction diagrams that model the dynamic aspects of a software system
- Write code that builds a software system
- Develop simple applications

Note: For performing the experiments consider any case study (ATM/ Banking/ Library/Hospital management systems)

Experiment 1:

Familiarization with Rational Rose or Umbrella environment

Experiment 2:

- Identify and analyze events
- Identify Use cases
- Develop event table

Experiment 3:

- Identify & analyze domain classes
- Represent use cases and a domain class diagram using Rational Rose
- Develop CRUD matrix to represent relationships between use cases and problem domain classes

Experiment 4:

- Develop Use case diagrams
- Develop elaborate Use case descriptions & scenarios
- Develop prototypes (without functionality)

Experiment 5:

- Develop system sequence diagrams and high-level sequence diagrams for each use case
- Identify MVC classes / objects for each use case
- Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three-layer objects



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Experiment 6:

- a) Develop detailed design class model (use GRASP patterns for responsibility assignment)
- b) Develop three-layer package diagrams for each case study

Experiment 7:

- a) Develop Use case Packages
- b) Develop component diagrams
- c) Identify relationships between use cases and represent them
- d) Refine domain class model by showing all the associations among classes

Experiment 8:

Develop sample diagrams for other UML diagrams - state chart diagrams, activity diagrams and deployment diagrams



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II Year –I I Semester		L	T	P	C
		0	0	2	1
FOSS LAB					

Course Objectives:

This Course will enable students to

- provide introduction to UNIX operating system and its File System.
- develop the ability to formulate Regular Expressions and use them for Pattern Matching.
- gain an understanding of important aspects related to the Shell and the Process.
- provide a comprehensive introduction to Shell Programming, Services and Utilities.

Course Outcomes:

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

- Demonstrate UNIX commands for file handling and process control
- Construct regular expressions for pattern matching and apply them to various filters for a specific task.
- Analyze a given problem and apply requisite facets of shell programming in order to devise a shell script to solve the problem

Programs:

1. Session-1

- Log into the system
- Use vi editor to create a file called myfile.txt which contains some text.
- correct typing errors during creation.
- Save the file
- logout of the system

Session-2

- Log into the system
- open the file created in session 1
- Add some text
- Change some text
- Delete some text
- Save the Changes
- Logout of the system

2.a) Log into the system

b) Use the cat command to create a file containing the following data. Call it mytable use tabs to separate the fields.

```
1425 Ravi 15.65
4320 Ramu 26.27
6830 Sita 36.15
1450 Raju 21.86
```

c) Use the cat command to display the file, mytable

d) Use the vi command to correct any errors in the file, mytable.



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- e) Use the sort command to sort the file my table according to the first field. Call the sorted file my table (same name)
- f) Print the file my table
- g) Use the cut and paste commands to swap fields 2 and 3 of my table. Call it my table (same name)
- h) Print the new file, mytable
- i) Logout of the system.

3.A)

- a) Login to the system
- b) Use the appropriate command to determine your login shell
- c) Use the /etc/passwd file to verify the result of step b.
- d) Use the who command and redirect the result to a file called myfile1. Use the more command to see the contents of myfile1.
- e) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the more command to check the contents of myfile2.

B) Write a sed command that deletes the first character in each line in a file.

- b) Write a sed command that deletes the character before the last character in each line in a file.
- c) Write a sed command that swaps the first and second words in each line in a file.

- 4. a) Pipe your /etc/passwd file to awk, and print out the home directory of each user.
- b) Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word.
- c) Repeat
- d) Part using awk

5. a) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else

- b) Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
- c) Write a shell script that determines the period for which a specified user is working on the system.

- 6. a) Write a shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers.
- b) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.

7. a) Write a shell script that computes the gross salary of a employee according to the following rules:

- i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.
- ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic



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The basic salary is entered interactively through the key board.

b) Write a shell script that accepts two integers as its arguments and computes the value of first number raised to the power of the second number.

8. a) Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, have the program ask the user for the necessary information, such as the file name, new name and so on.

b) Write shell script that takes a login name as command – line argument and reports when that person logs in

c) Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

9. a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.

b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

c) Write a shell script to perform the following string operations:

i) To extract a sub-string from a given string.

ii) To find the length of a given string.

10. Write a C program that takes one or more file or directory names as command line input and reports the following information on the file:

i) File type ii) Number of links iii) Read, write and execute permissions

iv) Time of last access

(Note : Use stat/fstat system calls)

11. Write C programs that simulate the following unix commands:

a) mv b) cp (Use system calls)

12. Write a C program that simulates ls Command (Use system calls / directory API)

13. Write a shell script to accept the name of the file from standard input and perform the following tests on it a) File executable b) File readable c) File writable d) Both readable & writable

14. Write an awk program to print sum, avg of students marks list

15. Write an awk program which will find maximum word and its length in the given input File



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II Year – II Semester		L	T	P	C
		0	0	3	1.5
JAVA PROGRAMMING LAB					

Course Objectives:

The aim of this lab is to

- Practice programming in the Java
- Gain knowledge of object-oriented paradigm in the Java programming language
- Learn use of Java in a variety of technologies and on different platforms

Course Outcomes:

By the end of the course student will be able to write java program for

- Evaluate default value of all primitive data type, Operations, Expressions, Control-flow, Strings
- Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism
- Construct Threads, Event Handling, implement packages, developing applets

Exercise - 1 (Basics)

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.
- c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.

Exercise - 2 (Operations, Expressions, Control-flow, Strings)

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program to sort for an element in a given list of elements using merge sort.
- d) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3 (Class, Objects)

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- b) Write a JAVA program to implement constructor.

Exercise - 4 (Methods)

- a) Write a JAVA program to implement constructor overloading.
- b) Write a JAVA program implement method overloading.

Exercise - 5 (Inheritance)

- a) Write a JAVA program to implement Single Inheritance
- b) Write a JAVA program to implement multi level Inheritance
- c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?



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Exercise - 7 (Exception)

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program illustrating Multiple catch clauses

Exercise – 8 (Runtime Polymorphism)

- a) Write a JAVA program that implements Runtime polymorphism
- b) Write a Case study on run time polymorphism, inheritance that implements in above problem

Exercise – 9 (User defined Exception)

- a) Write a JAVA program for creation of illustrating throw
- b) Write a JAVA program for creation of illustrating finally
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) Write a JAVA program for creation of User Defined Exception

Exercise – 10 (Threads)

- a) Write a JAVA program that creates threads by extending Thread class .First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds ,(Repeat the same by implementing Runnable)
- b) Write a program illustrating **isAlive** and **join ()**
- c) Write a Program illustrating Daemon Threads.

Exercise - 11 (Threads continuity)

- a) Write a JAVA program Producer Consumer Problem
- b) Write a case study on thread Synchronization after solving the above producer consumer problem

Exercise – 12 (Packages)

- a) Write a JAVA program illustrate class path
- b) Write a case study on including in class path in your os environment of your package.
- c) Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 13 (Applet)

- a) Write a JAVA program to paint like paint brush in applet.
- b) Write a JAVA program to display analog clock using Applet.
- c) Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

- a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
- b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet.



