SCHEME AND SYLLABUS FOR FIRST & SECOND YEARS OF FOUR YEAR UNDER GRADUATE DEGREE COURSE B. TECH (COMPUTER SCIENCE & ENGINEERING) [W.E.F. 2022 - 2023 ADMITTED BATCH]

DEPARTMENT OF COMPUTER SCIENCE & SYSTEMS ENGINEERING
ANDHRA UNIVERSITY COLLEGE OF ENGINEERING
ANDHRA UNIVERSITY
VISAKHAPATNAM-530 003

ANDHRA UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND SYSTEM ENGINEERING
SCHEME AND SYLLABI
(With effect from 2022-23 admitted batch)
Common for CSE & IT

B.Tech & B.Tech + M.Tech
(Computer Science & Engineering)

I Year – I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS1101	BS	Engineering Mathematics –I	4	0	30	70	100	3
CS1102	BS	Green Chemistry	4	0	30	70	100	3
CS1103	HSS	English	4	0	30	70	100	3
CS1104	ES	Computer Programming Using C	4	0	30	70	100	3
CS1105	ES	IT Essentials	4	0	30	70	100	3
CS1106	HSS	Communication skills Lab	0	3	50	50	100	1.5
CS1107	ES	Computer Engineering Workshop Lab	0	3	50	50	100	1.5
CS1108	ES	Computer Programming using C lab	0	3	50	50	100	1.5
Total Credits								**19.5**

B.Tech & B.Tech + M.Tech

I Year-II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS1201	BS	Engineering Mathematics–II	4	0	30	70	100	3
CS1202	BS	Engineering Physics	4	0	30	70	100	3
CS1203	ES	Elements of Electronics Engineering	4	0	30	70	100	3
CS1204	ES	Data Structures Using C	4	0	30	70	100	3
CS1205	ES	Digital Logic Design	4	0	30	70	100	3
CS1206	ES	Linux Administration Lab	0	3	50	50	100	1.5
CS1207	BS	Engineering Physics Lab	0	3	50	50	100	1.5
CS1208	ES	Data Structures Lab	0	3	50	50	100	1.5
Total Credits								**19.5**

B.Tech & B.Tech + M.Tech
(Computer Science & Engineering)
II Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS2101	ES	Discrete Mathematical Structures	4	0	30	70	100	3
CS2102	PC	Computer Organization and Architecture	4	0	30	70	100	3
CS2103	BS	Probability, Statistics and Queuing theory	4	0	30	70	100	3
CS2104	PC	Operating Systems	4	0	30	70	100	3
CS2105	PC	Object Oriented Programming Through Java	4	0	30	70	100	3
CS2106	PC	Computer Organization & Architecture Lab	0	3	30	70	100	1.5
CS2107	PC	Object Oriented Programming Through Java Lab	0	3	50	50	100	1.5
CS2108	PC	Operating Systems Lab	0	3	50	50	100	1.5
CS2109	SC	Intellectual Property Rights (Internal)	1	2	100	0	100	2
CS2110	MC	Environmental Science	0	0	-	100	100	0
Total credits								**21.5**

B.Tech & B.Tech + M.Tech
II Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS2201	ES	Microprocessors	4	0	30	70	100	3
CS2202	PC	Design and Analysis of Algorithms	4	0	30	70	100	3
CS2203	PC	Database Management Systems	4	0	30	70	100	3
CS2204	PC	Formal Languages & Automata Theory	4	0	30	70	100	3
CS2205	HSS	Managerial Economics	4	0	30	70	100	3
CS2206	PC	Algorithms Lab through C++.	0	3	50	50	100	1.5
CS2207	PC	Database Management Systems Lab	0	3	50	50	100	1.5
CS2208	SC	Web Technologies	1	2	50	50	100	2
CS2209	MC	Professional Ethics & Universal Human Values	0	0	0	100	100	0
CS2210	MC	NCC/NSS	0	2	-	-	-	0
Total credits								**20**
Internship-I								

B.Tech & B.Tech + M.Tech
(Computer Science & Engineering)

I Year – I Semester

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CS1101	BS	Engineering Mathematics –I	4	0	30	70	100	3
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CS1107	ES	Computer Engineering Workshop Lab	0	3	50	50	100	1.5
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Total Credits								**19.5**

CS1101 ENGINEERING MATHEMATICS-I

Course Objectives

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series

Course Outcomes

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

Partial Differentiation: Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

Applications of Partial Differentiation: Geometrical interpretation -Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

Multiple Integrals: Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

Multiple Integrals-Applications: Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Centre of gravity - Moment of inertia - product of

inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

Fourier Series: Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis

Text Book

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

Reference Books

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company. 6.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

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CS1102 GREEN CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Batteries, Fuels Mechanism of Corrosion of Metals and Corrosion Control Methods, Green Chemistry and Technology and Processes involving Green Chemistry and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Learning outcome:

- The students are able to apply the basic concepts and principles studied in Chemistry to the field of Engineering.
- The students are able to apply chemistry to different branches of engineering
- The students are able to acquire the knowledge in the areas of Water Chemistry, Mechanism of Corrosion of Metals and Corrosion Control Methods, Batteries, Fuel Cells, Green Chemistry and Technology and Processes involving Green Chemistry and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Technology
Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Batteries
Primary batteries: The chemistry - Types: Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells – liquid cathode, solid cathode and lithium-ferrous sulphide cells. Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries.

Fuel Cells
Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells-Membranes and Fuels

Corrosion
Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion. Corrosion

Controlling Methods, Protective Coatings, Metallic Coatings, Electroplating and Electroless Plating.

Green Chemistry and Technology

Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of green chemistry, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, functional group approaches to green chemistry, Elimination of toxic functional group, optimization of frameworks for the design of greener synthetic pathways, Applications of green chemistry - Green solvents, green fuels and propellants, biocatalysis.

Text Books

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.
3. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

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CS1103 ENGLISH

Course Objectives

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers–Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages –Prefixes and Suffixes–Synonyms, Antonyms– Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook

1. Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India.2018.

References

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar, F.T. Wood. Macmillan.2007
3. On Writing Well, William Zinsser. Harper Resource Book. 2001
4. Study Writing, Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

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CS1104 COMPUTER PROGRAMMING USING C

Course Objectives

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

Decision Making, Branching, Looping: Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statement, the else.. if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops.

Arrays & Strings: One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointes, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications.

Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments-Program Applications.

Text Books

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.

Reference Books

1. Let Us C ,Yashwant Kanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), EnzoMarinari (Author), Giovanni Organtini, World Scientific.

CS1105 IT ESSENTIALS

Course Objectives

- Select the appropriate computer components to build, repair, or upgrade personal computers.
- Explain how to correctly use tools and safely work in a lab.
- Install components to build, repair, or upgrade personal computers.
- Configure computers to communicate on a network
- Configure devices to connect to the Internet and Cloud services
- Explain how to use, configure, and manage laptops and mobile devices

Course Outcomes

- Understands the roles and responsibilities of the IT professional
- Able to Troubleshoot advanced hardware and software problems
- Provides an experience-oriented course that employs industry-relevant instructional approaches to prepare students for entry-level jobs in the industry.

Syllabus

Introduction to the Personal Computer Describe a Computer System, Identify the Names, Purposes, and Characteristics of Cases and Power Supplies, Identify the Names, Purposes, and Characteristics of Internal Components, Identify the Names, Purposes, and Characteristics of Ports and Cables, Identify the Names, Purposes, and Characteristics of Input Devices, Identify the Names, Purposes, and Characteristics of Output Devices, Explain System Resources and Their Purposes.

Safe Lab Procedures and Tool Use Explain the Purpose of Safe Working Conditions and Procedures, Identify Tools and Software Used with Personal Computer Components and Their Purposes, Implement Proper Tool Use.

Computer Assembly Attach the Components to the Motherboard and Install the Motherboard, Install Internal Drives, Install Drives in External Bays, Install Adapter Cards, Connect the Power Cables Reattach the Side Panels to the Case, Boot the Computer for the First Time. **Basics of Preventive Maintenance and Troubleshooting** Explain the Purpose of Preventive Maintenance, Identify the Steps of the Troubleshooting Process.

Fundamental Laptops and Portable Devices Identify Common Preventive Maintenance Techniques for Laptops and Portable Devices, Describe How to Troubleshoot Laptops and Portable Devices.

Fundamental Operating Systems Explain the Purpose of an Operating System, Describe and Compare Operating Systems to Include Purpose, Limitations, and Compatibilities, Determine Operating System Based on Customer Needs, Install an Operating System, Identify and Apply Common Preventive Maintenance Techniques for Operating Systems, Troubleshoot Operating Systems.

Fundamental Networks Explain the Principles of Networking, Describe Types of Networks, Describe Basic Networking Concepts and Technologies, Describe the Physical Components of a Network, Describe LAN Topologies and Architectures.

Fundamental Security: Explain Why Security Is Important, Describe Security Threats, Identify Security Procedures, Identify Common Preventive Maintenance Techniques for Security, Troubleshoot Security.

Text books:

1. IT Essentials: PC Hardware and Software Companion Guide Fourth Edition, Cisco Networking Academy.

References:

1. Network security essentials application and standrads, by William stallings, 4th edition, prentice hall.
2. Mike Meyers' CompTIA A+ Guide to Managing and Troubleshooting PCs, Sixth Edition 6th Edition

CS1106 COMMUNICATION SKILLS LAB

Course Objectives

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation

Reference Books

1. Ashraf Rizvi. Effective Technical Communication. Tata McGraw Hill Education Private Limited, New Delhi.
2. Speak Well. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. Body Language. Manjul Publishing House, New Delhi.

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CS1107 COMPUTER ENGINEERING WORKSHOP LAB

Course Objectives

- Explain the internal parts of a computer, peripherals, I/O ports, connecting cables
- Demonstrate basic command line interface commands on LINUX
- Teach the usage of Internet for productivity and self-paced lifelong learning
- Describe about Compression, Multimedia and Antivirus tools
- Demonstrate Office Tools such as Word processors, Spreadsheets and Presentation tools

Course Outcomes

- Assemble and disassemble components of a PC
- Construct a fully functional virtual machine, Summarize various LINUX operating system commands.
- Able to Troubleshoot hardware and software problems.

Syllabus

Module I – Hardware Concepts

1. Every student should identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. Every student should disassemble and assemble the PC back to working condition.

Module II – Software Installations

1. Every student should individually install operating system like LINUX or MS windows on the personal computer. The system should be configured as dual boot with both windows and LINUX.
2. Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition.
3. Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.
4. Cyber Hygiene: Students should learn about viruses on the internet and install antivirus software. Student should learn to customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.
5. Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and popup blockers.

Module III – MS-Office

1. MS Word - Features to be covered: Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date.
2. Creating project abstract Features to be covered: Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
3. Creating a Newsletter: Features to be covered: Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs in word.
4. Spreadsheet Orientation: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler: Gridlines, Format Cells, Summation, auto fill, Formatting Text.
5. Calculating GPA - Features to be covered: Cell Referencing, Formulae in spreadsheet – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, Sorting, Conditional formatting.
6. Creating Power Point: Student should work on basic power point utilities and tools in Latex and Ms Office/equivalent (FOSS) which help them create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images, Tables and charts.

CS1108 Computer Programming Using C Lab

Course Objectives

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analysing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real-world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

Syllabus

Practice the following concepts with algorithm, flow chart and implementation.

1. C – Tokens, Data Types - Format Specifiers, I/O Statements.
2. Operators in C, their Precedence and Associativity, Arithmetic Expressions/Instructions, Type casting, Math.h functions.
3. Control Statements (Conditional): If and its Variants, Switch (Break).
4. Goto Statement, Control Statements (Looping): While, Do-While, For Loop, Continue & Break (Unconditional), Nested Loops
5. Arrays, One Dimensional Array: Declaration and Initialization, Accessing Array Elements.
6. Two Dimensional Array: Declaration and Initialization, Accessing Array Elements.
7. Strings: Read & Write, “String.h” Predefined Functions, without predefined functions.

8. Pointers: Declarations, Types, Pointers to Arrays, Pointers to Character Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Unions.
10. Functions: Function Declaration, Classification (Arguments and Return Type), Storage Classes.
11. Parameter Passing Techniques, Passing Parameters Types, Recursion
12. Files: Opening, Closing of Files, Reading and Writing of Files.
13. Binary Files, Random Accessing of Files, Enum, Typedef, Pre-processor Commands.
14. Numerical methods: Bisection method, Newton Raphson method, Lagrange's interpolation, Simpson's rule for numerical integration.

References:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

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CS1205	ES	Digital Logic Design	4	0	30	70	100	3
CS1206	ES	LINUX Administration Lab	0	3	50	50	100	1.5
CS1207	BS	Engineering Physics Lab	0	3	50	50	100	1.5
CS1208	ES	Data Structures Lab	0	3	50	50	100	1.5
Total Credits								**19.5**

CS1201 ENGINEERING MATHEMATICS – II

Course Objectives

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley- Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

Linear Algebra: Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

Ordinary Differential Equations of First Order and its Applications: Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

Differential Equations of Higher Order: Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

Laplace Transforms: Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by tn - Division by t – Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

Text Book

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

Reference Books

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

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CS1202 ENGINERING PHYSICS

Course Objectives

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibres and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications.
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fibre. Realize their role in optical fibre communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one-Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

Thermodynamics: Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of

thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

Electromagnetism: Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics: Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

Optics-

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

Lasers And Fibre Optics: Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers Introduction to optical fibres, principle of propagation of light in optical fibres, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibres, Fibre optics in communications, Application of optical fibres.

Modern Physics-

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi-conductors and insulators.

Nanophase Materials: Introduction, properties, Top-down and bottom-up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

Text Books

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaurand S.L. Gupta–Dhanpat Rai

Reference Books

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

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CS1203 ELEMENTS OF ELECTRONICS ENGINEERING

Course Objectives

- Introduce students to basics of semiconductors, their classification and properties
- To provide theory of PN junction diode, its characteristics and applications
- To introduce basics of rectifying circuits and bipolar junction transistor
- To provide basics of transistor biasing, transistor amplifiers and field effect transistors

Course Outcomes

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

- Explain the basics of semiconductors and their classification
- Understand the theory of PN junction diode, rectifying circuits and bipolar junction transistor
- Explain the concepts of transistor biasing, transistor amplifiers and field effect transistors

SYLLABUS

Introduction to Electronics and Semiconductors: Energy band theory, Conduction in Insulators, Semiconductors and metals, Electron emission from metals, Classification of semiconductors, Carrier concentration in an intrinsic semiconductor, Properties of intrinsic semiconductor, Drift and diffusion currents.

Semi-Conductor Diode: Theory of PN junction diode, Open circuited PN junction, V-I characteristics of a PN diode, Diode current equation, Transition and diffusion capacitances, Break down in PN diode, Applications of PN diodes. Zener diode, Zener regulator, Tunnel diode, Schottky diode.

Rectifying circuits: Half wave and full wave rectifiers, Bridge rectifiers, Efficiency, Ripple and regulation of each rectifier, Capacitor filters.

Bipolar Junction Transistor: Introduction, construction, Operation of PNP and NPN Transistors – Transistor Circuit configurations- Characteristics of a CE configurations – h parameters, low frequency small signal equivalent circuit of a Transistor.

Transistor Biasing and thermal stabilization: Transistor Biasing, Stabilization, Different methods of transistor biasing – Fixed bias, Collector feedback bias – self bias – Bias compensation.

Transistor Amplifiers: CE, CB, CC amplifier configurations –Multistage amplifier – A Two Stage RC coupled amplifier – frequency response curve and bandwidth.

Field Effect Transistors: Junction Field Effect Transistors (JFET) – JFET characteristics, JFET Parameters, Small signal equivalent circuit – MOSFETS – Depletion and Enhancement MOSFETS.

Text Books:

1. Electronic Device and Circuits by Sanjeev Guptha.

Reference Books:

1. Electronic Device and Circuits Theory by Robert L. Boylested Electronic Device and Circuits by David. A. Bell

CS1204 DATA STRUCTURES USING C

Course objectives

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps binary search trees, and graphs and writing programs for these solutions.

Course outcomes

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.
- Demonstrate different methods for traversing trees.
- Compare alternative implementations of data structures with respect to performance.
- Discuss the computational efficiency of the principal algorithms for sorting and searching

SYLLABUS

Introduction to Data Structures: Review of C Programming, Recursive Definition and Processes, Recursion in C, Simulation of Recursion, Efficiency of Recursion, Abstract Data Types, Meaning and Definition of Data Structures, Arrays.

Stacks: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix: Definitions, Evaluation and Conversions.

Queues: Queue as an Abstract Data Type, Sequential Representation, Types of Queues, Operations, Implementation using Arrays.

Linked List: Operations, Implementation of Stacks, Queues and priority Queues using Linked Lists+, Circular Lists: Insertion, Deletion and Concatenation Operations, Stacks and Queues as Circular Lists, Doubly Linked Lists.

Trees: Binary Trees - Definitions and Operations, Binary Tree Representation: Node Representation, Implicit array Representation, Binary Tree Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, Efficiency of Binary Search Tree operations.

Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type, Algorithmic Notation, Sequential Searching and its Efficiency, Binary Search, Interpolation Search.

Sorting: General Background: Efficiency, Asymptotic Notations, Efficiency of Sorting, Bubble Sort and Quick Sort and their Efficiency, Selection Sorting, Binary Tree Sort, Heap Sort, Insertion Sorts, Shell Sort, Address calculation Sort, Merge and Radix Sorts.

Graphs and Their Application: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Topological Ordering of nodes, Graph Traversal and Spanning Forests, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M.Tanenbaum, Prentice Hall Of India (2nd Edition)
2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill.

CS1205 DIGITAL LOGIC DESIGN

Course objectives

- To introduce the basic principles for design of combinational circuit and sequential circuits.
- To learn simple digital circuits in preparation for computer engineering.

Course Outcomes

A student who successfully fulfils the course requirements will have demonstrated:

- An ability to define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.
- An ability to understand the different Boolean algebra theorems and apply them for logic functions.
- An ability to define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions.
- An ability to define the following combinational circuits: multiplexer, de-multiplexers encoders/decoders, comparators, arithmetic-logic units; and to be able to build simple circuits.
- An ability to understand asynchronous and synchronous sequential circuits, like counters and shift registers.
- An ability to understand memories like RAM and ROM, Programmable Logic Array and Programmable Array Logic.

SYLLABUS

Binary Systems: Digital Systems. Binary Numbers. Number Base Conversions. Octal and Hexadecimal Numbers. Complements. Signed Binary Numbers. Binary Codes. Binary Storage and Registers. Binary Logic

Boolean Algebra and Logic Gates: Basic Definitions. Axiomatic Definition of Boolean Algebra. Basic Theorems and Properties of Boolean Algebra. Boolean Functions. Canonical and Standard Forms. Other Logic Operations. Digital Logic Gates. Integrated Circuits.