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II Year - II Semester	Skill Oriented Course- II	L	T	P	C
		0	0	4	2
ANIMATIONS- INTRODUCTION TO 3D					

Course Objectives:

This Course will enable students to

- To know about 3D software interface.
- To know about different type of 3d modeling like polygon, nerves modeling, curve based modeling, Patch modeling,
- To understand the basic blocking of 3D Inorganic and organic modeling, high poly modeling, unwrapping texturing.

Course Outcomes:

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

- To understand different styles and treatment of content in 3d model creation
- To analyze the importance of cognitive 3d designing.
- To apply tools to create effective 3D modelling texturing and lighting

1. Create any Model some objects such as chairs, tables, fruits, utensils
2. Create any Model instruments, tools
3. Create any Model of Cars or Bike,
4. Create any model of the male or female character.
5. Create any Model of any animal.
6. Create any Model of any birds, fishes, and worms.
7. Apply basic material and shader types & Procedurals textures.
8. Unwrap the models of objects and characters using various projection maps.
9. Apply texture on various objects and characters.
10. Create a natural outdoor or indoor scene.
11. Create Opacity, Smoothness, Secularity, and color maps, Transparency, Reflection
12. Bump & Displacement Maps
13. Render a frame and video of indoor and outdoor scenes.
14. Render a video of indoor scenes.
15. Render a photorealistic output of an interior scene.
16. Advance lighting using mental ray render.
17. Animate day and night scene of a street with the help of lighting.



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II Year - II Semester	Skill Oriented Course- II	L	T	P	C
		0	0	4	2
DISTRIBUTED TECHNOLOGIES-MONGODB					

Course Objectives:

This Course will enable students to

- master the leading document-oriented NoSQL database, MongoDB Architecture, CRUD, Schema
- Design, Data Modelling and Indexing using real-life case studies
- Learn how to design Schema using Advanced Queries

Course Outcomes:

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

- Install, configure and setup the drivers to use MongoDB with your programming language of choice
- Gain an in-depth understanding of main features of MongoDB and their use cases
- Retrieve data in the database using advanced querying
- to build new types of applications for mobile, cloud, e-commerce and social technologies

Perform Experiments related to the following concepts:

1. MongoDB on Windows
2. MongoShell
3. Databases, Documents
4. Collections
5. MongoDB Connections
6. Query and Projection
7. Operators
8. Aggregation Pipeline Operators
9. Database Commands
10. Shell Methods



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**MINOR COURSES
PART B**



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PART B	Minor Course	L	T	P	C
		3	0	2	4
OBJECT ORIENTED PROGRAMMING THROUGH C++					

Course Objectives:

- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
- Understand dynamic memory management techniques using pointers, constructors, destructors
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
- Demonstrate the use of various OOPs concepts with the help of programs

Course Outcomes:

By the end of the course, the student

- Classify object oriented programming and procedural programming
- Apply C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling
- Build C++ classes using appropriate encapsulation and design principles
- Apply object oriented or non-object oriented techniques to solve bigger computing problems

UNIT I

Introduction to C++: Difference between C and C++, Evolution of C++, The Object Oriented Technology, Disadvantage of Conventional Programming, Key Concepts of Object Oriented Programming, Advantage of OOP, Object Oriented Language.

UNIT II

Classes and Objects & Constructors and Destructor: Classes in C++, Declaring Objects, Access Specifiers and their Scope, Defining Member Function, Overloading Member Function, Nested class, Constructors and Destructors, Introduction, Constructors and Destructor, Characteristics of Constructor and Destructor, Application with Constructor, Constructor with Arguments parameterized Constructor, Destructors, Anonymous Objects.

UNIT III

Operator Overloading and Type Conversion & Inheritance: The Keyword Operator, Overloading Unary Operator, Operator Return Type, Overloading Assignment Operator (=), Rules for Overloading Operators, Inheritance, Reusability, Types of Inheritance, Virtual Base Classes- Object as a Class Member, Abstract Classes, Advantages of Inheritance, Disadvantages of Inheritance.

UNIT IV

Pointers & Binding Polymorphisms and Virtual Functions: Pointer, Features of Pointers, Pointer Declaration, Pointer to Class, Pointer Object, The this Pointer, Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction, Binding in C++, Virtual Functions, Rules for Virtual Function, Virtual Destructor.

UNIT V

Generic Programming with Templates & Exception Handling: Definition of class Templates, Normal Function Templates, Over Loading of Template Function, Bubble Sort Using Function Templates, Difference between Templates and Macros, Linked Lists with Templates, Exception Handling, Principles of Exception Handling, The Keywords try throw and catch, Multiple Catch Statements, Specifying Exceptions.



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Overview of Standard Template Library, STL Programming Model, Containers, Sequence Containers, Associative Containers, Algorithms, Iterators, Vectors, Lists, Maps.

List of Experiments:

Exercise -1 (Classes Objects)

Create a Distance class with:

- feet and inches as data members
- member function to input distance
- member function to output distance
- member function to add two distance objects

1. Write a main function to create objects of DISTANCE class. Input two distances and output the sum.
2. Write a C++ Program to illustrate the use of Constructors and Destructors (use the above program.)
3. Write a program for illustrating function overloading in adding the distance between objects (use the above problem)

Exercise – 2 (Access)

Write a program for illustrating Access Specifiers public, private, protected

1. Write a program implementing Friend Function
2. Write a program to illustrate this pointer
3. Write a Program to illustrate pointer to a class

Exercise -3 (Operator Overloading)

1. Write a program to Overload Unary, and Binary Operators as Member Function, and Non Member Function.
2. Write a c ++ program to implement overloading assignment = operator

Exercise -4 (Inheritance)

Write C++ Programs and incorporating various forms of Inheritance

- i) Single Inheritance
- ii) Hierarchical Inheritance
- iii) Multiple Inheritances
- iv) Multi-level inheritance
- v) Hybrid inheritance

Exercise -5(Templates, Exception Handling)

1. Write a C++ Program to illustrate template class
2. Write a Program for Exception Handling Divide by zero
3. Write a Program to rethrow an Exception

Exercise -6

1. Write a C++ program illustrating user defined string processing functions using pointers (string length, string copy, string concatenation)
2. Write a C++ program illustrating Virtual classes & virtual functions.
3. Write C++ program that implement Bubble sort, to sort a given list of integers in ascending order

Text Books:

- 1) A First Book of C++, Gary Bronson, Cengage Learning.
- 2) The Complete Reference C++, Herbert Schildt, TMH.



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Reference Books:

- 1) Object Oriented Programming C++, Joyce Farrell, Cengage.
- 2) C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning
- 3) Programming in C++, Ashok N Kamthane, Pearson 2nd Edition

e- Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105151/>
- 2) <https://github.com/topics/object-oriented-programming>



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PART B	Minor Course	L	T	P	C
		3	0	2	4
DATA ANALYTICS USING PYTHON					



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PART B	Minor Course	L	T	P	C
		4	0	0	4
ARTIFICIAL INTELLIGENCE					

Course Objectives: The student will be able to

- Know the methodology of Problem solving
- Implement basic AI algorithms
- Design and carry out an empirical evolution of different algorithms on a problem formalization

Course Outcomes (COs): At the end of the course, student will be able to

- Understand the fundamental concepts in Artificial Intelligence
- Analyze the applications of search strategies and problem reductions
- Apply the mathematical logic concepts.
- Develop the Knowledge representations in Artificial Intelligence.
- Explain the Fuzzy logic systems.