Combinational Logic Design, Gate-Level Minimization: The Map Method. Four Variable Map. Five-Variable Map. Product of Sums Simplification. Don't-Care Conditions. NAND and

NOR Implementation. Other Two- Level Implementations. Exclusive-OR Function. Hardware Description Language (HDL).

Combinational Logic: Combinational Circuits. Analysis Procedure. Design Procedure. Binary Adder Subtractor. Decimal Adder. Binary Multiplier. Magnitude Comparator. Decoders. Encoders. Multiplexers. HDL For Combinational Circuits.

Sequential Logic Design, Synchronous Sequential Logic: Sequential Circuits. Latches Flipflops. Analysis of Clocked Sequential Circuits. HDL For Sequential Circuits. State Reduction and Assignment. Design Procedure.

Registers ad Counters: Registers. Shift Registers. Ripple Counters. Synchronous Counters. Other Counters. HDL for Registers and Counters.

Memory and Programmable Logic: Introduction. Random-Access Memory. Memory Decoding, Error Detection and Correction. Read-Only Memory. Programmable Logic Array. Programmable Array Logic. Sequential Programmable Devices.

Text Book

1. DigitalDesign,3rdEdition, M. Morris Mano, Pearson Education.

Reference Books

1. Digital Logic Design Principles, Norman Balabanian & Bradley Carlson, John Wiley &Sons (Asia) Pvt.Ltd.,2002
2. Fundamentals of Digital Logic with VHDL Design, Stephen Brown and ZvonkoVranesic, TataMcGraw-HillEdition,2002.

CS1206 LINUX ADMINISTRATION LAB

Course Objectives

- To understand LINUX operating system and its internals.
- To understand LINUX file system structure and its operations.
- To understand LINUX shell environment and its programming.
- To understand communication in LINUX and the corresponding primitives.

Course Outcomes

- The student learns about LINUX features for multiuser, multitasking capabilities.
- The student learns about file system organization, file and directory manipulation, setting file permissions, and disk free space administration.
- The student learns about writing shell scripts for different applications.
- The student learns about how users communicate with each other in LINUX environment.

SYLLABUS

1) Study and practice on file system / handling files with commands, syntax, usage, application.
2) Practice on vi editor.
3) Study and practice on redirection operators with relevant commands, syntax, usage, application.
4) Study and practice on filters with relevant commands, syntax, usage, application.
5) Study and practice on Backup with relevant commands, syntax, usage, application.
6) Study and practice on internet related commands, syntax, usage, application.
7) Study and practice on shells/shell programming with relevant programming constructs, syntax, usage, application.
8) Study and practice on awk with relevant commands, syntax, usage, application.
9) Study and practice on regular expressions and the grep family with relevant commands, syntax, usage, application.
10) Study and practice on compilation process of C programs under UNIX.

References:

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Shell programming by Yashwanth Kanetkar.

CS1207 ENGINNERING PHYSICS LAB

Course Objectives

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyse various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and fibre optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes

- Ability to design and conduct experiments as well as to analyse and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray □o and Extraordinary □e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.

10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.

11. Carey Foster's Bridge – Verification of laws of Resistance and Determination of Specific Resistance.

12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.

13. Photoelectric cell-Characteristics.

14. Planks Constants.

15. Laser- Diffraction.

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CS1208 DATA STRUCTURES LAB

Course Objectives

- To implement stacks and queues using arrays and linked lists.
- To develop programs for searching and sorting algorithms.
- To write programs using concepts of various trees.
- To implement programs using graphs.

Course Outcomes

- Student will be able to write programs to implement stacks and queues.
- Ability to implement various searching and sorting techniques.
- Ability to implement programs using trees and graphs.

SYLLABUS

List of Programs:

1. Write a C program for sorting a list using Bubble sort and then apply binary search.
2. Write a C program for implementing the operations of a queue.
3. Write a C program to implement the operations on priority queues.
4. Write a C to implement the operations on circular queues.
5. Write a C program to implement the operations on stacks.
6. Write a C program for evaluating a given postfix expression using stack.
7. Write a C program for converting a given infix expression to postfix form using stack.
8. Write a C program to implement the operations on single linked list.
9. Write a C program for demonstrate operations on double linked list.
10. Write a C program for the representation of polynomials using circular linked list and for the addition of two such polynomials
11. Write a C program to create a binary search tree and for implementing the in order, Pre order, post order traversal using recursion
12. a) Write a C program for finding the transitive closure of a digraph
    b) Write a C program for finding the shortest path from a given source to any vertex in a digraph using Dijkstra's algorithm.
13. a) Write a C program for finding the Depth First Search of a graph.
    b) Write a C program for finding the Breadth First Search of a graph

References:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M.Tanenbaum, Prentice Hall Of India (2nd Edition)

2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill.

B.Tech & B.Tech + M.Tech
(Computer Science & Engineering)
II Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS2101	ES	Discrete Mathematical Structures	4	0	30	70	100	3
CS2102	PC	Computer Organization and Architecture	4	0	30	70	100	3
CS2103	BS	Probability, Statistics and Queuing theory	4	0	30	70	100	3
CS2104	PC	Operating Systems	4	0	30	70	100	3
CS2105	PC	Object Oriented Programming Through Java	4	0	30	70	100	3
CS2106	PC	Computer Organization & Architecture Lab	0	3	30	70	100	1.5
CS2107	PC	Object Oriented Programming Through Java Lab	0	3	50	50	100	1.5
CS2108	PC	Operating Systems Lab	0	3	50	50	100	1.5
CS2109	SC	Intellectual Property Rights (Internal)	1	2	100	0	100	2
CS2110	MC	Environmental Science	0	0	-	100	100	0
Total credits								**21.5**

CS2101 DISCRETE MATHEMATICAL STRUCTURES

Course Objectives

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic and truth tables.
- To understand about permutations and combinations.
- To understand various types of relations and discuss various properties of the relations.
- To study the graphs, graph isomorphism and spanning trees.
- To study about Boolean algebra and Finite State Machines.

Course Outcomes

At the end of the course student will be able to

- Rewrite mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic.
- Identify and give examples of various types of relations and describe various properties of the relations.
- Ability to solve problems using permutations and combinations.
- Determine isomorphism of graphs and spanning tree of a given graph using BFS/DFS algorithms. Also determine minimal spanning tree of a given graph.

SYLLABUS

The Foundations-Logic and Proofs: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers Rules of Inference, Introduction to Proofs, Proof Methods and Strategy, Basic Structures-Sets, Functions, Sequences and Sums: Sets, Set Operations, Functions, Sequences and Summations.

The Fundamentals-Algorithms, the Integers and Matrices: Algorithms, The Growth of Functions, Complexity of Algorithms, The Integers and Division, Primes and Greatest Common Devisors, Integers and Algorithms, Applications of Number Theory, Matrices.

Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness.

Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recursion Relations, Generating Functions, Inclusion-Exclusion, and Applications of Inclusion-Exclusion.

Relations: Relations and their properties, n-ary relations, applications, Representation, closure, equivalence relations, Partial orderings.

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

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees,

Boolean Algebra: Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits

Modelling Computation: Languages and Grammars, Finite-State Machines with Output, Finite-State Machines with No Output, Language Recognition, Turing Machines.

Text Book

1. Discrete Mathematics & Its Applications with Combinatorics and Graph Theory by Kenneth H Rosen, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Reference Books

1. Discrete Mathematics for Computer Scientists & Mathematicians by Joe L. Mott, Abraham Kandel, Theodore P. Baker, Prentice-Hall, India.
2. Discrete Mathematics by Richard Johnson Baug, Pearson Education, New Delhi.
3. Discrete and Combinatorial Mathematics by Ralph. G. Grimaldi, Pearson Education, New Delhi.

CS2102 COMPUTER ORGANIZATION AND ARCHITECTURE

Course Objectives

- To study about structure and functional components of a computer.
- Understanding the hierarchical organization of a computer system which consists of instruction set of commands.
- Learn about the architecture of a computer from a programming view.
- To design a balance system that minimizes performance and utilization of all elements.

Course Outcomes

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

- Demonstrate knowledge about major components of a computer such as processor, memory and I/O modules along with their interconnections internally with outside world.
- have detailed idea about architecture of central processing unit, functions of control unit, memory, I/O devices and their issues.
- Understand simple and multiple processor organization and their issues.

SYLLABUS

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control,

Reduced Instruction Set Computer (RISC), Architecture and Programming of 8085 Microprocessor

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISK Pipeline, Vector Processing, Array Processors.

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept.2008.
2. Computer Architecture and Organization, P.Chakraborty.
3. Microprocessor Architecture, Programming and Applications with the 8085by Ramesh S Gaonkar

Reference Books

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN81- 7319-609-5
3. Computer System Architecture", John. P.Hayes.

CS2103 PROBABILITY, STATISTICS AND QUEUING THEORY

Course objectives

- To provide foundations of probabilistic and statistical analysis
- To provide an understanding on concepts of probability, random variables, probability distributions, sampling, estimation, hypothesis testing, regression, correlation, multiple regression, hypothesis testing, sample test, queuing methods
- To explore applications of probabilistic and statistical tools to solve real world problems.

Course outcomes

After completion of the course the student should be able to:

- Define and explain basic concepts in probability theory and how to translate real-world problems into probability models
- Solve standard problems that include random variables, discrete and continuous probability distributions
- Perform Test of Hypothesis and construct a confidence interval to estimate population parameters
- Compute and interpret the results of Correlation Analysis, Multivariate Regression, Chi-Square test for Independence and Goodness of Fit
- Explain basic concepts in Markov processes, M/M/1 and M/M/C queueing systems.

SYLLABUS

Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes Theorem of Probability and Geometric Probability.

Random variables and their properties: Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability Distributions their Properties, Transformation Variables, Mathematical Expectations, Probability Generating Functions.

Probability Distributions: Discrete Distributions: Binomial, Poisson Negative Binominal Distributions and Their Properties; **Continuous Distributions:** Uniform, Normal, Exponential Distributions And Their Properties.

Multivariate Analysis: Correlation, Correlation Coefficient, Rank Correlation, Regression Analysis, Multiple Regression, Attributes, Coefficient Of Association, Chi Square Test For Goodness Of Fit, Test For Independence.

Estimation: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un- biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.

Testing of Hypothesis: Formulation of Null hypothesis, critic al region, level of significance, power of the test;

Sample Tests: Small Sample Tests: Testing equality of means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient; Large Sample tests: Tests based on normal distribution

Queuing Theory: Queue description, characteristics of a queuing model, study state solutions of M/M/1: Model, M/M/1; N Model, M/M/C: Model, M/M/C: N Model, Case studies.

Text Books

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.
2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw – Hill

Reference Book

1. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

CS2104 OPERATING SYSTEMS

Course objectives:

- To understand evolution of Operating System.
- To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.
- To learn design and implementation of policies and mechanisms for OS subsystem.
- To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system.

Course Outcomes:

- The student understands OS evolution, its structure and services provided by it.
- Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization, inter process communication, deadlocks and other process subsystem related concepts.
- Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory, file system design and implementation issues.
- investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies.

SYLLABUS

Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple-Processor Scheduling, Thread Scheduling.

Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks.

Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files.

File Systems, Implementation, and Secondary-storage Structure: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

Case study: Overview of LINUX, Windows Operating systems.

Text Book:

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, John Wiley Publ., Seventh Edition.
2. Operating Systems; A Practical Approach. Rajiv Chopra.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, ,2nd edition, 1995, PHI.
2. Operating Systems, William Stallings 5th Edition -PHI
3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co.,1998 edition.

CS2105 OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives:

- This subject will help to improve the analytical skills of object-oriented programming
- Overall development of problem solving and critical analysis
- Formal introduction to Java programming language

Course Outcome:

On successful completion of this course, the student should be able to:

- Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard
- Understand the basic principles of the object-oriented programming
- Demonstrate an introductory understanding of graphical user interfaces, multi- threaded programming, and event-driven programming.

SYLLABUS

Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference

Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing

I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

Java Database Connectivity (JDBC): JDBC Product, Types of Drivers, Two-Tier Client/Server Model, Three-Tier Client/Server Model, Basic Steps of JDBC, Creating and Executing SQL Statement, The Result Set Object, Working with Database MetaData Interface

Reference Books:

1 Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.

2 Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

3 Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.

4 Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.

5 The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.

6 Java Programming, D. S. Malik, Cengage Learning.

CS2106 COMPUTER ORGANIZATION & ARCHITECTURE LAB

SCourse Objectives

- to design and analyse the operational behaviour of IC gates, multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU.
- to implement assembly language programming using various trainers.
- to make students familiar with Pentium class PC architecture.

Course Outcomes

After completion of the course the student should be able to:

- analyse the operational behaviour of various digital logic units such as multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU.
- write assembly language code using various trainers.
- understand Pentium class PC architecture.

SYLLABUS

I - Cycle: Digital Logic Design Experiments

TTL Characteristics and TTL IC Gates

Multiplexers & Decoders

Flip-Flops

Counters

Shift Registers

Binary Adders & Subtractors

A L U

II - CYCLE: 8085 Assembly Language Programming

8085 Assembly Language Programming according to theory course microprocessors-I using the following trainers:

Keyboard Monitor of 8085µP Trainer

Serial Monitor of 8085µP Trainer with Terminal

8085 Line Assembler of 8085μP Trainer with PC as Terminal

8085 Cross Assembler using In-Circuit Emulator (ICE) with 8085μP Trainer and PC as Terminal

Graded Problems are to be used according to the syllabus of computer organization Pentium class pc architecture familiarization hardware & software parts demonstration

Reference Books

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept.2008
2. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S
   Gaonkar.

CS2107 OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

Course Objectives:

- To develop programs using basic OOPS concepts such as classes and objects.
- To implement programs using Inheritance concepts.
- To implement programs using Exception handling.
- To develop programs using operator overloading concepts.

Course Outcomes:

- Student will be able to use OOPs concepts.
- Ability to apply Inheritance concepts to several problems.
- Ability to use Exception Handling concepts.

List of Programs:

1. Program to define a structure of a basic JAVA program
2. Program to define the data types, variable, operators, arrays and control structures.
3. Program to define class and constructors. Demonstrate constructors.
4. Program to define class, methods and objects. Demonstrate method overloading.
5. Program to define inheritance and show method overriding.
6. Program to demonstrate Packages.
7. Program to demonstrate Exception Handling.
8. Program to demonstrate Multithreading.
9. Program to demonstrate I/O operations.
10. Program to demonstrate Network Programming.
11. Program to demonstrate Applet structure and event handling.
12. Program to demonstrate Layout managers.

CS2108 OPERATING SYSTEMS LAB

Course Objectives:

- To learn about UNIX/LINUX operating system environment.
- To learn about system calls for UNIX/LINUX Operating System.
- To understand resource management policies and mechanisms and their performance evaluation.

Course Outcomes:

- The student learns about multiprogramming, and multitasking capabilities of UNIX/LINUX.
- The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
- The student learns to simulate OS resource management aspects like process scheduling, page replacement, disk scheduling, free space management and others to evaluate performance.

Syllabus

Module I

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple shell programming exercises
3. Shell programming using decision making constructs, loop constructs, file and directory manipulation
4. Simple C programs using command line arguments, system calls, library function calls, make utility
5. C programs using system call to create processes and study parent, child process mechanism
6. C programs to create process chaining, spawning
7. C programs to error handling using errno(), perror() function
8. C programs to use pipe system call for inter process communication

Module II

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms
2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms
3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management (first fit, best fit, worst fit).
5. C programs to study disk scheduling algorithms (i.e., SCAN, SSTF, LOOK, etc.,)

References:

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Unix programming by Stevens, Pearson Education.
3. Shell programming by Yashwanth Kanetkar.
4. Operating System Concepts by Silberschatz, and Peter Galvin.

CS2109 INTELLECTUAL PROPERTY RIGHTS

Course Objective:

- To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes
- To create consciousness on IPR in students at an early stage of their education so that they develop an appreciation for ethical and rightful use of existing knowledge
- To make them understand how to take ownership of knowledge they may develop as a result of their creative innovations, take ownership and either drive themselves in becoming entrepreneurs or become responsible knowledge users in society
- To expose students some of the recent debates on the societal implications of IPR and its role in national/international trade and socio-economic development.

Course outcome:

Learners will be able to

- identify the types of intellectual property protection available for their research outcome
- conduct patent search and analyse patentability of the invention
- understand the basic structure of Patent document
- understand the registration and prosecution of different IPs
- understand the basics of IP commercialization and techno/commercial/legal issues in IPR commercialization

SYLLABUS

Introduction: Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, Promotion of social good, Prevention of duplicates, counterfeit products and IP.

Evolution of IP system: Historical view of IP system in India and abroad, Legal basis and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO.

Types of IPR: Major forms of IP in India and globally, Acts enacted in India related to IP.

Patent: Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non-obviousness, and utility, Non-patentable inventions.

Patent filing and prosecution: Prior art search, Process of obtaining a patent in India, Provisional and complete specification, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement and Enforcement.

Trademark: Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement.

Copyright: Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act.

Industrial Design: What is Industrial design, Design registration, Design infringement.

Trade Secret: What are Trade Secrets, How trade secrets are maintained in trade and business.

Other forms of IP: Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge.

IP commercialization: Licensing & Royalty; Technology Transfer; IP assignment, Compulsory License.

Emerging areas: Pat informatics, IP and bank loan, IP insurance, IP audit, IP valuation, IP management, Use of artificial intelligence in IP enforcement, Open innovation.

Text Books

1. Ganguli Prabuddha, Gearing up for Patents The Indian Scenario", Universities Press (1998)
2. Ganguli Prahuddha "Intellectual Property Rights-Unleashing the Knowledge Economy". Tata McGraw Hill (2001)
3. Geographical Indications of Goods Act 1990 Ganguli Piabaddha "Geographical Indications-its evolving contours accessible in http ips. nminsoda/files/2012/05/main book pdf (2009)

Reference Books

1. Ganguli Prabuddha and Jahade Siddharth, "Nanotechnology Intellectual Property Rights Research, Design, and Commercialisation", CRC Press, Taylor and Francis Group, USA (2012)
2. Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities [Paperback J,Darrell A. Posey and Graham Dotfield, IDRC Books; annotated edition (June (1996)
3. Netancl Neil Weinstock, Copyright's Paradox, Oxford University Press (2010)
4. The Indian Patents Act 1970 (as amended in 2005)
5. The Indian Copyright Act 1950 as amended in 2017)
6. Indian Trademarks Act 1999
7. The Indian Industrial Designs Act 2000
8. The Protection of Plant Varieties and Farmers' Right Act 2001
9. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPO publication No 917 www.wipo.int/ebookshop
10. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPO publication No.498 www.wipo.int/ebookshop

CS2110 ENVIRONMENTAL SCIENCE

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavours after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems. Salient features of international conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar

Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide- watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams: benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy:

Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha,Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., &Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

B.Tech & B.Tech + M.Tech
(Computer Science & Engineering)
II Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS2201	ES	Microprocessors	4	0	30	70	100	3
CS2202	PC	Design and Analysis of Algorithms	4	0	30	70	100	3
CS2203	PC	Database Management Systems	4	0	30	70	100	3
CS2204	PC	Formal Languages & Automata Theory	4	0	30	70	100	3
CS2205	HSS	Managerial Economics	4	0	30	70	100	3
CS2206	PC	Algorithms Lab through CPP.	0	3	50	50	100	1.5
CS2207	PC	Database Management Systems Lab	0	3	50	50	100	1.5
CS2208	SC	Web Technologies	1	2	50	50	100	2
CS2209	MC	Professional Ethics& Universal Human Values	0	0	0	100	100	0
CS2210	MC	NCC/NSS	0	2	-	-	-	0
							Total credits	**20**
Internship-I								

CS2201 MICROPROCESSORS

Course Objectives:

- To discuss the architectures of 8085, 8086 microprocessors, their instruction sets and related ALP programs.
- To discuss interfacing semiconductor memories, interfacing peripheral to Intel 8086.
- To study interfacing data converters to 8086 and discuss about micro controller 8051 architecture.

Course Outcomes:

- Understand the basic architectures of 8085 and 8086 microprocessors.
- Ability to write ALP programs using instruction sets.
- Understand the various interfacing concepts and micro controllers.

SYLLABUS

Introduction to Microprocessors and Microcomputers: A Brief Architecture and Programming of 8085Microprocessor.

Architecture: Instruction Set and Programming of 8086Microprocessor

Interfacing Semiconductor Memories and I/O Devices: Semiconductor Memories: Classification Internal Organization& Functional Description, Interfacing SRAMs and EPROMs to8086, Interfacing Characteristics of I/Devices, I/O Device addressing methods, I/O Device Programming Methods.

Interfacing Peripherals to Intel8086 -1: Parallel I/O Interface- 8255, Serial I/O Interface – 8251, Timer Interface -8253/8254

Interfacing Peripheral to Intel 8086 - 2: Keyboard / Display Interface – 8279, Interrupt Controller Interface – 8259

Interfacing Data Converters to 8086: D/A Conversion Methods, A/D Conversion methods, Interfacing DAC, Interfacing ADC.

Introduction to Micro controllers: Intel 8051Architecture and Programming

Text Books:

1. Microprocessor Architecture, Programming, and Applications with the 8085 Ramesh S.Gaonkar, 4thEdition, PenramInternational,1999
2. The 80x86 Family, Design, Programming and Interfacing, John E.Uffenbeck, 3rdEdition,Pearson Education Inc.,2002
3. KennethJ.Ayala, 8051 Microcontroller Architecture, Programming And Applications, 2ndEdition, Penram InternationalPublications,1999

Reference Books:

1. BARRYB.BREY, The Intel Microprocessors 8086 / 8088, 80186 / 80188, 80286, 80386 and 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium4, Architecture, Programming and Interfacing, 8th Edition, Pearson Education Inc.,2009
2. Walter A. Tribeland, Avtar Singh, The 8088 and 8086 Microprocessors, Programming, interfacing, Software, Hardware, and Applications, 4thEdition, Pearson Education Inc.,20033. Microprocessors and Interfacing, Programming and Hardware, 2ndEdition, Douglass V. Hall, TMH Edition,1999
3. Sanjay K Bose, Hardware and Software of Personal Computers, New Age International (P)Ltd.,1991 Myke Predko, Programming and Customizing the 8051 Microcontroller, TMH,1999

CS2202 DESIGN AND ANALYSIS OF ALGORITHMS

Course Objectives:

Upon completion of this course, students will be able to do the following:

- Analyse the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations

Course Outcomes:

Students who complete the course will have demonstrated the ability to do the following:

- Argue the correctness of algorithms using inductive proofs and invariants.
- Analysis worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and conquer algorithms. Derive and solve recurrences describing the performance of divide and-conquer algorithms.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic programming algorithms, and analysis them.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analysis them.

SYLLABUS

Introduction: What is an Algorithm, Algorithm Specification, Pseudocode Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Amortized Complexity, Amortized Complexity, Asymptotic Notation, Practical Complexities, Performance Measurement.

Divide and Conquer: General Method, Defective Chessboard, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Performance Measurement, Randomized Sorting Algorithms.

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-cost Spanning Trees, Prim's Algorithm, Kruskal's Algorithms, An Optimal Randomized Algorithm, Optimal Merge Patterns, Single Source Shortest Paths.

Dynamic Programming: All - Pairs Shortest Paths, Multistage graphs, optimal binary search tree, String editing, 0/1 Knapsack, Reliability Design.

Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Colouring, Hamiltonian Cycles, Knapsack problem

Branch and Bound: Least cost (LC) Search, The 15-Puzzle, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack Problem, LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson problem.

Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP and NP – complete problems – Challenges of Numerical Algorithms. Limitations of Algorithms Power: Backtracking – Branch-and Bound– Approximation Algorithms for NP-hard Problems – Algorithms for solving Nonlinear Equations.

Text Books:

1. Fundamentals of computer algorithms E. Horowitz S. Sahni, Sanguthevar Rajasekaran, University Press.
2. Introduction to Algorithms by Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest & Clifford Stein, Prentice Hall of India, New Delhi, New Delhi.

Reference Books:

1. Data structures and algorithm analysis in C++ / Mark Allen Weiss, Florida International University. — Fourth edition.
2. Introduction to Design & Analysis of Algorithms by Anany Levitin, Pearson Education, New Delhi, 2003
3. Introduction to Algorithms by Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest & Clifford Stein, Prentice Hall of India, New Delhi, New Delhi.
4. The Design and Analysis of Computer Algorithms, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman

CS2203 DATABASE MANAGEMENT SYSTEMS

Course Objectives:

- To learn the evolution of DBMS Versus File systems, data models, and layers of abstraction.
- To understand conceptual and physical aspects of database design.
- To learn formal and commercial query language specifications.
- To understand concurrency control, recovery management, and other related issues.

Course Outcomes:

- The student will understand ER-modelling for conceptual database design and relational model.
- The student is introduced to formal and commercial query languages: Relational Algebra, calculus and SQL.
- The student will learn schema refinement and normalization.
- The student understands locking protocols concurrency control, and crash recovery methods.

SYLLABUS

Introduction: File system versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, The Relational model, Levels of abstraction, Data Independence, Transaction management, Structure of a DBMS.

Introduction to Database Design and The Relational Model: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships & Relationship Sets, Additional Features of the ER Model, Conceptual Design with ER Model, Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/ Altering Tables and Views.

Relational Algebra and SQL: Preliminaries, Relational Algebra, The form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Embedded SQL, Dynamic SQL, JDBC.

Database Design: Schema Refinement and Normal Forms, Introduction to Schema Refinement, Functional Dependencies, Reasoning about FD's, Normal Forms, Properties of Decomposition, Normalization, Other kinds of Dependencies.

Transaction Management: The ACID Properties, Transactions & Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.

Crash Recovery: Introduction to ARIES, The Log, Other Recovery-Related Structures, The Write-Ahead Log Protocol, Check pointing, Recovering from a System Crash, Media Recovery.

Text Books:

1. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke 4th Edition, McGraw-Hill.

Reference:

1. Database System Concepts; A. Silberschatz, H. Korth 5th Edition, McGraw-Hill

CS2204 FORMAL LANGUAGES AND AUTOMATA THEORY

Course objectives:

- To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.
- To employ finite state machines to solve problems in computing.
- To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.
- To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences.

Course outcomes:

- Ability to think analytically and intuitively for problem-solving situations in related areas of theory in computer science
- Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;
- Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

Introduction to Grammars and Languages: Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages, Chomsky Hierarchy of languages.

Finite State Machine (FSM): Definition of finite state machine, Representation of FSMs. Classification of FSM's and their construction, Conversion from NFA to DFA, Elimination of ε – transitions from NFA, Equivalence of two FSM's, optimization of finite state machine (Equivalence theorem method and Table filling method), Finite state machine with output: Moore and Mealy machines. Applications of FSM.

Regular Expression and Languages: Regular Expression, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages: Pumping Lemma for regular Languages, Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, Equivalence and Minimization of Automata.

Context Free Grammars and Languages: Context Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages, Normal Forms, Pumping Lemma for CFL, Closure properties of CFL, Decision properties for CFL.

Push down Automata: Definition of push down automata, The Languages of a PDA, push down automata, Equivalence of PDA's and CFG's, push down automata to context free grammar, context free grammar to push down automata, Deterministic Pushdown Automata.

Turing Machines: The Definition of Turing Machine, Turing Machine Model, Representation of Turing Machines, Language Acceptability by Turing Machines, Design of Turing Machines, Description of Turing Machines, Techniques for TM Construction, Variants of Turing Machines, Turing Machines and Type 0 Grammars.

Undecidability: A Language That Is Not Recursively Enumerable, An Undecidable Problem That Is RE, Undecidable Problems About Turing Machines, Decidable & Undecidable Problems, Post Correspondence Problem.

Text books:

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani & JD Ullman—pearson education- III edition
2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books:

1. Theory of computation, formal languages and automata theory, G P Saradhi Varma, B.Thirupathi Rao –Sci Tech publications.

CS2205 MANAGERIAL ECONOMICS

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

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

- Understand the various economic activities in business and industry.
- Analyse the real-world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Micro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis:

Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity

(Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making; **Cost analysis** - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures: Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles:

Pricing Analysis: Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

CS2206 ALGORITHMS LAB Through C++

Course objectives:

- The laboratory component will emphasize two areas:
- Implementation of algorithms covered in class: This will involve running the algorithms under varying input sets and measuring running times, use of different data structures for the same algorithm (wherever applicable) to see its effect on time and space, comparison of different algorithms for the same problem etc.
- Design of Algorithms: This will involve design and implementation of algorithms for problems not covered in class but related to topics covered in class.
- The exact set of algorithms to design and implement is to be decided by the instructor. In addition, there will be at least one significantly large design project involving some real world application. An efficient design of the project should require the use of multiple data structures and a combination of different algorithms/techniques.

Course Outcomes:

The student should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such assorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

Programs List:

1. a) Create a CPP class called Student with the following details as variables within it.

   (i) Register_number

   (ii) Student_name

   (iii) Programme_name

   (iv) Phone _number

   Write a program to create nStudent objects and print the Register_number, Student_name, Programme_name, and Phone_number of these objects with suitable headings.

   b). Write a program to implement the Stack using arrays. Write Push (), Pop(), and Display() methods to demonstrate its working.

2. a). Design a superclass called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a CPP program to read and display at least 3 staff objects of all three categories.

b). Write a class called Customer to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as and display as using StringTokenizer class considering the delimiter character as "/".

3. a). Write a program to read two integers a andb. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.

b). Write a program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.

4. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using CPP how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

5. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using CPP how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

6. Implement the Knapsack problem using (a) Dynamic Programming method (b) Greedy method.

7. Write a program-from a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm..

8. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.

9. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.

10. Write programs to

(a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.

(b) Implement Travelling Sales Person problem using Dynamic programming.

11. Design and implement in CPP, to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.

12. Design and implement in CPP to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

REFERENCES:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
2. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins.
4. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press.
5. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley.
6. R. Sedgewick, Algorithms in C (Parts 1-5), Addison Wesley.
7. M. H. Alsuwaiyel, Algorithm Design Techniques and Analysis, World Scientific.
8. Gilles Brassard and Paul Bratley, Algorithmics: theory and practice, Prentice-Hall.
9. Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley.
10. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Addison-Wesley.

CS2207 DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives

- To introduce to a commercial DBMS such as ORACLE.
- To learn and practice SQL commands for schema creation, data manipulation.
- To learn conceptual and physical database design based on a case study.
- To apply database design stages by studying a case study.

Course Outcomes

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

- The student is exposed to a commercial RDBMS environment such as ORACLE.
- The student will learn SQL commands for data definition and manipulation.
- The student understands conceptual through physical data base design.
- The student takes up a case study and applies the design steps.

SYLLABUS

Features of a commercial RDBMS package such as ORACLE/DB2, MS Access, MYSQL & Structured Query Language (SQL) used with the RDBMS.

I. Laboratory Exercises Should Include:

a. Defining Schemas for Applications,
b. Creation of Database,
c. Writing SQL Queries,
d. Retrieve Information from Database,
e. Creating Views
f. Creating Triggers
g. Normalization up to Third Normal Form
h. Use of Host Languages,
i. Interface with Embedded SQL,
j. Use of Forms
k. Report Writing

II. Some sample applications are given below:

1. Accounting Package for Shops,

2. Database Manager for Magazine Agency or Newspaper Agency,
3. Ticket Booking for Performances,
4. Preparing Greeting Cards & Birthday Cards
5. Personal Accounts - Insurance, Loans, Mortgage Payments, Etc.,
6. Doctor's Diary & Billing System
7. Personal Bank Account
8. Class Marks Management
9. Hostel Accounting
10. Video Tape Library,
11. History of Cricket Scores,
12. Cable TV Transmission Program Manager,
13. Personal Library.
14. Sailors Database
15. Suppliers and Parts Database

Reference Books

1. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke 4th Edition, McGraw Hill
2. Database System Concepts; A. Silberschatz, H. Korth 5th Edition, McGraw-Hill

CS2208 ` WEB TECHONOLOGIES

Course objectives

- To facilitate the graduates with the ability to visualize, gather information, articulate, analyze, solve complex problems, and make decisions. These are essential to address the challenges of complex and computation intensive problems increasing their productivity.
- To facilitate the graduates with the technical skills that prepare them for immediate employment and pursue certification providing a deeper understanding of the technology in advanced areas of computer science and related fields, thus encouraging to pursue higher education and research based on their interest.
- To facilitate the graduates with the soft skills that include fulfilling the mission, setting goals, showing self-confidence by communicating effectively, having a positive attitude, get involved in team-work, being a leader, managing their career and their life.

Course outcomes

- Able to understand the working principles of the computer system and its components, apply the knowledge to build, asses, and analyze the software and hardware aspects of it.
- Develops comprehensive skills of Programming Languages, Software process models, methodologies, and able to plan, develop, test, analyze, and manage the software and hardware intensive systems in heterogeneous platforms individually or working in teams.
- Able to use the professional, managerial, interdisciplinary skill set, and domain specific tools in development processes, identify the research gaps, and provide innovative solutions to them.

Syllabus

1. Design the following static web pages required for an online book store web site.
   a) HOME PAGE: The static home page must contain three frames.
   b) LOGIN PAGE
   c) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table.
   d) REGISTRATION PAGE
2. Write JavaScript to validate the following fields of the Registration page.
   a) First Name (Name should contains alphabets and the length should not be less than 6 characters).
   b) Password (Password should not be less than 6 characters length).
   c) E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)

d) Mobile Number (Phone number should contain 10 digits only).
e) Last Name and Address (should not be Empty).

3. Develop and demonstrate the usage of inline, internal and external style sheet using CSS
4. Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:

   a) Input: Click on Display Date button using onclick( ) function

   Output: Display date in the textbox

   b) Input: A number n obtained using prompt

   Output: Factorial of n number using alert

   c) Input: A number n obtained using prompt

   Output: A multiplication table of numbers from 1 to 10 of n using alert

   d) Input: A number n obtained using prompt and add another number using confirm

   Output: Sum of the entire n numbers using alert

5. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (colour, bold and font size).
6. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
7. Develop and demonstrate PHP Script for the following problems:
   a) Write a PHP Script to find out the Sum of the Individual Digits.
   b) Write a PHP Script to check whether the given number is Palindrome or not
8. Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.
9. Implement the following web applications using (a) PHP (b) Servlets (c) JSP
   a) A web application that takes a name as input and on submit it shows a hello page where name is taken from the request. It shows the start time at the right top corner of the page and provides a logout button. On clicking this button, it should show a logout page with Thank You message with the duration of usage (hint: Use session to store name and time).
   b) Write a PHP Program to display current Date, Time and Day.
   c) A web application that takes name and age from an HTML page. If the age is less than 18, it should send a page with “Hello, you are not authorized to visit the site” message, where should be replaced with the entered name. Otherwise, it should send “Welcome to this site” message.
   d) A web application that lists all cookies stored in the browser on clicking “List Cookies” button. Add cookies if necessary.
10. Implement the web applications with Database using (a) PHP, (b) Servlets and (c) JSP.
11. Modify the above PHP program to use an xml instead of database

12. Write a program to design a simple calculator using
    (a) JavaScript
    (b) PHP
    (c) Servlet and
    (d) JSP.

References:

1. Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill.

2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education.

CS2209 PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Course Objectives:

- To recognize the moral values that should guide the Engineering profession.
- To resolve moral issues concerning one's profession.
- To develop and exhibit a set of moral beliefs and attitudes that engineers should inculcate.
- To inculcate social values and morality in one's life.
- To develop awareness about Professional/Engineering Ethics and Human Values.

Learning Outcomes:

Students will be able to:

- Apply the conceptual understanding of ethics and values into everyday practice.
- Understand the importance of moral awareness and reasoning in life.
- Acquire professional and moral etiquette that an engineer requires.
- Develop the acumen for self-awareness and self-development.
- Develop cultural tolerance and integrity.
- Tackle real-life challenges with empathy.

SYLLABUS

HUMAN VALUES
Values - Respect - Caring - Sharing - Honesty- Courage - Self confidence - Communal Harmony
Morals - Virtues

PROFESSIONAL VALUES
Integrity - Discipline - Valuing time - Cooperation - Commitment - Code of conduct - Challenges in the workplace

PROFESSIONAL ETHICS
Overview - Engineering ethics - Moral issues - Profession - Models of professional roles - Responsibility

RESPONSIBILITIES AND RIGHTS
Safety and risk - Collegiality and loyalty - Confidentiality - Occupational crime - Human rights - Employee rights - Intellectual property rights

GLOBAL ISSUES
Globalization - Environmental ethics - Computer ethics - Code of ethics - Multinational corporations - Engineers as advisors in Planning and Policy making

Textbook:
1. R.S. Nagarazan. *A Textbook on Professional Ethics and Human Values.* New Age International Publishers. 2006.

Reference Books:

1. Premvir Kapoor. *Professional Ethics and Human Values.* Khanna Publishing House. 2019.
2. B.S. Raghavan. *Human Values and Professional Ethics*. S.Chand Publications. 2012.
3. R.R. Gaur & Others. *A Foundation Course in Human Values and Proff. Ethics*. Excel Books. 2009.
4. A. N. Tripathi. *Human Values*. New Age International (P) Limited. 2009
5. R. Subramanian. *Professional Ethics*. OUP India. 2013.