UNIT I:

Introduction to artificial intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI.

UNIT II:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem

Search Strategies: exhaustive searches, heuristic search techniques, iterative-deepening A*, constraint satisfaction

UNIT III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, predicate logic

UNIT IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure.

UNIT V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

Text Books:

1. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence, Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI



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Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier



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DEPARTMENT OF INFORMATION TECHNOLOGY

PART B	Minor Course	L	T	P	C
		3	0	2	4
UNIX AND SHELL PROGRAMMING					

Course Objectives:

Understanding the shell commands, shell programming, system calls of files and processes, signals, inter-process communication concepts and programming, TCP and UDP.

Course Outcomes: After finishing this course student will be able to:

- Gain good knowledge on Unix commands and awareness of shell programming
- Know about different system calls for files and directories
- Ability to know the working of processes and signals
- Application of client server program for IPC
- Knowledge about socket programming

UNIT-I:

Introduction, Architecture of unix, Responsibilities of shell, unix file system, vi editor. **Unix commands:** Some Basic Commands, file utilities, process utilities, text processing utilities, network utilities, disk utilities, backup utilities , Security by file permissions.

UNIT-II:

Shell Programming: shell variables, The Export command, The Profile File a Script Run During starting, The First Shell Script, The read command, Positional Parameters, The \$? Variable , Knowing the exit Status- More about the Set Command, The Exit command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement- The Expr Command, Performing Integer Arithmetic- Real Arithmetic in Shell Programs- The here Document(<<), The Sleep Command, Debugging Scripts, The Script command, The Eval command, The Exec Command, Sample programs.

UNIT-III:

Files - Introduction, file descriptors, open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking-fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, links-soft and hard links-symlink, link, unlink.

UNIT IV:

Directories-Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions.

UNIT V:

Process Control: process identifiers, fork function, vfork function, exit function, wait and waitpid functions, exec functions, user identification. **Signals:** signal handling using signal function, kill and raise, alarm, pause, abort and sleep functions.

List of Experiments:

- 1)a) Study of Unix/Linux general purpose utility command list: man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.
- b) Study of vi editor
- c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system
- d) Study of Unix/Linux file system (tree structure)
- e)Study of .bashrc, /etc/bashrc and Environment variables.



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- 2) Write a C program that makes a copy of a file using standard I/O, and system calls
- 3) Write a C program to emulate the UNIX `ls -l` command.
- 4) Write a C program that illustrates how to execute two commands concurrently with a command pipe.
Ex: - `ls -l | sort`
- 5) Implementation of `fork ()`, `wait ()`, `exec()` and `exit ()`, System calls

Text Books:

1. Unix the ultimate guide, 3rd edition, Sumitabha Das, TMH.
2. Advanced programming in the Unix environment by W. Richard Stevens.
3. Unix network programming by W. Richard Stevens.

Reference Books:

1. Introduction to Unix and shell programming, Venkateshmurthy
2. Unix and shell programming by B.M. Harwani, OXFORD university press.



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PART B	Minor Course	L	T	P	C
		4	0	0	4
CLOUD COMPUTING					

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to

- Illustrate the key dimensions of the challenge of Cloud Computing
- Classify the Levels of Virtualization and mechanism of tools.
- Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.
- Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud
- Assess control storage systems and cloud security, the risks involved its impact and develop cloud application

UNIT I:

Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency

UNIT II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT III:

Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure

UNIT IV:

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

UNIT V:

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.



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Reference Books:

4. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madiseti, University Press
5. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
6. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH



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Suggested Courses for Honors Program



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II Year - II Semester	Honors Course	L	T	P	C
		4	0	0	4
MATHEMATICS FOR MACHINE LEARNING (AI & ML)					

Course Objectives:

The main objectives of this course is to make student understand and apply the basic mathematical concepts that are essential for machine learning algorithms

Course Outcomes:

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

- understand the basic notions of machine learning and of the related basic mathematical tools;
- comprehend the basic concepts and techniques of convex optimization
- have a good knowledge of the statistical and computational properties of some well known machine learning algorithms;
- implement machine learning algorithms on synthetic and real data sets using mathematical concepts like linear algebra, probability and calculus

UNIT-I

Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces

UNIT-II

Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections, Rotations

UNIT-III

Matrix Decompositions: Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigendecomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Phylogeny

UNIT-IV

Vector Calculus : Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series

UNIT-V

Probability and Distributions: Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Summary Statistics and Independence, Gaussian Distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform
 Continuous Optimization: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization

Text Books:

1. "Mathematics for Machine Learning", Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, Cambridge University Press.
2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2017.



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Reference Books:

1. Machine Learning: An Applied Mathematics Introduction, Paul Wilmott, Panda Ohana Publishing 2019.



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	Honors Course	L	T	P	C
		4	0	0	4
TEXT MINING AND TIME SERIES ANALYSIS (AI & ML)					

Course Objectives: This course will cover the major techniques for mining and analyzing text data to discover interesting patterns, extract useful knowledge, and support decision making, with an emphasis on statistical approaches that can be generally applied to arbitrary text data in any natural language with no or minimum human effort. Develop the skills needed to do empirical research in fields operating with time series data sets. The course aims to provide students with techniques and receipts for estimation and assessment of quality of economic models with time series data.

Course Outcomes:

After completing the course Student will be able to:

- Student will be aware of fundamental concepts of text mining, unsupervised information extraction.
- Student will be aware of text clustering algorithms like feature selection, distance-based clustering and latent semantic indexing.
- Student will be aware of Text classification algorithm and text mining techniques.
- Student should aware of all the characteristics of time series and measures of dependencies.
- Student will be able to understand the ARIMA Models.

UNIT I:

Introduction to Text Mining: Introduction, Algorithms for Text Mining, Information Extraction from Text: Introduction, Named Entity Recognition, Relation Extraction, Unsupervised Information Extraction. Text Summarization Techniques: Extractive Summarization, Topic Representation Approaches, Influence of Context, Indicator Representation and Machine Learning for Summarization.

UNIT II:

Text Clustering Algorithms: Introduction, Feature Selection and Transformation Methods for Text Clustering, Distance-Based Clustering Algorithms, Word and Phrase-based Clustering, Probabilistic Document Clustering and Topic Modelling. Dimensionality Reduction and Topic Modelling: Latent Semantic Indexing, Topic Models and Dimension Reduction.

UNIT III:

Text Classification Algorithms: Introduction, Feature Selection for Text Classification, Decision Tree Classifiers, Rule-based Classifier, Probabilistic and Naïve Bayes Classifiers, Linear Classifier, Proximity-based Classifier, Meta-Algorithms for Text Classification, Probabilistic Models for Text Mining: Mixture models, Stochastic Processes in Bayesian Nonparametric Models, Graphical Models.

UNIT IV:

Characteristics of Time Series: Introduction, Nature of Time Series Data, Time Series Statistical Models, Measures of Dependence: Autocorrelation and Cross-Correlation, Stationary Time Series, Time Series Regression and Exploratory Data Analysis: Classical Regression, Exploratory Data Analysis, Smoothing.