SCHEME & SYLLABUS For All Semesters
(With effect from 2022-23 Admitted Batch)

B.Tech & B.Tech + M.Tech
(Computer Science and Engineering)

Department of Computer Science & Systems Engineering

Andhra University College of Engineering (A)

Andhra University

Guidelines for Obtaining MINOR in Computer Science Engineering:

Students belonging to other departments have to complete the following courses to obtain MINOR degree in Computer Science & Engineering:

1. A student belonging to other department have to study CPNM and Python Programming as Compulsory courses and any two of the following 4 open electives as follows:

   OE I: Artificial Intelligence & Machine Learning

   OE II: Data Science

   OE III: Cyber Security and Digital Forensics

   OE IV: Database Management System

   OR

   One or two MOOCS courses from NPTEL related to Computer Science Engineering without repetition from subjects within the curriculum can be used in Lieu of any of the above Open electives.
2. The duration of NPTEL courses should **NOT** be less than 12 weeks.
3. The MOOCS course(s) chosen by students of other departments for obtaining a MINOR in CSE should be taken prior permission/ approval from the Chairperson – BoS of the department of **CS & SE, AUCE(A)**.

Guidelines for Obtaining HONORS in Computer Science Engineering:

1. The student shall earn additional 15 credits beyond 160 credits from the same branch/ department/ discipline registered for major degree.
   (i) The students having 7.0 CGPA without any backlog subjects will be permitted to register for HONORS.
   (ii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
   (iii) Honors is to be completed simultaneously with B. Tech program.

To obtain Honors in CSE the following subjects are to be taken for obtaining Honors:

1) Large Language Model & Prompt Engineering
2) Reinforcement Learning
3) High Performance Computing
4) Social Media Analytics
5) Software Metrics
6) MOOCs for 3 credits of 12 weeks duration related to any one of the above courses. MOOCs may be treated as optional to obtain Honors degree in CSE. If a student completes MOOCs with good grade, then it may be considered as betterment for any of the above five Courses (1 to 5)

The above five courses and MOOCs may be completed or pursued during 3rd and 4th years of his/her study of B.Tech, B.Tech + M.Tech program

(With effect from 2022-23 AB)
B. Tech & B. Tech + M. Tech
(Computer Science and Engineering)
III year - I semester

Course Code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS3101	PC	Data Communications & Computer Networks	4	0	30	70	100	3
CS3102	PC	Artificial Intelligence	4	0	30	70	100	3
CS3103	PC	Compiler Design	4	0	30	70	100	3
CS3104	PE	Professional Electives - I	4	0	30	70	100	3
CS3105	OE	Open Electives - I	4	0	30	70	100	3
CS3106	PC	Data Communications & Computer Networks Lab	0	3	50	50	100	1.5
CS3107	PC	Python Programming Lab	0	3	50	50	100	1.5
CS3108	SC	Soft Skills	1	2	50	50	100	2
CS3109	INT	Internship - I	0	0	50	50	100	2
Summer Internship 2 Months (Mandatory) after 2nd year (to be evaluated during III year I semester)								
Total Credits								**22**

CS3101 DATA COMMUNICATIONS & COMPUTER NETWORKS

Course Objectives:

- To study basics of data communication systems.
- To study the various types of transmission media.
- To study the various hardware concepts related to data communications.
- To make the students understanding of basic requirements of network hardware, software and its architecture.

Course Outcomes:

- Ability to understand concepts related to data communication hardware and its interface.
- Ability to understand concepts related to Signal encoding techniques and multiplexing.
- The student must be able to understand the concepts related to MAC sub layer.
- Understand the concepts related to network and transport layer.

SYLLABUS:

Introduction to Data Communications: A Communications Model, Network Models(OSI, TCP/IP models), Analog and Digital Data Transmission, Transmission Impairments.

Data Communication Interface: Asynchronous and Synchronous Transmission. Data Link Control Flow Control, Error Detection, Error Control, High-Level Data Link Control (HDLC).

Signal Encoding Techniques: Digital data to Digital signal, Digital to Analog Signal, Analog data to Digital Signal, and Analog Data to Analog signal.

Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing: Characteristics, Digital Carrier Systems Statistical Time-Division Multiplexing: Characteristics.

Medium Access Control Sublayer: Wireless LAN's:802.11Architecture and Protocol Stack, 802.11Frame structure.

Network Layer: Network Layer Design Issues, Shortest path routing algorithm, Congestion Control Algorithms, IP Protocol, IP Address.

Transport layer: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Simple Network Management Protocol (SNMP).

Text Books:

1. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw-Hill Co Ltd, Second Edition, ISBN: 0-07-049935-7

2. Computer Networks, Andrews S Tanenbaum, 5th Edition, Pearson Edu.

References:

1. Data and Computer Communications, Eighth Edition, William Stallings, Pearson Education, Inc.

CS3102 ARTIFICIAL INTELLIGENCE

Course Objectives:

- To learn about AI problems, techniques and their modelling as state space search, problem characteristics, Production System categories.
- To learn different uninformed and heuristic search strategies for solving AI problems with examples
- To learn theorem proving with predicate logic, resolution, rulebased inference with forward and backward chaining
- Inheritable knowledge representation using slot-filler structures and dealing with different forms of uncertain and implicit knowledge
- To introduce essential concepts of plan generation, Natural Language understanding and Expert Systems.

Course Outcomes:

- By the end of the course the student understands, applies, evaluates and creates AI solutions as they are
- able to characterize and model AI problems in a state space search framework and identify appropriate production system category to solve them
- able to understand and evaluate pros & cons of different heuristic search strategies and apply appropriate heuristic search for specific problem solving scenario.
- able to represent domain knowledge in the form of predicates / rules and applies logic and inference for deducing the validity of a given assertion.
- able to create problem specific slot-filler knowledge structures and apply statistical, fuzzy and non-monotonic reasoning methods aptly to solve real world problems involving any type of uncertainty.
- able to understand basic concepts and approaches to natural language processing, plan generation and expert system development.

SYLLABUS:

Introduction to Artificial Intelligence: Artificial Intelligence, AI Problems, AI Techniques, Defining the Problem as a State Space Search, Production Systems, control strategies, Uninformed search using BFS and DFS, Heuristic search, Problem Characteristics, Production system categories for AI problem solving

Heuristic Search Techniques: Issues in The Design of Search Programs, Generate-And- Test, Hill Climbing and its variants, Best-First Search, A* Algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis.

Knowledge Representation using Predicate Logic and Rules: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Resolution in propositional logic, Resolution in predicate logic with Clause form, Unification & Resolution algorithm, Question answering, Procedural Vs Declarative Knowledge, Logic programming with Prolog, Forward Vs Backward Reasoning and combining them, Matching Techniques, Matching with variables, RETE Algorithm, Conflict resolution

Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Logics for Non monotonic reasoning, Depth first search with Dependency-directed backtracking, Justification based Truth Maintenance

System, Statistical Reasoning: Bayes Theorem for probabilistic inference, Certainty Factors and Rule-Based Systems, Bayesian Belief Networks, Dempster Shafer Theory, Fuzzy Logic

Structured Representations of Knowledge: Semantic Nets, representing non-binary predicates, Partitioned Semantic Nets, Frames as sets and instances, Slots as full-fledged Objects, Property Inheritance through tangled hierarchies, Conceptual Dependency, Conceptual Dependency Graphs, Scripts, examples in natural language understanding, merits and demerits of strong slot filler structures.

Natural Language Processing: Steps in Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis and grammars, Discourse and pragmatic processing; Planning: Components of a Planning System, Goal Stack Planning, Non-linear Planning using Constraint Posting, Hierarchical Planning, Reactive Systems.

Experts Systems: Overview of an Expert System, Applications of expert systems, Components of an Expert Systems, Expert system development, Types of Expert Systems: Rule Based, Frame Based, Neural Network based, Black Board Architectures, Case studies of successful expert systems, Expert System Shells, Knowledge Acquisition and Validation Techniques.

Text Books:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw -Hill Publications 2. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI publications References:

2. Artificial Intelligence, George F Luger, Pearson Education Publications 2. Artificial Intelligence : A modern Approach, Russell and Norvig, Prentice Hall

CS3103 COMPILER DESIGN

Course objectives:

- To explain the basic understanding of grammars and language definition and introducing various phases of designing a compiler.
- To make the student to understand the concepts underlying the design and implementation of language processors and its mechanisms.
- To extend the knowledge of parser by parsing LL parser and LR parser.
- To enrich the knowledge in various phases of compiler ant its use, code optimization techniques, loop optimization techniques, machine code generation, and use of symbol table.

Course outcomes:

- Ability to understand grammars, language definitions and various phases of designing a compiler.
- Ability to understand Language processors and different parsers.
- Ability to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
- Ability to do usage of registers in efficient manner during the program execution.
- Ability to acquire the knowledge of modern compiler & its features.

SYLLABUS:

Introduction: Introduction to Compilers and Language processors, Programming Language basics, Structure & Different Phases of a Compiler, Review of Compiler Structure, Structure of Optimizing Compilation, Compiler construction tools, Boot strapping, Cross compilers.

Finite Automata & Lexical Analysis: Introduction to Lexical Analysis, Lexical Analyzers, Approaches to design Lexical Analysers, Language for specifying lexical analyzers, Introduction to Finite automata, Regular Expressions & Languages, Recognition of Tokens, Transition Diagrams, Implementation of lexical analyzers, Lexical Analyzer Generator LEX.

Syntax Analysis: Syntactic Specification of Programming Languages, Context Free Grammars & Languages, Introduction to Parsers. Top-down parsing techniques: Brute force parsing, Recursive Descent Parsing, Predictive Parsing, Bottom–up Parsing: Shift reduce parsing, Operator parsing, LR (k) parsing.

Semantic Analysis and Intermediate Code Generation: Semantic Actions, Syntax Directed Translations, Translation on the parse Tree, Implementation of Syntax Directed Translator, Intermediate Codes, Syntax Directed translation to Postfix code, Syntax Trees, Intermediate Code Generation, Three Addr5ess Code-Translation of Expressions, Type Checking & Type Conversions.

Code Optimization: Principal sources of Code Optimization, Loop Optimization, Basic Blocks & Flow Graphs, DAG Representation of Basic Blocks, Applications of DAG, Local Optimization, Unreachable Code Elimination, Dead Code Elimination, Data Flow Analysis, Data Flow Equations & Computations, Peep-Hole Optimization.

Machine Dependent Optimizations, Overview of Informal Compiler Algorithm Notation (ICAN), If Simplification, Loop Simplification, Loop Inversion, Branch Optimization and Prediction

Code Generation and Code Scheduling: Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation & Assignments, Code Generation Algorithm, Code Generators, Optimal Code Generation for Expressions, Code Generation From DAG.

Symbol Tables, Runtime Environment and Error Handling: Contents of a Symbol Table, Data Structures for Symbol Tables; Run time Environments, Implementation of a simple Stack allocation, Heap Management, Block Structured Languages; Error Detection & Recovery, Lexical Phase Errors, Syntactic & Semantic Errors, Error Handling Routines.

Text Books:

1. Principles of Compiler Design by Aho.D. Ullman, Lam and Ravi Sethi, Pearson Education Second Edition
2. Advanced Compiler Design and Implementation, Steven Muchnic, Elsevier Publications.

Reference Books:

1. Compiler Construction by Kenneth. C. Louden, Vikas Pub. House.
2. Compiler Design, A.A. Pentambekar, Technical Publications
3. Modern Compiler Design, Grune.D, Van Reeuwijk K, Bal H.E, Jacobs C J H, Lan gendoen K, Springer,

CS3106 DATA COMMUNICATIONS & COMPUTER NETWORKS LAB

Course Objectives:

- This course provides students with hands on training regarding the design, troubleshooting, modelling and evaluation of computer networks.
- To study the various hardware concepts related to data communications
- To make the students understand the basic requirements of network hardware, software and its architecture.
- To understand the various Error detection & control techniques
- To learn Socket programming techniques

Course Outcomes:

The students will learn:

- About networking concepts and connecting systems
- To setup Local Area Network using packet tracer software
- To experiment in a real tested networking environment, network design and troubleshooting topics and tools
- Simulator Error control and flow control techniques
- To write socket program and client server applications.

SYLLABUS: Module I: Packet tracer software

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Connect the computers in Local Area Network.
3. Study of basic network command Network configuration commands.
4. Configure a Network topology using packet tracer software.

Module II: Network simulator (NS)

1. Implementation of Error Detection/Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High-Level Data Link Control
5. Study of Socket Programming and Client-Server model using Java
6. Write a socket program for Echo/Ping/Talk commands using Java
7. Study of Network simulator (NS) and simulation of Congestion Control Algorithms

CS3107 PYTHON PROGRAMMING LAB

Course Objectives:

- familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling
- introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation
- familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and data frames
- introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others
- Implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course Outcomes:

- After completion of the course the student should be able to:
- implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries
- calculate statistical measures using Python such as measures of central tendency, correlation
- use Python data related libraries such as Numpy and Pandas and create data visualizations
- implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

SYLLABUS:

1. Python Programs on lists & Dictionaries

2. Python Programs on Searching and sorting

3. Python Programs on Text Handling

4. Python Programs on File Handling

5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation

6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation

7. Python Programs on NumPy Arrays, Linear algebra with NumPy

8. Python Programs for creation and manipulation of Data Frames using Pandas Library

9. Write a Python program for the following.

   - Simple Line Plots,

- Adjusting the Plot: Line Colours and Styles, Axes Limits, Labelling Plots,
- Simple Scatter Plots,
- Histograms,
- Customizing Plot Legends,
- Choosing Elements for the Legend,
- Boxplot
- Multiple Legends,
- Customizing Colorbars,
- Multiple Subplots,
- Text and Annotation,
- Customizing Ticks

10. Python Programs for Data pre-processing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features

11. Python Program for Compressing data via dimensionality reduction: PCA

12. Python Programs for Data Clustering

13. Python Programs for Classification

14. Python Programs for Model Evaluation: K-fold cross validation.

Reference Books:

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall
2. Chris Albon,―Machine Learning with Python Cookbook-practical solutions from pre-processing to Deep learning‖, O'REILLY Publisher,2018
3. Mark Summerfield, Programming in Python 3--A Complete Introduction to the Python Language, Second Edition, Additson Wesley
4. Phuong Vo.T.H , Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd
5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd
6. Magnus VilhelmPersson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd
7. Sebastian Raschka&VahidMirjalili, ―Python Machine Learning‖, Packt Publisher, 201

(With effect from 2022-23 AB)
B. Tech & B. Tech + M. Tech
(Computer Science and Engineering)
III year - II semester

Course code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS3201	PC	Object Oriented Software Engineering	4	0	30	70	100	3
CS3202	PC	Machine Learning	4	0	30	70	100	3
CS3203	PC	Cryptography & Network Security	4	0	30	70	100	3
CS3204	PE	Professional Elective - II	4	0	30	70	100	3
CS3205	OE	Open Elective - II	4	0	30	70	100	3
CS3206	PC	Object Oriented Software Engineering Lab	0	3	50	50	100	1.5
CS3207	PC	Machine Learning Lab	0	3	50	50	100	1.5
CS3208	PC	Cryptography & Network Security Lab	0	3	50	50	100	1.5
CS3209	SC	Embedded Systems Design	1	2	50	50	100	2
Industrial / Research Internship 2 months								
Total Credits								21.5

CS3201 OBJECT ORIENTED SOFTWARE ENGINEERING

Course objectives:

- The students would be able to get the concepts of Object Orientation and software engineering perceptions and software process models.
- The students would be able to understand requirements engineering processes, Unified Modeling Language and its notations and diagrams.
- The students would be able to understand various architectural styles and the concepts of various architectural patterns and some design patterns.
- The students would be able to understand various types of testing and quality assurance issues.
- The students would be able to gain understanding about software process and project management activities.

Course Outcomes:

- The students will be able to understand the best practices of Object Oriented software engineering and will be able apply various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
- The students would be able to analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project.
- The students would be able to create various design models for a software system to meet the user needs.
- Students can apply the knowledge, techniques, and skills in the development of a software product.
- The students would be able to evaluate the software through various types of testing and perform software process and project management and quality assurance activities.

SYLLABUS:

Introduction to Object Oriented Software Engineering: Nature of the Software, Types of Software, Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction to Object Orientation, Software Process Models-Waterfall Model, Opportunistic Model, Phased Released Model, Spiral Model, Evolutionary Model, Concurrent Engineering Model.

Requirements Engineering: Domain Analysis, Problem Definition and Scope, Requirements Definition, Types of Requirements, Techniques for Gathering and Analyzing Requirements, Requirement Documents, Reviewing, Managing Change in Requirements.

Unified Modelling Language & Use Case Modelling: Introduction to UML, Modelling Concepts, Types of UML Diagrams with Examples; User-Centred Design, Characteristics of Users, Developing Use- Case Models of Systems, Use-Case Diagram, Use- Case Descriptions, Basics of User Interface Design, Usability Principles, User Interfaces.

Class Design and Class Diagrams: Essentials of UML Class Diagrams, Associations and Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Interaction and Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

Software Design and Architecture: Process of Design, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document; Pattern Introduction, Design Patterns: Abstraction-Occurrence Pattern, General Hierarchical Pattern, Play-Role Pattern, Singleton Pattern, Observer Pattern, Delegation Pattern, Adaptor Pattern, Façade Pattern, Immutable Pattern, Read-Only Interface Pattern and The Proxy Pattern; Software Architecture Contents of Architecture Model, Architectural Patterns: Multilayer, Client-Server, Broker, Transaction Processing, Pipe& Filter and MVC Architectural Patterns.

Software Testing: Overview of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OOTest Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

Software Process Management: Introduction to Software Project Management, Rationale Management, Configuration Management, Activities of Software Project Management, Structure of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking and Monitoring.

Text Books:

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Leth bridge& Robert, LanganiereMcgraw-Hill
2. Software Engineering, K.K. Agarwal, New Age Publications2008
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

References:

1. Software Engineering: A Practitioner's Approach, Roger S Pressman.
2. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A.Sykes, Addison-Wesley Professional.