UNIT V:

ARIMA Models: Introduction, Autoregressive Moving Average Models, Difference Equations, Autocorrelation and Partial Autocorrelation, Building ARIMA Models, Multiplicative Seasonal ARIMA Models, Spectral Analysis and Filtering: Cyclical Behaviour and Periodicity, Spectral Density, Periodogram and Discrete Fourier Transform, Nonparametric and Parametric Spectral Estimation, Linear Filters, Dynamic Fourier Analysis and Wavelets.



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Text Books:

1. Charu C. Aggarwal, Chengxing Zhai, “Mining Text Data”, Kluwer Academic Publishers, Springer, 2012.
2. Robert H. Shumway and David S. Stoffer, “Time Series Analysis and Its Applications with R Examples”, Springer, 2016.

Reference Books:

1. James D. Hamilton, Time Series Analysis, Princeton University Press, 2004.
2. Avishek Pal and PKS Prakash, Practical Time Series Analysis, Birmingham - Mumbai, 2017.
3. Box, G.E.P., G.M. Jenkins and G.C. Reinsel. n Time Series Analysis, Forecasting, and Control, 3rd ed. Englewood Cliffs, NJ: Prentice Hall, 1994.
4. Chan, N.H. Time Series: Applications to Finance. 2002, New York: Wiley.
5. Fuller, W.A. Introduction to Statistical Time Series, 2nd ed. New York: Wiley, 1996.



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DEPARTMENT OF INFORMATION TECHNOLOGY

	Honors Course	L	T	P	C
		4	0	0	4
NATURAL LANGUAGE PROCESSING (AI & ML)					

Course Objectives:

- This course introduces the fundamental concepts and techniques of natural language processing (NLP).
- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes: After completion of this course

- Demonstrate a given text with basic Language features
- To design an innovative application using NLP components
- Explain a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I:

Introduction :Origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata, English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II:

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging, Hidden Markov and Maximum Entropy models.

UNIT III:

Syntactic Analysis : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs, Feature structures, Unification of feature structures

UNIT IV:

Semantics And Pragmatics: Requirements for representation, First-Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, selectional restrictions, Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods, Word Similarity using Thesaurus and Distributional methods.

UNIT V:

Discourse Analysis And Lexical Resources : Discourse segmentation, Coherence, Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution, Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).



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Text Books:

1. Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, OReilly Media, 2009.

Reference Books:

1. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkha and Fred J. Damerau, Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010. Edition
4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.



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DEPARTMENT OF INFORMATION TECHNOLOGY

	Honors Course	L	T	P	C
		4	0	0	4
REINFORCEMENT LEARNING (AI & ML)					

Course Objectives:

By the end of the class students should be able to:

- Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
- Given an application problem (e.g. from computer vision, robotics, etc), decide if it should be formulated as a RL problem; if yes be able to define it formally (in terms of the state space, action space, dynamics and reward model), state what algorithm (from class) is best suited for addressing it and justify your answer.

Course Outcomes:

By the end of this course, students should be able to do the following:

1. Learn how to define RL problems like Tic-Tac-Toe, Multi-arm.
2. Student will be able to understand the finite markov decision processes.
3. Student will be to Understand Monte Carlo Methods and how it is work with tabular methods to solve classical control problems
4. Student should aware of Eligibility Traces and Understand how to find with approximate solutions.
5. Explore imitation learning tasks and solutions
6. Recognize current advanced techniques and applications in RL

UNIT I:

Reinforcement Learning Problem: Introduction, Elements of Reinforcement Learning, Limitations and Scope, Tic-Tac-Toe, Multi-arm Bandits: n -Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandit, Associative Search.

UNIT II:

Finite Markov Decision Processes: Agent-Environment Interface, Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation, Dynamic Programming: Policy- Evaluation, Improvement, Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.

UNIT III:

Monte Carlo Methods: Monte Carlo- Prediction, Estimation of Action Values, Control, Control without Exploring Start, Temporal- Difference learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning, Games, Afterstates.

UNIT IV:

Eligibility Traces: n -Step TD Prediction, Forward and Backward View of TD(λ), Equivalences of Forward and Backward Views, $saras(\lambda)$, Watkin's Q(λ), Off-policy Eligibility Traces using Important Sampling, Variable λ .

UNIT V:

Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting and Learning, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search.



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Text Book:

1. Rich S. Sutton, Andrew G. Barto, Reinforcement Learning: An Introduction, Second Edition, MIT Press, 2015.
2. Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone parisi, Reinforcement Learning Algorithms: Analysis and Applications, 1st Edition, Springer, 2021.

Reference Books:

1. Phil Winder, Reinforcement Learning: Industrial Applications of Intelligent Agent, 1st Edition, O'Reilly, 2020.
2. Kyriakos G. Vamvoudakis, Yan Wan, Frank, L. Lewis, Derya Cansever, Handbook of Reinforcement Learning and Control, 1st Edition, Springer, 2021.

NPTEL Link: Reinforcement Learning:
https://onlinecourses.nptel.ac.in/noc22_cs34/preview



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II Year - II Semester	Honors Course	L	T	P	C
		4	0	0	4
INTERNET OF THINGS (Systems Engineering)					

Course Objectives:

The main objectives of this course are

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

Course Outcomes (COs):

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

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
- Develop prototype models for various applications using IoT technology.

UNIT I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT II:

Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.



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Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly



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	Honors Course	L	T	P	C
		4	0	0	4
DATA COMMUNICATIONS AND INFORMATION CODING THEORY (Systems Engineering)					

Course Objective:

The objective of this course is to introduce the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on.

Course Outcomes:

The students at the end of the course will be able to:

- Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
- Describe the real life applications based on the fundamental theory.
- Calculate entropy, channel capacity, bit error rate, code rate, steady-state probability and so on.
- Implement the encoder and decoder of one block code or convolutional code using any program language

UNIT I:

Overview; Basic Concepts - Entropy and Mutual information; Lossless Source Coding – Source entropy rate; Kraft inequality; Huffman code; Asymptotic equipartition property; Universal coding; Noisy Channel Coding - Channel capacity

UNIT II:

Random channel codes; Noisy channel coding theorem for discrete memory-less channels; Typical sequences; Error exponents; Feedback; Continuous and Gaussian channels; Lossy Source Coding - Rate-Distortion functions; Random source codes; Joint source-channel coding and the separation theorem.

UNIT III:

Source coding- Text, Audio and Speech: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

UNIT IV:

Source coding- Image and Video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard

UNIT V:

Error control coding- Block codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC Error control coding

Text books:

1. Mark Kelbert(Author), Yuri Suhov, Information Theory and Coding by Example, Cambridge University Press,2013



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Reference books:

1. Simon Haykin and Michael Moher, Communication Systems, 5th Edition, Wiley, 2010
2. T.M. & Thomas, J.A. (2006). Elements of information theory. New York: Wiley.
3. Ad´amek, Foundations of coding, Wiley Interscience, 1991.
4. T. M. Cover and J. A. Thomas, Elements of information theory, Wiley, 1991.



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	Honors Course	L	T	P	C
		4	0	0	4
SERVICE ORIENTED ARCHITECTURES (Systems Engineering)					

Course Objectives:

- To gain understanding of the basic principles of service orientation
- To learn service oriented analysis techniques
- To learn technology underlying the service design
- To learn the concepts such as SOAP, Registering and Discovering Services.