CS3202 MACHINE LEARNING

Course Objectives:

- This course introduces the essential concepts and techniques of machine learning to the students and more specifically
- provides a good foundation to machine learning concepts and paradigms
- introduces Bayes Decision theory and Maximum likelihood estimation for learning model parameters as a tradeoff between bias and variance
- Explains multi-variate data exploration methods like missing value imputation, dimensionality reduction for classification and regression.
- introduce semi-parametric approaches for mixture models with clustering and Expectation Maximization
- introduces non-parametric methods for density estimation, smoothening, regression, etc
- Demonstrates the applicability of Decision Trees, linear discriminants and SVMs for classification and regression and explains the comparative analysis of their performance

Course outcomes:

- After completion of the course, the student should be able to:
- understand different types of ML, applications of ML in different domains, VC dimension and PAC learning for concept learning and supervisory model selection
- create Bayesian discriminant functions for decision regions with maximum likelihood estimation of parameters considering bias-variance tradeoff
- Understand and apply methods for missing value imputation, parameter estimation and dimensionality reduction on Multi-variate datasets
- Explore data applying various approaches like Expectation Maximization, clustering and non-parametric methods like nearest neighbors
- Able to solve classification and regression problems with Decision Trees, linear discriminants and SVMs and analyze the performance of classification algorithms

SYLLABUS:

Introduction to Machine Learning, Types and applications of Machine learning, **Supervisory Learning**: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms

Bayesian Decision Theory: Classification, losses and risks, discriminant functions, Association Rules, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

Multivariate methods: Multivariate data, parameter estimation, missing value imputation, Multivariate normal distribution, Multivariate classification, Tuning complexity, Discrete features, Multivariate regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, SVD and Matrix factorization, multi-dimensional scaling, LDA

Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, Supervised learning after clustering, Feature embedding, Laplacian Eigenmaps, Spectral clustering, Hierarchical clustering, choosing number of clusters

Non-parametric methods: Non-parametric density estimation methods like Histograms, kernel estimators, K-nearest neighbor estimators, generalization to multivariate data, nonparametric classification, condensed nearest neighbors, Distance based classification, outlier detection, non-parametric regression: smoothing models, choosing smoothing parameters

Decision Trees and Assessing Classification algorithms: Decision Tree purpose and structure, Uni-variate Trees for classification and regression, rule extraction from trees, Learning Rules from data, Multivariate trees, Assessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation, Hypothesis testing, assessing performance of a classifier, comparing two classification algorithms

Linear Discrimination: Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, discrimination by regression, learning to rank, Kernel Machines: features of Support vector machines, optimal separating hyperplane, Soft margin hyperplane for non-separable spaces, kernel Trick, Vectorial kernels, SVM for regression.

Text Book:

1. Introduction to Machine Learning by Ethem Alpaydin, Prentice-Hall of India, 3rd Edition, 2019

Reference books:

1. Machine Learning, Peter Flach, Cambridge University Press, 2012

2. Machine Learning, Tom Mitchell , McGraw Hill, 1997

CS3203 CRYPTOGRAPHY & NETWORK SECURITY

Course Objectives:

- To understand the basic concepts of Cryptography and Network Security.
- To be able to understand message security, confidentiality and database security
- To learn about the various types of malwares and attacks.
- To learn about Intrusions, intrusion detection system and understand buffer overflow
- To understand various protocols for network security to protect against the threats in the networks.

Course Outcomes:

- After successful completion of the course, the students would be able to
- Realize the need and importance of network security, understand and apply the concepts of security towards data over network.
- Understand the principles of cryptography and network security and apply the knowledge to design cryptographic concepts and algorithms.
- Understand and analyze various types of malwares and several network attacks.
- Evaluate several intrusions and understand buffer overflow attacks.
- Understand and apply security standards and implement various network security protocols.

SYLLABUS:

Cryptography: Concepts & Techniques

Need for Security, Security Approaches, Principles of Security, Threats-Attacks & Attack Types-Services-Mechanisms, Basic Mathematics for cryptography- Factorization, Prime numbers, Primality Testing, Modular Arithmetic, Discrete logarithms, Residues, Fermat's & Euler's Theorem, Chinese Reminder theorem

Symmetric & Asymmetric Cryptography:

Network Security Model: Plain Text-Cipher Text-Encryption-Decryption-Key, Key Range and Key Size, Classic Cryptography: Stream ciphers, Substitution-Transposition, Steganography.

Basic Concept of Symmetric Cryptography, Algorithm Types and Modes, DES-AES-RC4, Principles of Public-Key Cryptography, Message Authentication, Hash functions, RSA, Concepts of Digital Signature.

Key Management and Integrity:

Symmetric Key Distribution, Diffie-Hellman Key exchange, Public Key Distribution, Public Key infra structure(PKI) Digital Certificates (public key), Basic principles of Access control.

E-mail & IP Security:

E-mail security -PGP/SMIME, IP Security & architecture, IPV6

Internet Security Protocols and Standards:

Basic concepts, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure hyper text transfer protocol (SHTTP), Time stamping protocol (TSP), Wireless Application Protocol (WAP), Secure Electronic Transaction (SET), security in GSM, Security in 3G.

Firewalls, Intrusion Detection System and Virtual Private Networks:

Types of Firewalls, Firewall Architectures, IDS- Signature and Anomaly based IDS, Basics of VPN, VPN architecture

Network Vulnerabilities:

Different types of Vulnerabilities in Network, Introduction to IP Spoofing, ICMP, ARP, DDOS, Buffer Overflow attacks

Text Books:

1. Cryptography And Network Security by Atul kahate, McGrawHill
2. Network Security Essentials- Applications and Standards by William Stallings, 3 rd Edition, Pearson

Reference Books:

1. Cryptography and Network Security by William Stallings, Pearson Education Asia, New Delhi.
2. Network Security Essentials Applications and Standards, by William Stallings, Pearson Education Asia, New Delhi.

CS3206 OBJECT ORIENTED SOFTWARE ENGINEERING LAB

Course objectives:

- The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, The course is realized as a project-like assignment that can, in principle, by a team of two/three students working full time. Typically the assignments have been completed during the semester requiring approximately 60-80 hours from each project team.
- The goal of the Software Engineering Project is to have a walk through from the requirements, design to implementing and testing. An emphasis is put on proper documentation. Extensive hardware expertise is not necessary, so proportionate attention can be given to the design methodology.
- Despite its apparent simplicity, the problem allows plenty of alternative solutions and should be a motivating and educating exercise. Demonstration of a properly functioning system and sufficient documentation is proof of a completed assignment.
- Term projects are projects that a group student or might take through from initial specification to implementation. The project deliverables include.

Course Outcomes:

- Ability to define a problem and to translate end-user requirements into system and software requirements.
- Ability to generate a high-level design of the system from the software requirements.
- Ability to draw various design diagrams (UML, Architectural Designs, Database Design and User Interface Designs) for the requirements gathered.
- Ability to implement the designed problem in Object Oriented Programming Language.
- Will have experience and/or awareness of testing problems, test whether all the requirements specified have been achieved or not and will be able to develop a simple testing report.

SYLLABUS:

1. Documentation including

   A. A problem statement

   B. A requirements document

   C. A Requirements Analysis Document.

   D. A System Requirements Specification.

   E. A Software Requirements Specification.

2. A design document

   A. A Software Design Description and a System Design Document.

3. A Test specification.

4. Manuals/guides for

    A. Users and associated help frames

    B. Programmers

    C. Administrators (installation instructions)

5. A project plan and schedule setting out milestones, resource usage and estimated costs.

6. A quality plan setting out quality assurance procedures

7. An implementation.

References:

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, Pearson Education
2. Visual Modelling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Education
3. UML2 Toolkit, Hans -Erik Eriksson, etc; Wiley

CS3207 MACHINE LEARNING LAB

Course Objectives:

- The lab course provides hands-on experimentation for gaining practical orientation on different Machine learning concepts. Specifically students learn
- To write programs for various data exploration and analytics tasks and techniques in R Programming language.
- To apply various Machine learning techniques available in WEKA for data exploration and pre-processing datasets containing numerical and categorical attributes · To apply various Machine learning techniques for available in WEKA for extracting patterns / Knowledge and interpret the resulting patterns

Course Outcomes:

At the end of this course student are able to

- understand the data structures available in R programming and learn to write R programs to perform several data analytics operations like plotting, boxplots, normalization, discretization, transformation, attribute selection, etc., on datasets
- write R programs to build regression and classification models for numerical and categorical datasets and evaluate the models with appropriate performance metrics. 3. understand and use Weka explorer for data exploration, visualization, and other data pre processing tasks for numerical and categorical datasets.
- extract Association rules using A-priori and FP-growth methods available in WEKA and interpret the patterns.
- Build and cross-validate models for Classification and Clustering on labelled and unlabeled datasets respectively using different methods.

1. Exploratory data analysis using R

1. Load the 'iris.csv' file and display the names and type of each column. Find statistics such as min, max, range, mean, median, variance, standard deviation for each column of data. Repeat the above for 'mtcars.csv' dataset also.

2. Write R program to normalize the variables into 0 to 1 scale using min-max normalization

3. Generate histograms for each feature / variable (sepal length/ sepal width/ petal length/ petal width) and generate scatter plots for every pair of variables showing each species in a different color .
4. Generate box plots for each of the numerical attributes. Identify the attribute with the highest variance.

5. Study of homogeneous and heterogeneous data structures such as vector, matrix, array, list, data frame in R.

6. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into a value around 0 with z-score normalization.

7. Write R Program using ‘apply’ group of functions to create and apply discretization function on each of the numeric variables/ features of iris dataset to transform them into 3 levels designated as “Low, Medium, High” values based on equi-width quantiles such that each variable gets nearly equal number of data points in each level.

8. a) Use R to apply linear regression to predict evaporation coefficient in terms of air velocity using the data given below:

    a. Air Velocity (cm/sec) 20,60,100,140,180,220,260,300,340,380

    b. Evaporation Coefficient (sqmm/sec)

    c. 0.18, 0.37, 0.35, 0.78, 0.56, 0.75, 1.18, 1.36, 1.17, 1.65

    d. b) Analyze the significance of residual standard-error value, R-squared value, F statistic. Find the correlation coefficient for this data and analyze the significance of the correlation value.

    e. c) Perform a log transformation on the ‘Air Velocity 'column, perform linear regression again, and analyze all the relevant values.

9. Write R program for reading ‘state.x77’ dataset into a dataframe and apply multiple regression to predict the value of the variable ‘murder’ based on the other independent variables based on their correlations.

10. Write R program to split ‘Titanic’ dataset into training and test partitions and build a decision tree for predicting whether survived or not given the description of a person travelled. Evaluate the performance metrics from the confusion matrix. .

2. WEKA Knowledge Extraction toolkit:

11. Create an ARFF (Attribute-Relation File Format) file and read it in WEKA. Explore the purpose of each button under the pre-process panel after loading the ARFF file. Also, try to interpret using a different ARFF file, weather.arff, provided with WEKA.

12. Performing data preprocessing in Weka Study Unsupervised Attribute Filters such as Replace Missing Values to replace missing values in the given dataset, Add to add the new attribute Average, Discretize to discretize the attributes into bins. Explore Normalize and Standardize options on a dataset with numerical attributes.

13. Classification using the WEKA toolkit Demonstration of classification process using id3 algorithm on categorical dataset(weather).
Demonstration of classification process using naïve Bayes algorithm on categorical dataset (‘vote’).
Demonstration of classification process using Random Forest algorithm on datasets containing large number of attributes.
14. Classification using the WEKA toolkit – Part 2
Demonstration of classification process using J48 algorithm on mixed type of dataset after discretizing numeric attributes.
Perform cross-validation strategy with various fold levels. Compare the accuracy of the results.

15. Association rule analysis in WEKA

Demonstration of Association Rule Mining on supermarket dataset using Apriori Algorithm with different support and confidence thresholds.
Demonstration of Association Rule Mining on supermarket dataset using FP- Growth Algorithm with different support and confidence thresholds.

16. Performing clustering in WEKA
Apply hierarchical clustering algorithm on numeric dataset and estimate cluster quality. Apply DBSCAN algorithm on numeric dataset and estimate cluster quality.

References:

1. Practical data science with R, Nina Zumel and John Mount- Dreamtech Press for module 1 on R
2. Data Mining: Practical Machine Learning tools and techniques, Ian H.Witten, Eibe Frank and Mark A.Hall, Morgan Kaufmann Pub, 3rd Edition for module 2 on WEKA

CS3208 CRYPTOGRAPHY & NETWORK SECURITY LAB

Course Objectives:

- Understand the concepts of encryption and decryption and various techniques.
- Understand various algorithms such as DES, Blowfish, Rijndael, Message Digest
- Understand how to find IP address, MAC address, neighbouring machines
- Understand Intrusion detection and ARP protocols

Course Outcomes:

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

- Perform encryption and decryption using various algorithms
- Implement various encryption and Message Digest algorithms
- Find IP address, MAC address, neighbouring machines
- Detect intrusion packets and demonstrate ARP poisoning

List of Experiments cycle 1:

Cryptography

1. Write a C program that contains a string (char pointer) with a value ‗Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value ‗Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
4. Ceaser cipher
5. Substitution cipher
6. Hill Cipher
7. Write a C/JAVA program to implement the DES algorithm logic.
8. Write a C/JAVA program to implement the Blowfish algorithm logic.
9. Write a C/JAVA program to implement the Rijndael algorithm logic.
10. Write the RC4 logic in Java Using Java cryptography; encrypt the text ‗Hello world' using Blowfish. Create your own key using Java key tool.
11. Write a Java program to implement RSA algorithm.

12. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
13. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
14. Calculate the message digest of a text using the MD5 algorithm in JAVA.

Cycle 2 – Network Security:

1. a) Find the IP address, MAC address of your machine.

   b) Find the neighbouring machines in your network.

   c) Check if a server is up and running.
2. Run tcpdump/windump utility with atleast 4 options.
3. Capture the packets in your system using wireshark and analyse any one TCP packet in detail.
4. Use snort to detect intrusion packets.
5. Demonstrate ARP Poisoning.

Reference Books:

1.Computer Security - Principles and Practices, 2ndEdition by William Stallings, Pearson Education, Inc.

2.Cryptography and Network Security by William Stallings, Pearson Education Asia, New Delhi.

CS3209 EMBEDDED SYSTEMS DESIGN (SC)

Course Objectives:

- To introduce basics of electronics and reading electronics diagrams
- To introduce students to basics of Arduino programming language and IDE
- Assembly language program using 8051
- Interfacing 8051 Microprocessor
- Embedded system design using msp430

Course Outcomes:

At the end of this course, students will:

- Learn the basics of electronics, including reading schematics (electronics diagrams) and how to prototype circuits with a breadboard.
- Learn the Arduino programming language and IDE
- Acquire knowledge on how to program basic Arduino/ RASPBERRY Pi/8051/MSP430 using assemble language or C language.
- students able to learn how to build prototype models and interfacing various sensor to Arduino/ RASPBERY Pi/8051/MSP430

MODULE I: EMBEDDED SYSTEM DESIGN USING MSP430

1. Introduction to MSP430 launch pad and Programming Environment.
2. Read input from switch and Automatic control/flash LED (soft-ware delay).
3. Interrupts programming example using GPIO.
4. Configure watchdog timer in watchdog & interval mode.
5. Configure timer block for signal generation (with given frequency).
6. Read Temperature of MSP430 with the help of ADC.
7. Test various Power Down modes in MSP430.
8. PWM Generator.
9. Speed Control of DC Motor

MODULE II: EMBEDDED SYSTEM DESIGN USING 8051

1. Assemble language programs using 8051 implementing

a. Addition and subtraction of two 8bit numbers
b. Multiplication and division of two 8bit numbers
c. Largest and smallest in array of numbers
d. Arrange an array an ascending and descending orders
e. To move a block of data to another location

2. Hardware Interfacings with 8051

a. LEDS and Switches,

b. Seven Segment Display and Multi Segment Display,
c. Relays (AC Appliance Control)
d. LCD, Buzzer,
e. IR Sensors and other digital sensors,
f. Matrix Keypad
g. UART Communication (MCU to PC) UART Communication (MCU to MCU)
h. Graphical LCD
i. RTC Based Real Time Clock
j. Sensor Interfacing: Accelerometer/Gyro/Tilt Sensor, Analogue Sensors (Temperature, Gas & Alcohol) UART Based Sensors (Colour Sensor, Humidity Sensor).

MODULE III: EMBEDDED SYSTEM DESIGN USING ARDUINO

1. Embedded Systems Introduction, Different Microcontroller Architectures (CISC, RISC, ARISC).
Internal Resources & Hardware Chips in Details. History of AVR Microcontrollers and Features, Memory Architectures (RAM/ROM). 8051 Architecture and programming.
2. Introduction to ARDUINO, ARDUINO History and Family Programming in Embedded -C, Concepts of C language.
3. Hardware Interfacing with Arduino
k. LEDS and Switches,
l. Seven Segment Display and Multi Segment Display,
m. Relays (AC Appliance Control)
n. LCD, Buzzer,
o. IR Sensors and other digital sensors,
p. Matrix Keypad
q. UART Communication (MCU to PC) UART Communication (MCU to MCU)
r. Graphical LCD
s. RTC Based Real Time Clock
t. Sensor Interfacing: Accelerometer/Gyro/Tilt Sensor, Analogue Sensors (Temperature, Gas & Alcohol) UART Based Sensors (Colour Sensor, Humidity Sensor).
4. Software Programming/Assembly Language Programming for above HW interfacing experiments with development kits or Simulation environment.

MODULE IV: EMBEDDED SYSTEM DESIGN USING RASPBERRY Pi

1. Setup Headless Raspberry Pi

2. Basic Input and Output Using Pseudo File system

3. Basic Input and Output Using Address Map

4. Analog Input & Analog Output

5. Interfacing 7 Segment Display & 4x4 Matrix Keyboard/Keypad

6. I2C Communication

7. Servo Motor & stepper Motor

(With effect from 2022-23 AB)
B. Tech & B. Tech + M. Tech
(Computer Science and Engineering)
IV year - I semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CS4101	PE	Professional Elective– III	4	0	30	70	100	3
CS4102	PE	Professional Elective - IV	4	0	30	70	100	3
CS4103	PE	Professional Elective - V	4	0	30	70	100	3
CS4104	OE	Open Elective– III	4	0	30	70	100	3
CS4105	OE	Open Elective - IV	4	0	30	70	100	3
CS4106	HSSE	HSS Elective	4	0	30	70	100	3
CS4107	SC	Design Thinking and product Innovation	1	2	50	50	100	2
CS4108	INT	Internship -II	0	0	50	50	100	2
Industrial / Research Internship 2 months(Mandatory) after 3rd year (to be evaluated during IV Year I Semester)								
Total Credits								22

CS4107 DESIGN THINKING AND PRODUCT INNOVATION (SC)

Course Outcomes:
After successful completion of this activity the student will be able to

- outline a problem, apply methods of Empathy on user groups
- describe and define the problem specific to the user group
- apply Ideation tools to generate Ideas to solve the problem
- develop prototype
- test the ideas and demonstrate Storytelling ability to present the Ideas

Students shall form into groups and Identify a problem (preferably societal problem with engineering orientation to solve) suitable for the design thinking and go through the process week-wise. At the end of each phase, brief documentation shall be submitted and a final report covering all phases has to be submitted at the end of the semester.