Course Outcomes: At the end of this course, students are expected to gain the following learning:

1. Get the foundations and concepts of service based computing
2. Advocate the importance and means of technology alignment with business
3. Understanding the basic operational model of web services,
4. Gain the knowledge of key technologies in the service oriented computing arena
5. Apply and practice the learning through a real or illustrative project/case study.

UNIT I

Software Architecture: Need for Software Architecture, Objectives of Software Architecture, Types of Information Technology (IT) Architecture, Architectural Patterns and Styles

Architecting Process for Software Applications: Architectural Considerations, Architecting Process for Software Applications, Level 0: High-Level Architecture, Level 1: Solution Architecture Detailed Design

UNIT II

SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA Service-oriented Architecture and Microservices architecture –Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards And Guidelines for SOA, Emergence of MSA

Service-Oriented Architecture: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process

UNIT III

Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model

Service-Oriented Analysis and Design: Need for Models, Principles of Service Design Non-functional Properties for Services, Design of Activity Services (or Business Services) Design of Data Services, Design of Client Services, Design of Business Process Services

UNIT IV

Microservices Architecture:

Trend in SOA – Microservices Architecture (MSA): Services Model for Cloud and Mobile Solutions, API Adoption on the Rise, Challenges and Takeways from SOA Implementations Architecture Trend – Microservices Architecture, Microservices Architecture in Action

Cloud and MSA: Cloud Services, Hybrid Cloud Services, Considerations for Hybrid Cloud Services, Cloud Services and MSA, MSA for SMAC Solutions



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UNIT V

Mobile and MSA: Mobile Technologies, Types of Mobile Applications, MSA for mobile solutions Case Study: SOA – Loan Management System (LMS) PoC, MSA – APIary PoC

Text Book:

1. Shankar Kambhampaty, Service - Oriented Architecture & Microservices Architecture, 3ed: For Enterprise, Cloud, Big Data and Mobile , ISBN: 9788126564064, Wiley.
2. Mark Richards, Microservices vs Service-Oriented Architecture, O'Reilly Media, Inc., 2016.

Reference Books:

1. Thomas Erl, Services-Oriented Architecture: Concepts, Technology and Design, Prentice Hall, 2005.
2. Guido Schmutz, Peter Welkenbach, Daniel Liebhart, Service-Oriented Architecture: An Integration Blueprint, Packt Publisher, 2010.



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	Honors Course	L	T	P	C
		4	0	0	4
DESIGN OF SECURE PROTOCOLS (Systems Engineering)					

Course Objectives:

The main objective of this course is that to explore various protocols and design of various protocols with deeper security.

Course Outcomes:

By the end of the course Student will

- Get the exposure to various protocols.
- Gain knowledge on various secure mechanisms through set of protocols.
- Efficiently design new set of protocols.
- Learn Security issues and overcome means with protocols.

UNIT – I:

OSI:ISO Layer Protocols: Application Layer Protocols, TCP/IP, HTTP, SHTTP, LDAP, MIME, POP & POP3, RMON, SNMP. Presentation Layer Protocols, Light Weight Presentation Protocol Session layer protocols.

UNIT – II:

RPC protocols, transport layer protocols, ITOT, RDP, RUDP, TALI, TCP/UDP, compressed TCP. Network layer Protocols, routing protocols, border gateway protocol-exterior gateway protocol, internet protocol IPv4, IPv6, Internet Message Control Protocol, IRDP Transport Layer Security, TSL, SSL, DTLS

UNIT – III:

Data Link layer Protocol, ARP, In ARP, IPCP, IPv6CP, RARP, SLIP .Wide Area and Network Protocols, ATM protocols, Broadband Protocols, Point to Point Protocols, Other WAN Protocols, security issues.

UNIT – IV:

Local Area Network and LAN Protocols, ETHERNET Protocols, VLAN protocols, Wireless LAN Protocols, Metropolitan Area Network Protocol, Storage Area Network and SAN

UNIT – V:

Protocols, FDMA, WIFI and WIMAX Protocols, security issues. Mobile IP, Mobile Support Protocol for IPv4 and IPv6, Resource Reservation Protocol. Multicasting Protocol, VGMP, IGMP, MSDP .Network Security and Technologies and Protocols, AAA Protocols, Tunneling Protocols, Secured Routing Protocols, GRE- Generic Routing Encapsulation, IPSEC– Security.

Text Books:

1. Jawin: “Networks Protocols Handbook”, 3rd Edition, Jawin Technologies Inc., 2005.
2. Bruce Potter and Bob Fleck : “802.11 Security”, 1st Edition, O’Reilly Publications, 2002.

Reference Books:

1. Ralph Oppliger :“SSL and TSL: Theory and Practice”, 1st Edition, Artech House, 2009.
2. Lawrence Harte: “Introduction to CDMA- Network services Technologies and Operations”, 1st Edition, Althos Publishing, 2004.
3. Lawrence Harte: “Introduction to WIMAX”, 1st Edition, Althos Publishing, 2005



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	Honors Course	L	T	P	C
		4	0	0	4
NETWORK CODING (Systems Engineering)					

Course Objectives:

- Students will gain the understanding of core network programming by using sockets and transport layer protocols like TCP and UDP
- Students will gain the understanding of inter process communication and implementation of different forms of IPC in client-server environment
- Students will get an exposure to various application layer protocols which are designed using sockets and transport layer protocols

Course Outcomes:

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

- Explain the client-server paradigm and socket structures.
- Describe the basic concepts of TCP sockets and TCP echo client-server programs.
- Discuss the UDP sockets and UDP echo client-server programs.
- Explain Socket options and ability to understand IPC
- Apply the applications of sockets and demonstrate skill to design simple applications like FTP, TELNET etc.

UNIT-I:

Introduction to Network Programming: OSI model, transport layer protocols: TCP, UDP and SCTP, network architecture: client-server and peer-to-peer systems, Sockets-socket Address structures: IPv4, IPv6 and Generic-value result arguments, Byte ordering functions, Byte manipulation functions, Address conversion functions

UNIT-II:

TCP: introduction to TCP, TCP connection establishment and termination TIME_WAIT State. Elementary TCP sockets, Socket, connect, bind, listen, accept, fork, exec function, concurrent servers, Close function, read and write functions

UNIT-III:

TCP echo client server program, getsockname and getpeername functions I/O multiplexing: I/O models, Select function, TCP echo server using select function, shutdown function, Poll function

UNIT-IV:

UDP: Introduction to UDP, difference between TCP and UDP, recvfrom() and sendto() functions, UDP echo client server program, UDP echo client server using select function. Socket Options: IPv4 socket options, IPv6 socket options

UNIT-V:

Socket Options: Generic socket options, TCP socket options. IPC: Introduction to IPC, forms of IPC, UNIX kernel support for pipes, FIFO, message queues, semaphores and shared memory Network programming concepts Implementation: FTP, ping, arp, SMTP, TELNET



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Text Books:

1. Unix Network programming, the socket networking API, W.Richard Stevens, bill fenner, Andrew m.rudoff ,PHI.

References Books:

1. Advanced programming in the UNIX environment, W.Richard Stevens, pearson education



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II Year - II Semester	Honors Course	L	T	P	C
		4	0	0	4
PRINCIPLES OF CYBER SECURITY (Information Security)					

Course Objectives:

- To learn threats and risks within context of the cyber security architecture.
- Student should learn and Identify security tools and hardening techniques.
- To learn types of incidents including categories, responses and timelines for response.

Course Outcomes: At the end of the course, student will be able to

- Apply cyber security architecture principles.
- Demonstrate the risk management processes and practices.
- Appraise cyber security incidents to apply appropriate response
- Distinguish system and application security threats and vulnerabilities.
- Identify security tools and hardening techniques

UNIT-I:

Introduction to Cyber Security-Cyber security objectives, roles, differences between information security and cyber security, Cyber security principles-confidentiality, integrity, availability, authentication and non repudiation

UNIT-II:

Information Security within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts, **Risks & Vulnerabilities**-Basics of risk management, Operational threat environments, Classes of attacks

UNIT-III:

Incident Response-Incident categories, Incident response, Incident recovery, **Operational security protection**-Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management

UNIT-IV:

Threat Detection and Evaluation Monitoring-Vulnerability management, Security logs and alerts, Monitoring tools and appliances, **Analysis**-Network traffic analysis, packet capture and analysis

UNIT-V:

Introduction to backdoor System and security-Introduction to metasploit, backdoor, demilitarized zone (DMZ), Digital signature, Brief study on Harding of operating system.

Text Books:

1. NASSCOM: Security Analyst Student Hand Book, Dec 2015
2. Information Security Management Principles, Updated Edition, [David Alexander](#), [Amanda Finch](#), [David Sutton](#), BCS publishers, June 2013

Reference Books:

1. Cyber Security Fundamentals-Cyber Security, Network Security and Data Governance Security, 2nd Edition, ISACA Publishers, 2019



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	Honors Course	L	T	P	C
		4	0	0	4
COMPUTATIONAL NUMBER THEORY (Information Security)					

Course Objectives: This course will focus on designing efficient algorithms (and providing complexity analysis) for the most important problems from number theory, with major applications in coding theory and cryptography.

Course Outcomes:

Upon completing the course the student will be able to

- understand with basics of number theory and its applications.
- demonstrate the arithmetic of finite fields, polynomials.
- analyze the elliptic curves, testing and factorization.
- Student will be able to solve the discrete logarithms and large sparse linear systems.
- Student will be able to apply the skills for writing programs of cryptography algorithms.

UNIT I:

Arithmetic of Integers: Basic Arithmetic Operations, GCD, Congruences and Modular Arithmetic, Linear Congruences, Polynomial Congruences, Quadratic Congruences, Multiplicative Orders, Continued Fractions, Prime Number Theorem and Riemann Hypothesis, Running Times of Arithmetic Algorithms.

UNIT II:

Arithmetic of Finite Fields: Existence and Uniqueness of Finite Fields, Representation of Finite Fields, Implementation of Finite Field Arithmetic, Arithmetic of Polynomials: polynomials over Finite Fields, Finding Roots of Polynomials over Finite Fields, Factoring Polynomials over Finite Fields, Properties of Polynomials with Integer Coefficients, Factoring Polynomials with Integer Coefficients.

UNIT III:

Arithmetic of Elliptic Curves: Elliptic Curve, Elliptic-Curve Group, Elliptic Curve over Finite Fields, Pairing on Elliptic Curves, Elliptic-Curve Point Counting, Primality Testing: Introduction, Probabilistic Primality Testing, Deterministic Primality Testing, Primality Testing for Number of Special Forms.

UNIT IV:

Integer Factorization: Trial Division, Pollard's Rho Method, Pollard's $p-1$ Method, Dixon's Method, CFRAC Method, Quadratic Sieve Method, Cubic Sieve Method, Elliptic Curve Method, Number-Field Sieve Method, Discrete Logarithms: Square-Root Methods, Algorithms: Prime Fields, Fields of Characteristic Two, General Extension Fields, Elliptic Curves(ECDLP).

UNIT V:

Large Sparse Linear Systems: Structured Gaussian Elimination, Lanczos Method, Wiedemann Method, Block Methods

Text Books:

1. Abhijit Das, Computational Number Theory, CRC Hall, 1st Edition, 2013.
2. T. H. Cormen, C. E. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, Prentice Hall India, 2nd Edition, 2002.



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Reference Books:

1. Victor Shoup, A Computational Introduction to Number Theory and Algebra, 2nd Edition, Cambridge University Press, 2008.
2. R. Lidl and H. Niederreiter, Introduction to finite fields and their applications, Cambridge University Press, 2021.
3. M. Mignotte, Mathematics for computer algebra, Springer-Verlag, 1992.

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		L	T	P	C
	Honors Course	4	0	0	4
CRYPTANALYSIS (Information Security)					



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	Honors Course	L	T	P	C
		4	0	0	4
ELLIPTIC CURVE CRYPTOGRAPHY (Information Security)					

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	Honors Course	L	T	P	C
		4	0	0	4
INTRODUCTION TO QUANTUM COMPUTING AND QUANTUM CRYPTOGRAPHY (Information Security)					



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	Honors Course	L	T	P	C
		4	0	0	4
PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT (Information Security)					

Course objectives:

The course is designed to train the graduates in depth understanding of Public Key Cryptography, Public Key Infrastructure, security credentials and design new or modify existing cryptographic techniques.

Course Outcomes:

Graduates after completing the course shall gain:

- In depth understanding of Public key cryptography and Infrastructure.
- Ability to design and analyze Public Key cryptographic techniques.
- Ability to solve network security issues in real time applications.
- Ability to take up doctoral level research work in security.

UNIT I:

Public key infrastructure: components and architecture. PKI interoperability, deployment and assessment PKI data structures – certificates, validation, revocation, authentication, cross-certification. Repository, Certification Authority (CA) and Registration Authority (RA), trusted third party, digital certificates.

UNIT II:

PKI Services: Authentication, Integrity and Confidentiality, Mechanisms, Secure Communication, Secure Time Stamping, Non-Repudiation, Privilege Management, Certificate policies, Certificate Authority, Registration Authority.

UNIT III:

Key and Certificate Management: Key/Certificate Life Cycle Management, Certificate Revocation: Periodic Public Mechanisms, performance, Scalability and Timeliness, Multiple Key pairs, Key Pair Uses, Real-World Difficulties, Independent Certificate Management.

UNIT IV:

Trust Models: Strict Hierarchy of Certification Authorities, Distributed Trust Architecture, Web Model, User-Centric Trust, Cross-Certification, Entity Naming, Certificate Path processing, PKI Information Dissemination: Repositories and Techniques, private Dissemination, Public and Repositories, In-Band Protocol Exchange.

UNIT V:

PKI Standards: Introduction, Major Standards Activities, X.509, PKIX, X.500, LDAP, ISO TC68, ANSI X9f, S/MIME, IPsec, TLS, SPKI, OpenPGP, EDIFACT.

Text Books:

1. Carlisle Adams, Steve Lloyd, Understanding Public-Key Infrastructure: Concepts, Standards, and Deployment Considerations, Sams, 1999.
2. [John R. Vacca](#), Public Key Infrastructure, Building Trusted Applications and Web Services, Auerbach Publications, 2004.



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Reference Books:

1. Messaoud Benantar, Introduction to the Public Key Infrastructure for the Internet, Pearson Education, Prentice Hall, 2011.
2. Ashutosh Saxena, Public Key Infrastructure, Tata McGraw Hill.