SYLLABUS:

Introduction to Design Thinking: A primer on design thinking - Traditional approach, The new design thinking approach. Stages in Design Thinking: Empathize, Define, Ideate, Prototype, Test. Mindset for design thinking, Design thinking for product and process innovation, Difference between engineering design and design thinking.

Case Studies: General, Engineering and Service applications.

Activities: Identify an Opportunity and Scope of the Project Explore
the possibilities and Prepare design brief

Methods and Tools for Empathize and Define phases:

Empathize - Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer observation, Trend analysis

Define - Methods of Define Phase: Storytelling, Critical items diagram, Define success

Activities: Apply the methods of empathize and Define Phases Finalize
the problem statement

Methods and Tools for Ideate phase:

Ideate - Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;

Activities: Apply the methods of Ideate Phase: Generate lots of Ideas

Methods and Tools for Prototype Phase:

Prototype - Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product;

Activities: Apply the methods of Prototype Phase: Create prototypes for selected ideas

Methods and Tools for Test Phase:

Test - Methods of Testing: Feedback capture grid, A/B testing

Activities: Collect feedback; iterate and improve the ideas

Solution Overview - Create a Pitch - Plan for scaling up - Road map for implementation

Activities: Present your solution using Storytelling method

Project Submission: Fine tuning and submission of project report

Reference Books:

1. Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperCollins e-books, 2009.
2. Michael Lewrick, Patrick Link, Larry Leifer, *The Design Thinking Toolbox*, John Wiley & Sons, 2020.
3. Michael Lewrick, Patrick Link, Larry Leifer, *The Design Thinking Playbook*, John Wiley & Sons, 2018.
4. Kristin Fontichiaro, *Design Thinking*, Cherry Lake Publishing, USA, 2015.
5. Walter Brenner, Falk Uebernickel, *Design Thinking for Innovation - Research and Practice*, Springer Series, 2016.
6. Gavin Ambrose, Paul Harris, *Design Thinking*, AVA Publishing, 2010.
7. Muhammad Mashhood Alam, *Transforming an Idea into Business with Design Thinking*, First Edition, Taylor and Francis Group, 2019.
8. S.Balaram, *Thinking Design*, Sage Publications, 2011.

Web References:

1. https://designthinking.ideo.com/
2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/
3. https://www.coursera.org/learn/design-thinking-innovation
4. https://swayam.gov.in/nd1_noc20_mg38/preview

(With effect from 2022-23 AB)
B. Tech & B. Tech + M. Tech
(Computer Science and Engineering)
IV year - II semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
CS4201	PROJ	Project work	100	100	200	14
Internship (6 Months)						
					Total Credits	14

SC: Skilled Course

OE/PE: Open Elective/Professional Elective

HSSE: Humanities and Social Science Elective

MC: Mandatory Course

PROFESSIONAL ELECTIVES (CSE)

1. REAL TIME SYSTEMS
2. SOFTWARE PROJECT MANAGEMENT
3. SOFTWARE TESTING TECHNIQUES
4. DISTRIBUTED SYSTEMS
5. GRID COMPUTING
6. SENSOR NETWORKS
7. CLOUD COMPUTING
8. DIGITAL IMAGE PROCESSING
9. BIG DATA ANALYTICS
10. NATURAL LANGUAGE PROCESSING
11. SOFT COMPUTING
12. HUMAN COMPUTER INTERACTION
13. BIO INFORMATICS
14. DATA WAREHOUSING AND DATA MINING
15. DEEP LEARNING

REAL TIME SYSTEMS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

The objective of this course is:

- To learn and understand the evolution of Real Time Systems
- To study and examine hardware architectures for Real Time Systems
- To study and analyze the design issues for Real Time Operating Systems
- To study and evaluate programming language paradigms for creating Real Time applications
- To study and apply the techniques for Real Time performance analysis

Course Outcomes:

On completion of this course, the students shall be able to

- Understand the need for Real Time Systems, their characteristics and applications
- Recognize the processor, memory and interfacing hardware architectures for Real Time Systems
- Analyze and implement appropriate policy for Real Time Operating System services
- Choose appropriate programming language for development of real time software
- Evaluate the performance of a Real Time System

SYLLABUS:

Fundamentals of Real-Time Systems: Concepts and Misconceptions, Multidisciplinary Design Challenges, Birth and Evolution of Real-Time Systems.

Hardware for Real-Time Systems: Basic Processor Architecture, Memory Technologies, Architectural Advancements, Peripheral Interfacing, Microprocessor versus Microcontroller, Distributed Real-Time Architectures.

Real-Time Operating Systems: From Pseudokernels to Operating Systems, Theoretical Foundations of Scheduling, System Services for Application Programs, Memory Management Issues, Selecting Real-Time Operating Systems.

Programming Languages for Real-Time Systems: Coding of Real-Time Software, Assembly Language, Procedural Languages, Object-Oriented Languages, Overview of Programming Languages, Automatic Code Generation, Compiler Optimizations of Code.

Requirements Engineering Methodologies and Software Design Approaches: Requirements Engineering for Real-Time Systems, Formal Methods in System Specification, The Requirements Document, Qualities of Real-Time Software, Software Engineering Principles, Procedural Design Approach, Object-Oriented Design Approach.

Performance Analysis Techniques: Real-Time Performance Analysis, Applications of Queuing Theory, Input/Output Performance, Analysis of Memory Requirements.

Text Books:

1. “Real-Time Systems Design and Analysis” by Philips A. Laplante, Seppo J. Ovaska, 4e, Wiley

Reference Books:

1. “MicroC/OS-II: The Real-Time Kernel” by J. J. Labrosse, CRC Presss
2. “Real-Time and Embedded Guide” by Herman B
3. “Linux for Embedded and Real-Time Applications” by Doug Abbott
4. “Real Time Systems” by C. M. Krishna, Kang G. Shin, McGraw-Hill Intl. Edition
5. “Real-Time Systems” by Jane W. S. Liu, Pearson Education

SOFTWARE PROJECT MANAGEMENT
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization ‘s strategic goals.

Course Outcomes:

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

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

SYLLABUS:

Introduction to Software Project Management: Introduction to Project and Project Management, Reasons for IT project failure, Triple constraint of IT project management, Management spectrum of project, Overview of project life cycle models, Project manager skills and job description conceptualization and initiation of IT project, Business case.

Project Charter: Introduction, Project management process and their correlation with project life cycle phases, Introduction to Project Integration management and seven processes, Project Charter.

Project Scope Management: Introduction, Processes of scope management.

Project Human Resource Management: Introduction, Organizational structure – Function, Project and Matrix, Keys to managing people motivation theories and improving effectiveness, Project team selection.

Project Time and Cost Management: Introduction, Development of project schedule, CPM and PERT, Activities their sequencing and dependencies, Project network diagrams, Development of Gantt Charts, Earned Value Management, Introduction to Constructive Cost Model (COCOMO).

Project Risk Management: Introduction, Risk Management Process, Risk Identification for IT projects, Qualitative and Quantitative approaches to Risk Analysis, Risk Strategies, Risk Monitoring and Control, Risk Response and Evaluation Project Quality Management.

Project Communication Management: Introduction, Project Communication Plan, Project metrics, Information distribution, Performance Reporting. Project Change Management: Introduction, Impact of change, Change as a process, Change Management plan, Dealing with resistance and conflict, Configuration management.

Project Procurement Management: Introduction, Processes Planning Purchases and Acquisition, Contracting, Request Seller Responses, Select Sellers, Contract Administration, Contract Closure, Outsourcing of products and services.

Project Leadership and Ethics: Introduction, Project Leadership, Modern approaches, Styles of leadership, Ethical leadership, Making sound ethical decisions in the situations of conflict. Closure of a Project: Introduction, Project implementation, Administrative closure, Project Evaluation.

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

References:

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013

SOFTWARE TESTING TECHNIQUES
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To study fundamental concepts in software testing and discuss various software testing issues and solutions in software unit, integration, regression and system testing.
- To learn how to plan a test project, design test cases and data, conduct testing, manage software problems and defects, generate a test report.
- To expose the advanced software testing concepts such as object-oriented software testing methods, web-based and component-based software testing.

Course Outcomes:

By the end of the course, the student should have the ability to:

- Identify and understand various software testing problems, apply software testing knowledge and engineering methods and solve these problems by designing and selecting software test models, criteria, strategies, and methods
- Design and conduct a software test process for a software project
- Analyze the needs of software test automation
- Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.

SYLLABUS:

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing.

Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology.

Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing

White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing Static Testing: Inspections, Structured Walkthroughs, Technical Reviews. Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing

Regression testing: Progressives Vs regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques Efficient Test Suite Management: growing nature of test suite, Minimizing the test suite and its benefits,

test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite. Software Quality Management: Software Quality metrics, SQA models Debugging: process, techniques, correcting bugs.

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and Unit. Test Automation using Selenium tool.

Testing Object Oriented Software: basics, Object oriented testing, Testing Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems, Testing mobile systems

Text Books:

1. Software Testing, Principles and Practices, Naresh Chauhan, Oxford.
2. Software Testing- Yogesh Singh, CAMBRIDGE.

Reference books:

1. Foundations of Software testing, Aditya P Mathur, 2ed, Pearson.
2. Software testing techniques – BarisBeizer, Dreamtech, second edition.

DISTRIBUTED SYSTEMS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

The objective of this course is:

- To learn and understand distributed system design issues
- To study and examine communication protocols and models for distributed systems
- To study and analyze centralized and distributed algorithms for synchronization, processor allocation, fault tolerance and real time systems
- To study design and implementation issues for distributed file systems
- To examine and evaluate the approaches for distributed shared memory

Course Outcomes:

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

- Understand the advantages and usage of distributed systems over centralized systems
- Choose an appropriate communication protocol and model for implementing a distributed system
- Evaluate alternate policies for processor allocation, fault tolerance and real time systems
- Choose appropriate distributed file system models for distributed applications
- Critically examine and choose appropriate distributed shared memory model

SYLLABUS:

Introduction to Distributed Systems : What is a Distributed System?, Hard ware concepts, Software concepts, Design issues.

Communication in Distributed Systems: Layered Protocols, ATM networks, The Client – Server model, Remote Procedure Call, Group communication.

Synchronization in Distributed Systems: Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

Process Management: Processes and processors in Distributed System, Threads, System Models, Processors allocation, Scheduling in Distributed System, Fault Tolerance, Real Time Distributed System.

Distributed File Systems: Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

Distributed Shared Memory: Introduction, What is Shared memory? Consistency models, Page based Distributed Shared Memory, Shared –Variable Distributed Shared Memory, Object based Distributed Shared Memory.

Text Book:

1. Distributed Operating Systems by Andrew S. Tanenbaum, Pearson Education

Reference Books:

1. Advanced Concepts in Operating Systems by Mukesh Singhal and Niranjan G.Shivaratri,Tata McGraw Hill
2. Distributed Systems- Concepts and Design by George Coulouris, Jean Dollimore, Tim Kindberg, Pearson Education

GRID COMPUTING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

The student should be made to:

- Understand how Grid computing helps in solving large scale scientific problems.
- Gain knowledge on the concept of virtualization that is fundamental to cloud computing.
- Learn how to program the grid and the cloud.
- Understand the security issues in the grid and the cloud environment.

Course Outcomes:

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

- Apply grid computing techniques to solve large scale scientific problems
- Apply the concept of virtualization
- Use the grid and cloud tool kits
- Apply the security models in the grid and the cloud environment

SYLLABUS:

Introduction: The Data Centre, the Grid and the Distributed / High Performance Computing, Cluster Computing and Grid Computing, Meta computing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web Services and Grid Computing, Business Computing and the Grid – a Potential Win – win Situation, e-Governance and the Grid.

Technologies and Architectures: for Grid Computing Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing, Standards for Grid Computing, Recent Technological Trends in Large Data Grids

World Wide Grid Computing: Activities, Organizations and Projects Standard Organizations, Organizations Developing Grid Computing Tool Kits, Framework, and Middleware, Grid Projects and Organizations Building and Using Grid Based Solutions, Commercial Organizations Building and Using Grid Based Solutions.

Web Services and the Service Oriented: Architecture (SOA) History and Background, Service Oriented Architecture, how a Web Service Works, SOAP and WSDL, Description, Creating Web Services, Server Side. OGSA and WSRF OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF (Web Services Resource Framework), Resource Approach to Stateful Services, WSRF Specification.

Globus Toolkit History of Globus Toolkit: Versions of Globus Toolkit, Applications of GT4- Cases, GT4-Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data,

Choreography and Coordination, Main Features of GT4 Functionality – a Summary, GT4 Architecture, GT4 Command Line Programs, GT4 Containers

The Grid and the Databases: Issues in Database Integration with the Grid, The Requirements of a Grid-enabled Database, Storage Request Broker (SRB), How to Integrate the Databases with the Grid? The Architecture of OGSA-DAI for Offering Grid Database Services

Cluster Computing: Approaches to Parallel Computing, how to Achieve Low Cost Parallel Computing through Clusters, Definition and Architecture of a Cluster,

Cluster Middleware: An Introduction Levels and Layers of Single System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools. Early Cluster Architectures and High Throughput Computing Clusters: Early Cluster Architectures, High Throughput Computing Clusters, Condor.

Textbooks:

1. C.S.R.Prabhu – ―Grid and Cluster Computing‖-PHI(2008) Chapters: 1 to 13, 16, 17.

Reference books:

1. Jankiram, "Grid Computing Models: A Research Monograph", TMH (2005)

SENSOR NETWORKS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for ad hoc networks
- To understand the applications and security concepts of sensor networks

Course Outcomes:

- Ability to understands concepts related to Wireless Sensor Networks and Single node architecture.
- Ability understands concepts related to MAC Protocol and Network architecture.
- Ability understands concepts related to Link layer protocol, naming and addressing.
- Understands the concepts of Data-centric, content-based networking, Transport layer and Quality of Service.

SYLLABUS:

Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks (WSNs), Sensor networks vs Enabling Technologies for WSNs, **Single node architecture:** Hardware components, Energy consumption of sensor nodes, Some examples of sensor nodes, Operating systems and execution environments

Network Architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Physical layer and transceiver design considerations in WSNs

MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols.

Link layer protocols: Fundamentals: tasks and requirements, Error control, Framing, Link management

Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses

Data-centric and content-based networking: Introduction, Data-centric routing, Data aggregation, Data-centric storage

Transport layer and Quality of Service: The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Single packet delivery.

Text Books:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley& Sons Ltd, 2005

2. Network Management Fundamentals, Alexander Clemm CISCO Press 2007

CLOUD COMPUTING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To define Cloud Computing and expose the students to the frontier areas of Cloud Computing.
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To introduce various levels of services that can be achieved by cloud.
- To gain knowledge on virtualization techniques.
- To understand the working methodology of existing clouds, such as, Amazon, Google and Azure.

Course Outcomes:

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, laaS, public cloud, private cloud, hybrid cloud, etc.
- Classify the Levels of Virtualization and mechanism of tools and Analyze Cloud Architectures.
- Assess Control Storage Systems.
- Get an idea and set up Private Clouds.

SYLLABUS:

History of Computing Paradigms: Overview of Distributed Computing, Cluster Computing, Grid Computing, Ubiquitous Computing, Peer-to-Peer Computing. Distributed System Models and Enabling Technologies

Introduction to Cloud Computing: Cloud Computing and Service Models- Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS)

Virtual Machines and Virtualization: Implementation Levels of Virtualization, VMM Design Requirements and Providers, Virtualization Support at the OS Level, Middleware Support for Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management

Public Cloud Platform-Architectures and Programming: Google App Engine (GAE). Amazon Web Services (AWS), Microsoft Windows Azure. Service Oriented Architecture: REST, Publish Subscribe Model

Storage Systems: Storage Models, File Systems, and Databases, Distributed File Systems, General Parallel File System, Google File Systems, Apache Hadoop, Locks and Chubby: A Locking Service, Transaction Processing and NoSQL Databases, Big Table, Mega Store

Case Studies: The Grep The Web Application, Aneka Application of Maya Rendering Case Study

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack K. Dongarra, Distributed and Cloud Computing: From parallel processing to Internet of Things, Morgen Kauffmann 2013.
2. Cloud Computing Theory and Practice, Dan C. Marinescu.

References:

1. Cloud Computing: A Hands-On Approach, Arshdeep Bagha & Vijay Madisetti, University Press, 2022 Edition
2. Cloud Computing: A Practical Approach Anthony T. Velte Toby J.Velte, Ph.D. Robert Elsenpeter
3. Cloud Computing Bible, Barrie Sosinsk
4. Cloud Computing Course (nptel.ac.in)

DIGITAL IMAGE PROCESSING
PROFESSIONAL ELECTIVE
SYLLABUS

Course objectives:

To explain fundamentals of Image processing concepts.

- To provide mathematical foundation of image enhancement, image compression and image segmentation.
- To explain the students about Morphology and its applications in image processing.
- To explain various methods and techniques for image transformation.

Course outcomes:

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

- Understand the concepts of digital images and operations on the images
- Develop algorithms for fundamental concepts in Image processing.
- Perform image enhancement, image compression and image segmentation using various methods.
- Ability to implement Image transformation techniques

SYLLABUS:

Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship Between Pixels, Distance Measures, Connectivity, Image Geometry, Photographic Film. Histogram: Definition, Decision Of Contrast Basing On Histogram, Operations Basing on Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

Image Enhancement in Spatial Domain: Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations; Smoothing Filters-Mean, Median, Mode Filters – Comparative Study.

Edge enhancement in spatial domain: Edge enhancement filters, Directorial Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF filters, PREWITT Filter, Contrast based edge enhancement techniques, Comparative study, Low pass filters, High pass filters, Sharpening filters, Comparative study, Color fundamentals and color model

Image Compression: Run Length Encoding, modified run length encoding, Contour Coding, Huffman Code, Compression Due to Change in Domain, Compression Due to Quantization Compression at the Time of Image Transmission. Brief Discussion on: - Image Compression Standards.

Image Segmentation: Definition of segmentation, Characteristics of Segmentation, Detection of Discontinuities, Thresholding. Pixel Based Segmentation Method. Region Based Segmentation Methods,

Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Split and Merge Technique, Segmentation of moving objects.

Morphology: Dilation, Erosion, Opening, Closing, Hit-And-Miss Transform, Thinning, Thickening, Skeletons, Pruning Extensions to Gray – Scale Images Application of Morphology in I.P

Image Transforms: A Detail Discussion On Fourier Transform, DFT, FFT, Properties of Fourier transform, WALSH TransForm, WFT, HADAMARD Transform, DCT Image Enhancement in Frequency Domain: Design of Low Pass, High Pass, EDGE Enhancement, Smoothening Filters in Frequency Domain. ButterWorth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

Text Book:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Addision Wesley

Reference Books:

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks, Jr.(PHI)
2. Image Processing, Analysis, And Machine Vision By Milan SonkaVaclanHalavac Roger Boyle, Vikas Publishing House.
3. Digital Image Processing, S. Jayaraman, S. Esakkirajan& T. Veera Kumar, TMH
4. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, WileyBlackwell

BIG DATA ANALYTICS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

This course is aimed at enabling the students to

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyse big data like Hadoop, NoSQL,
- Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics.

Course Outcomes:

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

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on NoSQL, Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore Big Data Applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets and real time processing with Spark streaming.

SYLLABUS:

Introduction big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra, Table creation, loading and reading data.

Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization.

Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames, RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data,

Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN, Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj
2. SPARK: The Definitive Guide, Bill Chambers &MateiZaharia, O'Reilley, 2018Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional,2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012
6. Big Data Analytics - Chandramouli Subramanian, Asha A George, C R Rene Robin D Doreen Hephzibah Miriam, J Jasmine Christina Magdalene

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer,2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen,2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George,2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt,2010
5. "Programming Pig", O'Reilley, Alan Gates,2011

NATURAL LANGUAGE PROCESSING
PROFESSIONAL ELECTIVE
SYLLABUS

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 text representations and NLP algorithms using both the traditional symbolic and the more recent statistical and distributional approaches.
- Enable students to develop NLP models for text classification, information extraction, and dialog systems
- Provides a comprehensive study on NLP applications in a wide variety of domains

Course Outcomes:

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

- Understand the basic concepts and challenges of NLP and different stages of NLP Pipeline
- Understand and analyze various representational approaches starting from vectorization-based to distribution-based embeddings for processing natural language text
- Build and interpret machine learning and deep learning models for Text Classification
- Understand basic concepts of information extraction for building different variants of NER systems and the concepts and challenges underlying the development of dialog systems / chatbots
- Understand the approach and analyze the effectiveness of NLP applications in different domains.

SYLLABUS:

INTRODUCTION TO NLP and NLP Pipeline:
NLP tasks and applications, building blocks of language, NLP challenges, Basic approaches to NLP -Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP. NLP Pipeline- Data Acquisition, Text Extraction and Cleanup, Pre-processing, Feature Engineering, Building the model, Evaluation.

TEXT REPRESENTATION:
Vector space models, Basic Vectorization approaches, Distributed representations, Distributed representations beyond words and characters, Universal Text Representations, visualizing embeddings.

TEXT CLASSIFICATION:
Applications of text classification, Pipeline for building Text classification systems, One pipeline-many classifiers- Naïve Bayes, Logistic regression, SVM, Using Neural Embeddings in Text Classification, Deep Learning for Text Classification, Interpreting text classification models, Learning with no or less data and adapting to new domains, case study on corporate ticketing.

INFORMATION EXTRACTION:

Information Extraction-IE Applications, IE Tasks, General IE Pipeline, Keyphrase Extraction, Named Entity Recognition, Building an NER System, Building an NER System using existing library, using active learning, Named Entity Disambiguation and Linking, Relationship Extraction and other IE tasks

CHATBOTS:

Chatbots- Applications, Taxonomy of Chatbots, Pipeline for building Dialog Systems, Components of a Dialog system, other dialog pipelines with end-to-end approach, Deep Reinforcement learning for dialog generation, human-in-the-loop, case study on recipe recommender, open-ended generative chatbots

BRIEF OVERVIEW ON NLP APPLICATIONS:

Search and Information Retrieval- Components of Search Engine, Topic Modeling, Text Summarization, Recommender Systems for textual data, Machine Translation, Question- Answering Systems.

NLP APPLIED TO SOCIAL MEDIA AND E-COMMERCE:

Applications and challenges of NLP for Social Media, Issues related to NLP for social media data, NLP for supporting e-commerce activities, Search in E-commerce, Building E-commerce catalog, Review analysis, recommendations for e-commerce

Text Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, "*Practical Natural Language Processing*", O'Reilly Media Inc., 2021, ISBN: 978-93- 8588-918-9.

Reference Books:

1. Lewis Tunstall, Leandro von Werra, Thomas Wolf, "*Natural Language Processing with Transformers: Building Language Applications with Hugging Face*", O'Reilly Media Inc., 2022

2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2ndEdition, Daniel Jurafsky, James H. Martin - Pearson Publication,2014.

SOFT COMPUTING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To explain the role of Soft Computing in addressing the imprecision and uncertainty in real world scenarios.
- To explain fuzzy systems, fuzzy logic and its applications.
- To explain Artificial Neural Networks and various categories of ANN.
- Design hybrid system to revise the principles of soft computing in various applications.
- To explain Genetic algorithms and rough set.

Course Outcomes:

By the end of the course, the student should be able to obtain:

- Ability to represent Uncertainty / imprecision data.
- Understand perceptrons and counter propagation networks.
- Ability to select a suitable method of Soft Computing to solve a particular problem.
- Ability to build hybrid systems using Soft Computing techniques.
- Analyze the genetic algorithms and their applications.

SYLLABUS:

Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

Interference in fuzzy logic: fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

Artificial Neural Network: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetro-associative memory, Hebb's Learning, Adaline, Perceptron.

Multilayer Feed Forward Network: Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Evolutionary and Stochastic Techniques: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications. Hybrid Systems: Neural Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

Text Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S.Rajsekaran and G.A. VijayalakshmiPai, Prentice Hall of India.
2. Rough Sets, Z.Pawlak, Kluwer Academic Publisher, 1991.
3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997

References:

1. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.
2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley
3. Learning and Soft Computing, V. Kecman, MIT Press, 2001
4. Fuzzy Sets and Fuzzy Logic, Klir& Yuan, PHI, 1997

HUMAN COMPUTER INTERACTION
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To gain an overview of Human-Computer Interaction, with an understanding of user interface design in general, and alternatives to traditional "keyboard and mouse" computing
- Be able to predict user performance in various human-computer interaction tasks
- Appreciate the importance of a design that maintains a focus on the user; be familiar with a variety of both conventional and non-traditional user interface paradigms

Course Outcomes:

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

- Apply HCI and principles for interaction and design.
- Appreciate importance of user documentation and information search

SYLLABUS:

Introduction: Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession Managing Design Processes: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories

Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays

Command and Natural Languages: Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large

Quality of Service: Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences Balancing Function and Fashion: Introduction, Error Messages, Nonanthropomorphic Design, Display Design, Web Page Design, Window Design, Color

User Documentation and Online Help: Introduction, Online Vs Paper Documentation, reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process

Information Search: Introduction, searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces

Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization

Text Books:

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
2. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.

Reference Books:

1. Human Computer, Interaction Dan R.Olsan, Cengage ,2010.
2. Designing the user interface. 4/e, Ben Shneidermann , PEA.

BIO-INFORMATICS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To import fundamental concepts in the area of Bioinformatics.
- To understand the concept of DNA Sequence analysis and Protein Information Resources.
- To learn Pairwise alignment techniques and Secondary database searching.
- To gain competence in Analysis packages.

Course Outcomes:

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

- Get introduced to the basic concepts of Bioinformatics and its significance in biological data analysis
- Overview about types and biological data and database search tools
- Explain about the methods to characterize and manage the different types of biological data.
- Classify different types of Biological Databases
- Implement the algorithms for single and multiple sequence alignments

SYLLABUS:

Introduction: Definition, History and Application areas of Bioinformatics. Major Information Resources: NCBI, EBI, ExPasy, TIGR, JGI, DDBJ Biological Databases: Primary & Secondary; Structure Databases, Specialized Databases, Chemical Databases.File Formats in Bioinformatics-Genbank, EMBL, Swissprot/Uniprot, PDB, Clustal, FASTA etc.

Sequence Similarity Searching: Basics of sequence alignment, Local and Global Sequence Alignment, similarity, Identity, homology, Sensitivity/Selectivity, Scoring System & Substitution Matrices: Distance and Similarity matrices, Identity Matrices, PAM & BLOSUM matrices & their Derivation DNA sequence databases, specialized genomic resources

Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI & PHI Blast, Statistical Significance. Sequence Pattern and Profiles: Concepts of motif, pattern and profile. Profile construction and its application in Bioinformatics. Gene Identity and identification tools

Tools for DNA & Protein Sequence Analysis: EMBOSS, PHYLIP, Mega2 Tools at NCBI, EBI, DDBJ, Microarray data analysis tools

Markov models: Hidden Markov models – The evaluation, decoding and estimation problem and the algorithms. Application in sequence analysis.

Molecular phylogeny: maximum Parsimony, distance Matrix and maximum likelihood methods. Concepts of adaptive evolution.

Application of graph theory in Biology: Biochemical Pathway, Protein-protein interaction network, Regulatory network and their analysis.

Text Books:

1. T.K Attwood & D.J Parry-Smith. Delhi. "Introduction to Bioinformatics". Pearson Education (Singapore) Pte.Ltd., 2001.
2. Bioinformatics: David Mount
3. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic acids, R.
4. Durbin, S.R. Eddy, A. Krogh and G. Mitchison**.**

DATA WAREHOUSING AND DATA MINING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To understand the evolution of data warehousing and data mining systems
- To provide an understanding of data objects, similarity and dissimilarity metrics and
- preprocessing techniques.
- To impart knowledge about the basics of data warehousing and modelling using data
- cubes, OLAPs, AOI.
- To familiarize the concepts of mining frequent patterns based on Associations.
- To discuss about pattern mining using classification and clustering methods.

Course Outcomes:

- Understands data objects, attribute types, metrics, cleaning and transformation of data.
- Ability to represent and comprehend information with data warehousing technologies for multidimentional modelling and generalisation using Cubes, OLAPS and AOI.
- Grasp the concepts of Association mining using Apriori and FP- Growth.
- Learn about various approaches to supervised learning like classification approach.
- Learn about various approaches to unsupervised learning like clustering approach.

SYLLABUS:

Introduction to Data Mining: Importance of Data Warehousing and Data Mining, Kinds of data, Kinds of patterns, Technologies, Applications, Major Issues in Data Mining

Getting to know your data: Data Objects and Attributes Types, Statistical Descriptions of Data, Estimating Data Similarity and Dissimilarity, Data Visualization.

Data Preprocessing: Quality data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation.

Data Warehouse and OLAP Technology: Basic Concepts of Data warehouse, Data Modelling using Cubes and OLAP, DWH Design and usage, Implementation using Data Cubes and OLAPs,Data Generalization with AOI.

Mining Frequent Patterns Based on Associations and Correlations: Basic Concepts, Frequent Item set Mining Methods: Apriori Algorithm, Association Rule Generation, Improvements to A Priori, FP-Growth Approach, Pattern Evaluation Methods.

Classification and Prediction: Basic Concepts, Decision Tree Induction, Bayes Classification,Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Classification by Back Propagation, K-nearest neighbour classifier.

Cluster Analysis: Basic Concepts and issues in clustering, Requirments for Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Evaluation of Clustering Solutions.

Text Books:

1. Data Mining- Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei–Morgan Kaufmann publishers –--3rd edition

2. Data Mining Techniques, A.K.Pujari, University Press.

References Books:

1. Data mining concepts by Tan, Steinbech, and Vipin Kumar - Pearson Edu

DEEP LEARNING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

From the course the student will learn

- Knowledge and expertise for building deep learning models.
- Various architectures for deep learning and their suitability to specific problems
- Program development and evaluation support from Tensorflow
- Q-learning and the other methods for deep reinforcement learning
- Different types of auto-encoders for unsupervised feature extraction

Course Outcomes:

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

- Build feed forward neural networks with appropriate options using Tensorflow
- Write Tensorflow programs for learning using convolution neural networks.
- Apply the concepts of recurrent NNs with LSTM and attention for learning word embeddings and NLP tasks
- Apply various methods for deep reinforcement learning
- Use the appropriate type of auto-encoders for problem solving.

SYLLABUS:

Feed forward neural networks:perceptrons, cross-entropy loss estimation, derivatives and Stochastic Gradient descent, NN implementation issues, matrix representation of NNs, Data independence,

Tensorflow: preliminaries, simple TF program, Multi-layered NNs, setting checkpoints, tensordot, initialization of TF variables, simplifying TF graph creation. PyTorch basics and uses

Convolutional Neural Networks: Filters, strides and padding, simple TF Convolution program, Multilevel Convolution, convolution details, biases, layers with convolution, pooling

Recurrent NNs and Word Embeddings: Word Embeddings for Language Models,Building feed forward LMs, Improving Feed forward models, Overfitting, Recurrent Neural networks, Long-Short term Memory cells, TF implementation

Sequence to sequence Learning: Seq2Seq paradigm, writing a Seq2Seq Machine Translation program, Attention in Seq2Seq,Multilength Seq2Seq, Implementation in TF

Deep Reinforcement Learning: Value Iteration, Q-learning,Basic deep Q-learning,Policy gradient methods,Actor-critic methods, Experience replay

Unsupervised NN Models: Basic autoencoding, Convolutional autoencoding, variational autoencoding, Generative adversarial networks

Textbook:

1. Eugene Charniak, “Introducing to Deep Learning”, MIT press, 2018

2. Sherin Thomas,Sudhanshu Passi, “PyTorch Deep Learning hands-On”, Packt publishers

3. Ian Goodfellow, YoshuaBengio and Aaron Courville, “Deep Learning”, MIT press, 2016

Reference Books:

1. Jeremy Howard and Sylvain Gugger, “Deep Learning for coders with Fastai and Pytorch”, OReilly, 2020
2. John Krohn, etal, “Deep Learning Illustrated”, Pearson edu. India, 2020

OPEN ELECTIVES

1. CYBER SECURITY & DIGITAL FORENSICS
2. BLOCKCHAIN TECHNOLOGY
3. MOBILE COMPUTING
4. MOBILE ADHOC NETWORKS
5. RECOMMENDER SYSTEMS
6. NOSQL DATABASES
7. DATA SCIENCE
8. BUSINESS ANALYTICS
9. PYTHON PROGRAMMING
10. INTERNET OF THINGS
11. EMBEDDED SYSTEMS
12. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
13. INDUSTRY 4.0

OPEN ELECTIVES for other departments - (MINOR)

1. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
2. DATA SCIENCE
3. CYBER SECURITY & DIGITAL FORENSICS
4. DATABASE MANAGEMENT SYSTEMS

CYBER SECURITY & DIGITAL FORENSICS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and it applications.

Course Outcomes:

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

- Differentiate among different types of security attacks.
- Define computer forensics.
- Identify the process in taking digital evidence.
- Describe how to conduct an investigation using methods of memory, operating system, network and email forensics with different forensic tools.

SYLLABUS:

Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks--Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, defining a web application test scope and process, Defining types of penetration testing.

Web Application Security: Common Issues in Web Apps, what is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues.

Forensics & Network Assurance: Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection

Information Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case

Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle

Text Books:

1. Cyber Security & Digital Forensics by Anas Zakir, Clever Fox Publishing, Publication Date-2022
2. "Beginners Guide To Ethical Hacking and Cyber Security ", by Abhinav Ojha, Khanna Publishers, First Edition, Publication Date-2023

Reference Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart

BLOCKCHAIN TECHNOLOGY
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To understand the basic concepts block chain technology and to explore the driving force behind the crypto currency Bitcoin.
- To understand about the different methods of Decentralization using Block Chain and different Bitcoins and Alternative Coins.
- To understand about Ethereum and applications using Smart contracts and Block Chain Applications.
- To get familiarity with future currencies and to create own crypto token.

Course Outcomes:

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

- Explore the primitives of the distributed computing and cryptography related to blockchain
- Understand the types, benefits and limitation of block chain.
- Enumerate the Bitcoin features and its alternative options.
- Understand the modern currencies and its market usage.
- Implement and deploy the smart contracts in different environments like Ethereum.
- Usage of smart contracts in various real world application domains.

SYLLABUS:

Block Chain and its History: History of blockchain, Types of blockchain, Blockchain Components – Permissioned Blockchain Permission less Blockchain – Consortium Blockchain – basics of Consensus Algorithms, Architecture & Properties of Blockchain.

Decentralization and Consensus Algorithms: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations, Distributed systems, Distributed ledger, Merkle tree, structure of a block, Consensus

Algorithms: Proof of Work, Proof of Stack, Proof of Burn, Proof of Elapsed Time, Proof of Activity, Proof of Concept.

Bitcoin and Alternative Coins: Bitcoin, Transactions, Bitcoin payments , Bitcoin properties – Transaction life cycle – creation of coin –sending payments – double spending using blockchain – bitcoin anonymity – Ether: Ethercoin properties, Alternative Coins, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

Ethereum and smart contracts: Ethereum Architecture, solidity programming basics, Smart Contract, Deploying Smart Contracts, Integration with UI.

Blockchain Applications: Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media, Secure Voting and Digital Identity, Real Estate, Education

Textbooks:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017
2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
3. Blockchain Technology, Author- Chandramouli Subramanian, Asha A George, Abhilash K A, Meena Karthikeyan, University Press (India) Private Limited, 2021

References Books:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017

MOBILE COMPUTING
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
- To explore both theoretical and practical issues of mobile computing.
- To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

Course Outcomes:

On successful completion of course learner will be able:

- To identify basic concepts and principles in mobile communication & computing, cellular architecture.
- To describe the components and functioning of mobile networking.
- To classify variety of security techniques in mobile network.
- To describe and apply the concepts of mobility management

SYLLABUS:

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture, Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices, GSM - Services, System Architecture, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS-network operation, data services and applications

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

Mobile Network & Transport Layers: IP and Mobile IP Network Layers, Packet Delivery and Handover, Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks

Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation Transactional Models, Query processing, Data Recovery Process & QoS Issues

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software and Protocols.

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR,AODV,DSDV, etc., Mobile Agents, Service Discovery

Protocols and Platforms for Mobile Computing:
Basic of WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.

Text Books:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

Reference Books:

1. ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, "Mobile Computing, Technology Applications and Service Creation" Second Edition, Mc Graw Hill.
2. UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," Second Edition, Springer.

MOBILE ADHOC NETWORKS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To understand the concepts of mobile adhoc networks
- To understand the concepts of wireless LANs, wireless adhoc networks, types and their routing protocols.
- To introduce students to mobile communications and mobile computing.
- To understand basics of HIPERLAN, Wireless ATM technologies.