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	Honors Course	L	T	P	C
		4	0	0	4
INFORMATION SECURITY ANALYSIS AND AUDIT (Information Security)					

Course Objectives:

- Understanding and knowledge of Security Auditing, and introduce the Threats and defense in the systems.
- Acquiring the knowledge on Evidence collection and evaluation techniques.

Course Outcomes:

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

- Illustrate the fundamental concepts of information security and systems auditing
- Analyze the latest trend of computer security threats and defense
- Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms
- Explain the security controls in the aspects of physical, logical and operational security control and case studies
- Evaluate the security of information systems

UNIT-I:

Overview of Information System Auditing- Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit.

UNIT-II:

The management Control Framework-I- Introduction, Evaluating the planning Function, Leading Function, Controlling Function, Systems Development Management Controls, Approaches to Auditing Systems Development, Normative Models of the Systems Development Process, Evaluating the Major phases in the Systems Development Process, Programming Management Controls, Data Resource Management Controls.

UNIT-III:

The Management Control Framework-II- Security Management Controls, Operations management Controls Quality assurance Management Controls, Case Studies.

UNIT-IV:

Evidence Collection- Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools-Case Studies.

UNIT-V:

Evidence Evaluation- Evaluating Asset Safeguarding and Data Integrity, Evaluating System, Effectiveness, Evaluating System Efficiency, Information Systems Audit and Management: Managing the Information Systems Audit Function.



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Text Book:

1. Information Systems Control and Audit, 1st Edition, Ron Weber, Pearson Education, 2013

Reference Book:

1. Information System Audit and Assurance, D P Dube, TMH, New Delhi, 2008



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	Honors Course	L	T	P	C
		4	0	0	4
CLOUD AND IOT SECURITY (Information Security)					

Course Outcomes: At the end of the course, student will be able to

- Discuss about Security Requirements in IoT Architecture
- Explain Random number generation
- Demonstrate Authorization with Publish / Subscribe schemes
- Identify Lightweight and robust schemes for Privacy protection
- Explain about IoT cloud security architecture

UNIT I:

Introduction: Securing Internet of Things: Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications. Security Architecture in the Internet of Things, Security Requirements in IoT, Insufficient Authentication /Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT. Vulnerabilities, Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Attack, Fault trees

UNIT II:

Cryptographic Fundamentals for IoT: Cryptographic primitives and its role in IoT, Encryption and Decryption, Hashes, Digital Signatures, Random number generation, Cipher suites, key management fundamentals, cryptographic controls built into IoT messaging and communication protocols.

UNIT III:

Identity & Access Management Solutions for IoT: Identity lifecycle, authentication credentials, IoT IAM infrastructure, Authorization with Publish / Subscribe schemes and access control

UNIT IV:

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

UNIT V:

Cloud Security for IoT: Cloud services and IoT, offerings related to IoT from cloud service providers, Cloud IoT security controls, enterprise IoT cloud security architecture, New directions in cloud enabled IoT computing

Text Books:

1. Practical Internet of Things Security (Kindle Edition) by Bria Russell, Drew VanDuren

References Books:

1. Securing the Internet of Things, Elsevier
2. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations



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	Honors Course	L	T	P	C
		4	0	0	4
WEB SECURITY (Information Security)					

Course Objectives:

- Underlying security principles of the web
- Overview of concrete threats against web applications
- Insights into common attacks and countermeasures
- Current best practices for secure web applications

Course Outcomes: At the end of the course, student will be able to

- Demonstrate security concepts, security professional roles, and security resources in the context of systems and security development life cycle
- Justify applicable laws, legal issues and ethical issues regarding computer crime
- Explain the business need for security, threats, attacks, top ten security vulnerabilities, and secure software development
- Apply information security policies, standards and practices, the information security blueprint
- Analyze and describe security requirements for typical web application scenario

UNIT-I:

Introduction-A web security forensic lesson, Web languages, Introduction to different web attacks, Overview of N-tier web applications, Web Servers-Apache, IIS.

UNIT-II:

Securing the Communication Channel- Understanding the dangers of an insecure communication channel. Practical advice on deploying HTTPS, and dealing with the impact on your application, Insights into the latest evolutions for HTTPS deployments.

UNIT-III:

Web Hacking Basics- HTTP & HTTPS URL, Web under the Cover Overview of Java security Reading the HTML source, Applet Security Servlets Security Symmetric and Asymmetric Encryptions, Network security Basics, Firewalls & IDS.

UNIT-IV:

Securely Handling Untrusted Data-Investigation of injection attacks over time, Understanding the cause behind both server-side and client-side injection attacks, Execution of common injection attacks, and implementation of various defenses.

UNIT-V:

Preventing Unauthorized Access-Understanding the interplay between authentication, authorization and session management. Practical ways to secure the authentication process prevent authorization bypasses and harden session management mechanisms, Securing Large Applications, Cyber Graffiti.

Text Books:

1. Web Hacking: Attacks and Defense, Latest Edition , McClure, Stuart, Saumil Shah, and Shreeraj Shah, Addison Wesley, 2003
2. Professional Java Security, 1.3 Edition, Garms, Jess and Daniel Somerfield, Wrox, 2001



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	Honors Course	L	T	P	C
		4	0	0	4
BLOCK CHAIN ARCHITECTURE DESIGN AND USE CASES (Information Security)					

Course Objectives:

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

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

Course Outcomes:

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

- Demonstrate the foundation of the Block chain technology and understand the processes inpayment and funding.
- Identify the risks involved in building Block chain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Blockchain implementations and Understand Crypto currencymarkets
- Examine how to profit from trading crypto currencies.

UNIT I

Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain.

Evolution of Blockchain : Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

UNIT II

Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

UNIT III

Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

UNIT IV

Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, MyEtherWallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, OpenZeppelin Contracts



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UNIT V

Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application.

Advanced Concepts in Blockchain: Introduction, InterPlanetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

Text Books:

- 1) Ambadas, Arshad Sarfarz Ariff, Sham “Blockchain for Enterprise Application Developers”, Wiley
- 2) Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain” , O’Reilly

Reference Books:

- 1) Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
- 2) Blockchain: Blueprint for a New Economy, Melanie Swan, O’Reilly

e-Resources:

- 1) <https://github.com/blockchainedindia/resources>



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II Year - II Semester	Honors Course	L	T	P	C
		4	0	0	4
DATA VISUALIZATION (Data Science)					

Course Objectives:

The main objective of this course is to make it easier to identify patterns, trends and outliers in large data sets

Course Outcomes:

On completion of this course, the student will be able to

- Identify and recognize visual perception and representation of data.
- Illustrate about projections of different views of objects.
- Apply various Interaction and visualization techniques.
- Analyze various groups for visualization.
- Evaluate visualizations

UNIT-I:

Introduction to Data Visualizations and Perception: Introduction of visual perception, visual representation of data, Gestalt principles, Information overload.

UNIT-II :

Visual Representations: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT-III :

Classification of Visualization Systems: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

UNIT-IV :

Visualization of Groups: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization. Various visualization techniques, data structures used in data visualization.

UNIT-V :

Visualization of Volumetric Data And Evaluation of Visualizations: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

Text Books:

1. Ward, Grinstein, Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick, 2nd edition, A K Peters, Ltd 2015.

Reference Books:

1. Tamara Munzner, Visualization Analysis & Design ,1st edition, AK Peters Visualization Series 2014
2. Scott Murray, Interactive Data Visualization for the Web ,2nd Edition, 2017



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	Honors Course	L	T	P	C
		4	0	0	4
STATISTICAL FOUNDATIONS FOR DATA SCIENCE					
(Data Science)					

Course Objectives:

The course will introduce the fundamental concepts of probability and statistics required for a program in data science

Course outcomes:

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

- Use the statistical concepts in the field of data science.
- Employ the techniques and methods related to the area of data science in variety of applications.
- Apply logical thinking to understand and solve the problem in context.
- Explore statistical learning methods and their application to modern problems in science, industry, and society.
- Build analytics pipelines for regression problems and classification problems

UNIT I:

Basics of Data Science: Introduction; Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; Structured thinking for solving data science problems.

UNIT II:

Probability, Statistics and Random Processes: Probability theory and axioms; Random variables; Probability distributions and density functions (univariate and multivariate); Expectations and moments; Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations; Confidence (statistical) intervals; Correlation functions; White-noise process

UNIT III:

Probabilistic formulations of prediction problems: Plug-in estimators, empirical risk minimization, Linear threshold functions, perceptron algorithm, Risk bounds, Concentration inequalities, Uniform convergence, Rademacher averages; combinatorial dimensions, Convex surrogate losses for classification, Linear regression, Regularization and linear model selection, Feature Selection Methods, Cross Validation methods.

UNIT IV:

Game-theoretic formulations of prediction problems, High Dimensional methods, Lasso, Ridge Regression, Dimensionality Reduction, Minimax strategies for log loss, linear loss, and quadratic loss, Universal portfolios, Online convex optimization.

UNIT V:

Neural networks: Stochastic gradient methods, Combinatorial dimensions and Rademacher averages, Hardness results for learning, Efficient learning algorithms.



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Text Books:

1. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010
2. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.
3. James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning with Applications in R, Springer, 2013.

Reference Books:

1. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer, 2009.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF INFORMATION TECHNOLOGY

	Honors Course	L	T	P	C
		4	0	0	4
MINING MASSIVE DATA SETS (Data Science)					

Course Objective: The course will discuss data mining and machine learning algorithms for analyzing very large amounts of data. The emphasis will be on MapReduce and [Spark](#) as tools for creating parallel algorithms that can process very large amounts of data.

Course Outcomes:

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

- Discuss research directions in Mining Massive Datasets, such as similarity search, streaming data, clustering, and graph mining.
- Analyze policy, focusing on methods for mining massive datasets and potential policy and management applications, by synthesizing and summarizing the current state of the art, and facilitating discussion by posing questions, preliminary conclusions, and ideas to explore.
- Develop a research project relevant to Mining Massive Datasets and produce a report describing the project's background, methods, results, and conclusions.
- Knowledge of basic computer science principles and skills, at a level sufficient to write a reasonably non-trivial computer program.
- Good knowledge of Java and Python will be extremely helpful since most assignments will require the use of Spark

UNIT I:

Data Mining: Data Mining, Statistical Limits on Data Mining, MapReduce: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce.

UNIT II:

Finding Similar Items: Applications of Near-Neighbor Search, Shingling of Documents, Distance Measures, Theory of Locality-Sensitive Functions, Applications of LSH Hashing.

UNIT III:

Mining Data Streams: Stream Data Model, Sampling Data in Streams, Filtering Streams, Link Analysis: PageRank, Efficient Computational of PageRank, Link Spam, Hubs and Authorities.

UNIT IV:

Frequent Itemsets: Market-Based Model, Market Based and A-Priori Algorithm, Limited-Pass Algorithms, Clustering: Introduction, Hierarchical Clustering and K-means Algorithm, CURE Algorithm.

UNIT V:

Dimensionality Reduction: Eigenvalues and Eigenvectors, Principal-Component Analysis, CUR Decomposition, Large-Scale Machine Learning: Machine Learning Model, Perceptrons, SVM's, Nearest Neighbors.

Text Books:

1. Jure Leskovec, Anand Rajaraman, Jeffery D. ULLman, Mining of Massive Datasets, Cambridge University Press, 2014.
2. Pattern Recognition and Machine Learning. Christopher Bishop. Springer-Verlag New York. 2006.



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Reference Books:

1. Machine Learning: A Probabilistic Perspective. Kevin Murphy. MIT Press. 2012
2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Trevor Hastie, Robert Tibshirani, Jerome Friedman. Springer. 2013



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	Honors Course	L	T	P	C
		4	0	0	4
MEDICAL IMAGE DATA PROCESSING (Data Science)					

Course Objectives:

The course will provide the participants with an up-to-date background in current state-of-the-art in medical imaging and medical image analysis. The aim of the course is to show how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computer science.

Course Outcomes: At the End of the Course:

1. Student will be able to explain the basic concepts of Medical Imaging Technologies, Systems and Formation Principles.
2. Student will be able to analyze the Medical Image Storage and Processing.
3. Student will be able to visualize the MRI, NMR and Artifacts.
4. Student should expertise the Segmentation and Classification techniques on Medical Image Data.
5. Student will be able to analyze the Nuclear Imaging like PET, SPECT and 3D Images.

UNIT I:

Introduction: Introduction to Medical Imaging Technology, Systems, and Modalities. Brief History, Importance, Applications, Trends, Challenges. Medical Image Formation Principles: X-Ray physics, X-Ray generation, Attenuation, Scattering, Dose Basic Principles of CT, Reconstruction Methods, Artifacts, CT hardware.

UNIT II:

Storage and Processing: Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS); Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics; filtering; histogram modeling.

UNIT III:

Visualization: Medical Image Visualization Fundamentals of Visualization, Surface and Volume Rendering/Visualization, Animation, Interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR, Spin Physics, NMR Spectroscopy, Imaging Principles and Hardware, Image Artifacts.

UNIT IV:

Segmentation And Classification: Medical Image Segmentation, Histogram-Based Methods, Region Growing and Watersheds, Markov Random Field Models, Active Contours, Model-Based Segmentation. Multi-Scale Segmentation, Semi-Automated Methods, Clustering-Based Methods, Classification-Based Methods, Atlas-Guided Approaches, Multi-Model Segmentation. Medical Image Registration Intensity-Based Methods, Cost Functions, Optimization Techniques.

UNIT V:

Nuclear Imaging: PET and SPECT Ultrasound Imaging Methods, Mathematical Principles, Resolution, Noise Effect, 3D Imaging, Positron Emission Tomography, Single Photon Emission Tomography, Ultrasound Imaging, Applications. Medical Image Search and Retrieval Current Technology in Medical Image Search, Content-Based Image Retrieval, New Trends: Ontologies, Applications, Other Applications Of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic Support Systems.



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Text Books:

1. Paul Suetens, "Fundamentals of Medical Imaging", Second Edition, Cambridge University Press, 2009.
2. J. Michael Fitzpatrick and Milan Sonka, "Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis", SPIE Publications, 2009.

Reference Books:

1. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.
2. Geoff Dougherty, "Digital Image Processing for Medical Applications", First Edition, Cambridge University Press, 2009.
3. Jerry L. Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition 1, Prentice Hall, 2005.
4. John L. Semmlow, "Biosignal and Medical Image Processing", Second Edition, CRC Press, 2008.