Course Outcomes:

By the end of the course, the student should be able to obtain:

- Ability to understand the state-of-the-art research in the emerging subject of Mobile Adhoc Networks
- Understand GSM, TDMA, CDMA, IS-95 technology
- Understand wireless LANs, IEEE 802.11 WLANs.
- Understand Wireless ATM and HIPERLAN, Adhoc networking and WPAN.

SYLLABUS:

GSM and TDMA Technology: Introduction, What is GSM, Mechanisms to support a Mobile Environment, Communications in the Infrastructure.

CDMA Technology,IS-95, and IMT-2000: Introduction, Reference Architecture for North American Systems, What is CDMA, IMT-2000.

Mobile Data Networks: Introduction, The Data-Oriented CDPD Network, GPRS and Higher Data Rates, Short Messaging Service in GSM, Mobile Application Protocols.

Introduction to Wireless LANs: Introduction, Historical Overview of the LAN Industry, Evolution of the WLAN Industry, New Interest from Military and Service Providers, A New Explosion of Market and Technology, Wireless Home Networking.

IEEE 802.11 WLANs: Introduction, What is IEEE 802.11, The PHY Layer, MAC sub layer, MAC Management sub layer.

Wireless ATM and HIPERLAN: Introduction, What is Wireless ATM, What is HIPERLAN, HIPERLAN-2.

Ad Hoc Networking and WPAN: Introduction, What is IEEE 802.15 WPAN, What is HomeRF, What is Bluetooth, Interference between Bluetooth and 802.11

Wireless Geolocation Systems: Introduction, What is Wireless Geolocation, Wireless Geolocation System Architecture, Technologies for Wireless Geolocation, Geolocation Standards for E-911 Services, Performance measures for Geolocation Systems.

Text Books:

1. Principles of Wireless networks KavethPahlavan, K.Prasanth Krishnamurthy, Pearson Publications, Asia,2002

RECOMMENDER SYSTEMS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

To understand the

- Basic concepts of recommender systems
- Various approaches for building Recommender systems
- Personalization algorithms, evaluation tools, and user experiences
- Various attacks and privacy aspects on collaborative recommender systems
- Several applications of Recommender systems

Course Outcomes:

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

- Describe basic concepts behind Recommender Systems
- Explain a variety of approaches for building recommender systems
- Describe system evaluation methods from both algorithmic and users' perspectives
- Describe various attacks and privacy aspects on collaborative recommender systems.
- Describe applications of recommender systems in various domains

SYLLABUS:

Collaborative recommendations: User-based nearest neighbor recommendation, Item -based nearest neighbor recommendation, About ratings, Model-based and Preprocessing-based approaches, Recent practical approaches and Systems.

Content- based recommendation: Content representation and content similarity, Similarity-based retrieval, other text classification methods.

Knowledge-based recommendation: Introduction, Knowledge representation and reasoning, Interacting with constraint—based recommenders, Interacting with case-based recommenders, Example applications.

Hybrid recommendation approaches: Opportunities for hybridization, Monolithic hybridization design, Parallelized hybridization design, Pipelined hybridization design.

Evaluating recommender systems: Introduction, General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs.

Attacks on collaborative recommender systems: A first example, Attack dimensions, Attack types, Evaluation of effectiveness and countermeasures, Countermeasures, Privacy aspects - distributed collaborative filtering.

Online consumer decision making: Introduction, Context effects, Primacy/recency effects, Further effects, Personality and social psychology. Recommender systems and the next-generation web: Trust aware recommender systems, Folksonomies and more, Ontological filtering, Extracting semantics from the web.

Text Book:

1. Recommender Systems: An Introduction by Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich, Cambridge University Press.

Reference Book:

1. Recommender Systems: The Textbook by Charu C. Aggarwal, Springer Publications.

NoSQL DATABASES
OPEN ELECTIVE
SYLLABUS

Course Objectives:

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

- Define NoSQL, its characteristics and history, and the primary benefits for using NoSQL data
- Define the major types of NoSQL databases including a primary use case and advantages/disadvantages of each type
- Create wide-column, document, key-value, graph and object-oriented databases, add content, and run queries.
- Describe the NoSQL data architecture patterns
- Perform basic database administration tasks.
- Develop NoSQL desktop and cloud database solutions.

Course Outcomes:

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

- Enumerate different features of NOSQL Databases
- Compare different data models
- Design a Key-Value Database for a real world problem
- Design a Document Database for a real world problem
- Design a Graph Database for a real world problem

SYLLABUS:

Introduction to NoSQL. The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters,The Emergence of NoSQL.

Aggregate Data Models, Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.

More Details on Data Models, Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access, Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication, Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums

Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets

Document Databases, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

Column-Family Stores, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters.

Graph Databases, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services Recommendation Engines

Text Books:

1. Sadalage, P. & Fowler, M., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. (1st Ed.). Upper Saddle River, NJ: Pearson Education, In, 2012.

Reference Books:

1. Gauravvaish, Getting started with NoSQL , PACKT publishing, ISBN: 978184969488
2. Redmond, E. & Wilson, J., Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.), 2012
3. Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978- 1934356920 ISBN-10: 1934356921

DATA SCIENCE
OPEN ELECTIVE
SYLLABUS

Course Objectives:

From the course the student will learn

- Knowhow and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA) in data science.
- Critically explore and analyze data visualizations presented on the dashboards
- Suitability and limitations of tools and techniques related to data science process

Course Outcomes:

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

- Describe the steps involved in Data Science process and the technologies needed for a data scientist.
- Identify suitable ML techniques for data modelling and apply them for decision support.
- handle large datasets with distributed storage and processing system
- use appropriate tools for data collection, EDA and model building for specific types of data 5. build a prototype application of Data Science as a case study.

SYLLABUS:

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML including semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cipher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript Map Reduce library, creating an interactive dashboard with dc.js, Dashboard development tools, Applying the DS process for respective engineering problem solving scenarios as a detailed case study.

Textbook:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016

2. Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics

Reference Books:

1. Joel Grus, "Data Science From Scratch", OReilly, 2019

2. Doing Data Science: Straight Talk From the Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

BUSINESS ANALYTICS
OPEN ELECTIVE
SYLLABUS

Course objectives:

- To introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization
- To introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference
- To learn the basic arithmetic functions used in MS Excel
- To familiarize students with various types of regression including simple linear regression and multiple linear regression

Course outcomes:

After completion of the course the student should be able to:

- Describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data
- Estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing
- Estimate and interpret the parameters of simple linear regression and multiple linear regressions

SYLLABUS:

Foundations of Business Analytics: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. Descriptive Analytics: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and filtering, Data summarization with statistics, Data exploration using Pivot tables

Statistical Sampling: methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence

Trendliness and Regression: Modelling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modelling

Forecasting Techniques: Qualitative and judgmental forecasting, statistical forecasting models, forecasting models for stationary time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based forecasting models, regression forecasting with casual variables, practice of forecasting

Spreadsheet modeling and Analysis: Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and realism, developing user-friendly applications, analyzing uncertainty and model assumptions, model analysis using analytics solver platform

Linear Optimization & Applications: Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book:

1."Business Analytics: Methods, Models, and Decisions" James R. Evans, Pearson Publications,Second edition

Reference Book:

1."Business Analytics: The Science of Data-Driven Decision Making", U.Dinesh Kumar, Wiley Publications

PYTHON PROGRAMMING
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To develop skills on procedural oriented and object oriented programming in Python.
- To understand key data structures in Python and apply different data wrangling techniques using Python.
- To understand data related libraries such as Numpy and Pandas.
- To understand concepts of data analysis using Python libraries
- To introduce exploratory data analysis using Matplotlib data visualization concepts

Course Outcomes:

After completion of the course the student should be able to:

- Acquire knowledge on basic Python programming and usage of associated Python Libraries
- Acquire knowledge on usage of Object oriented Programming concepts in Python.
- Acquire knowledge on pre-processing data, compressing data, clustering, classification and cross-validation.
- Acquire knowledge on Data analysis with Pandas
- Acquire Knowledge on implementing Data Visualization techniques in Python.

SYLLABUS:

Introduction to Python: Rapid Introduction to Procedural Programming, Data Types: Identifiers and Keywords, Integral Types, Floating Point Types Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str, format, Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections, Introduction to PIP

Control Structures & Functions: Python Control Structures, Functions and OOP:Control Structures and Functions: Conditional Branching, Looping, Exception Handling, Custom Functions, Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics, creating a custom module

Object Oriented Programming: Object Oriented Concepts and Terminology, Custom Classes, Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access, File Handling: Writing and Reading Binary Data, Writing and Parsing Text Files

NumPy Arrays and Vectorized Computation: NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, Saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers

Data Analysis with Pandas: An overview of the Pandas package, The Pandas data structure-Series, The DataFrame, The Essential Basic Functionality: Reindexing and altering labels , Head and tail, Binary operations, Functional statistics , Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data

Data Analysis Application Examples: Data munging, Cleaning data, Filtering, Merging data, Reshaping data, Data aggregation, Grouping data

Data Visualization: The matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas

Text Books

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications

2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis , Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd

Reference Books

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications

2. Python for Data Analysis, Wes McKinney, Orielly Publications

3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers

4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall

5. Python Cookbook – Recipes for Mastering Python 3,3rdEdition, David Beazley, Brian K. Jones, Oreilly

INTERNET OF THINGS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- Understand IoT conceptual framework and design standardisation of IoT/M2M architectural layers and domains
- Learning the usage of messaging protocols between connected devices and the web
- Identify the functions and usage of data analytics and cloud services for IoT applications and business processes.
- Elucidate sensor technology for sensing the real world using analog and digital sensors
- Develop the codes, design and test the embedded devices for IoT and M2M using IDEs and development platforms

Course Outcomes:

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

- Understand the IoT Standards and design principles.
- Understand various web-communication protocols and their practical usage.
- Able to use IoT cloud-based services using the Xively, Nimbits.
- Able to learn various types of sensors and actuators, interfacing and use in IoT environment.
- Able to use number of device platforms of IDEs, such as Arduino, Intel Galileo, RPi, BB and mBed, provide development tools, libraries and framework, and are used for the development of embedded Software.

SYLLABUS:

The Internet of Things: An Overview of Internet of things, Internet of Things Conceptual Frame work, IoT architectural View, Technology behind IoT, Sources of IoT, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity: IoT/M2M System Layers and Design Standardization.

Design for Web Connectivity.: Web communication protocols for connected devices, Message Communication protocols for connected devices, Web Connectivity for Connected-Devices Network using Gateway, SOAP, REST, HTTP RESTFUL, and Web Sockets, Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

Data Acquiring, Organizing, Processing and Analytics: Data Acquiring and Storage, Organizing the Data, Transactions, Business Processes, Integration and Enterprise Systems. Analytics, Knowledge acquiring, managing and storing process.

Data Collection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing. Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively, Nimbits and other platforms.

Sensor, Participatory Sensing, RFID, Wireless Sensor Networks: Sensors Technology, Participatory Sensing, Actuator, Sensor Data Communication Protocols, RFID, WSN.

Prototyping and Designing the Software for IoT Applications: Prototyping embedded device Software, Devices, Gateways, Internet and Web/Cloud Services Software Development, Prototyping Online Component APIs and WebAPIs.

IoT Case Studies: Design Layers, Design Complexity and Designing Using Cloud PaaS. IoT Applications for Smart Homes, Cities, Environmental Monitoring and Agriculture. Connected Car and Its applications.

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

EMBEDDED SYSTEMS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To study the basics of embedded systems and interrupt basics.
- To discuss various software architectures in embedded systems.
- To impart knowledge about RTOS.
- To discuss Inter Task Communication procedures and design issues of RTOS.
- To provide various embedded software development tools and debugging techniques.

Course Outcomes:

- Grasp basics of embedded systems and interrupts.
- Familiarize Round-Robin, Round-Robin with Interrupts, Function-Queue Scheduling and Real-Time Operating Systems Architectures
- Gain knowledge about the concepts related to RTOS
- Understand various Inter Task Communication methods and design issues in RTOS environment.
- Understand about embedded software development tools.

SYLLABUS:

Introduction to Embedded Systems: Examples, Typical Hardware, Memory, Microprocessors, Busses; Interrupt Basics, Shared-Data problem, Interrupt Latency.

Software Architectures: Round-Robin Architecture, Round-Robin with Interrupts Architecture, Function-Queue Scheduling Architecture, Real-Time Operating Systems Architecture, Selection of Architecture.

Real Time Operating System: Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Semaphore Problems, Semaphore variants.

Inter Task Communication: Message Queues, Mailboxes, Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in RTOS Environment.

Design issues of RTOS: Principles, Encapsulation Semaphores and Queues, Hard Real-time Scheduling Considerations, Saving Memory Space, Saving Power.

Embedded Software Development Tools: Host and Target Machines, Linker/Locator for Embedded Software, Getting Embedded Software into the Target System.

Embedded Software Debugging Techniques: Testing on your Host Machine, Instruction Set Simulators, Laboratory Tools used for Debugging.

Text Books:

1. An Embedded Software Primer, David E. Simon, Pearson Education, 2005.

Reference Book:

1. Embedded Systems: Architecture, Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
OPEN ELECTIVE
SYLLABUS

COURSE OBJECTIVES: From the course the student will learn

- Know user interfaces to improve human and AI interaction and decision making.
- Allows the students to develop AI skills.
- Introduce the concepts of expert systems and machine learning.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

COURSE OUTCOMES:

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

- Understanding Artificial Intelligence and different branches of Artificial Intelligence and demonstrate awareness of informed search and exploration methods.
- Understanding various Machine Learning Methods.
- Analyzing the different Classification and Regression Techniques.
- Familiarization of Architecture in Convolution Neural Networks.
- **U**nderstanding the concepts of different supervised learning methods and its Applications.

Syllabus

Unit I: Introduction to Artificial Intelligence: Biological Motivation for a Human Brain, Neural Network Representation, ANN Architecture, Perceptron, Multi-Layer Perceptron Structure, Back Propagation.

Unit II: Machine Learning: Introduction to Machine Learning, Different Types of Machine Learning Methods, Supervised, Semi Supervised, Unsupervised and Reinforcement Learning.

Unit III: Classification and Regression Algorithms: Difference Between Classification and Regression, Classification Algorithms, KNN, SVM Algorithms and its Applications, Regression Algorithm, Linear Regression, Decision Tree Regression and Random Forest Regression.

Unit IV: Convolution Neural Networks: Introduction to Convolution Neural Networks**,** Basic Principle, Architecture**,** Types of CNN Layers, Pooling Layers, Convolution Layers and Fully Connected Layers, Applications of CNN.

Unit V: Advanced Topics in Artificial Intelligence and Machine Learning: DNN Model, Significance, Overview of DNN Technique and its Applications, Generative Models, Working Principle of GAN and its Applications.

Text Books:

1. Artificial Intelligence and Machine Learning by Vinod Chandra SS and Anand Hareendran S, PHI Publications.
2. Artificial Intelligence – A Model Approaceh Stuart Russel and Peter Norvig.

Reference Books:

1. Introduction to Artificial Intelligence by Ertel W (2018) Springer International Publishing.
2. Machine Learning and Artificial Intelligence by Joshi and Ameet V (2022) Springer International Publishing.

INDUSTRY 4.0
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- This course provides students with an introduction to Industry 4.0, its building blocks, its applications and advantages compared to conventional production techniques.
- Learners get a deep insight into components and technologies of industry 4.0 can be used to build up the production of the future.
- It is also important that the theory is deepened by means of roadmap technologies with phase wise developments.
- To impart knowledge of smart manufacturing, IIot for industry 4.0.
- To expand Robotic technology with Augmented reality for Industry 4.0 and obstacle with framework conditions for Industry 4.0

Course Outcomes:

Students will be able to:

- Describe Industry 4.0 and scope for Indian Industry
- Demonstrate conceptual framework and road map of Industry 4.0
- Describe IIoT, cloud computing and big data, smart factories' role in Industry 4.0
- Describe Robotic technology and Augmented reality for Industry 4.0
- Demonstrate obstacle and framework conditions for Industry 4.0

SYLLABUS:

Introduction to Industry 4.0: Introduction, Idea of Industry 4.0, Various Industrial Revolutions, Origin concept of Industry 4.0, Industry 4.0 Production system, How is India preparing for Industry 4.0, Comparison of Industry Factory and Today's Factory.

Trends in Industry 4.0: Introduction, Main Concepts and Components of Industry 4.0, State of Art Technologies, Proposed Framework for Industry 4.0, Trends of Industrial Big Data and Smart Business Transformation.

Roadmap for Industry 4.0: Introduction, Proposed Framework for Technology Roadmap: Strategy Phase, Development Phase, Smart Manufacturing, Types of Smart Devices, Smart Logistics, Smart Cities, Predictive Analytics.

Advances in the Era of Industry 4.0: Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Things, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly, IIoT- Industrial IoT.

The Role of Industry 4.0 and Future Aspects: Introduction, Challenges & Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

Reference Books:

1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröde, "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

List of OpenSource Software/learning website:

1. www.nptel.ac.in/

(Material Is Readily Available On Internet)

HSS ELECTIVES

1. OPERATIONS RESEARCH
2. ORGANIZATIONAL BEHAVIOUR
3. INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
4. FINANCIAL MANAGEMENT FOR ENGINEERS

OPERATIONS RESEARCH
HSS ELECTIVE
SYLLABUS

Course Objectives:

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

- Formulate a real-world problem as a mathematical programming model
- Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
- Understand the relationship between a linear program and its dual, including strong duality and complementary slackness
- Solve specialized linear programming problems like the transportation and assignment problems
- Solve network models like the shortest path, minimum spanning tree, and maximum flow problems

Course Outcome:

After learning the course, the students should be able to:

- Students will be able to describe characteristics and scope of OR.
- Students will be able to define and formulate mathematical problems.
- Students will be able to select optimal problems solving techniques for a given problem using LP.
- Students will be able to formulate and solve transportation, travelling sales man and transshipment problems.
- Students will be able to formulate and solve optimization problems related to job/ work assignments.
- Students will be able to demonstrate and solve simple models of Game theory.
- Students will be able to evaluate optimum solution using dynamic programming for different applications.

SYLLABUS:

Overview of Operations Research: Types of OR Models, Phases of Operations Research–OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis.

Standard Form of LPP: Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Artificial Variables, Big M Method, Two Phase Simplex Method, Degeneracy,
Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal and Dual Problems and Their Relations, Dual Simplex Method

Transportation Problem: LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogel's Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms

Assignment Problem: Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N Jobs K Machines Problems, Two-Jobs M- Machine Problems, Crew Scheduling Problems

Network Representation of a Project: CPM and PERT, Critical Path Calculations, Time – Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

Replacement Problems: Individual and Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems with and Without Shortages, Inventory Problems with Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

Game Theory: Two Person Zero Sum Games, Mixed Strategy Games and Their Algorithms.

Textbooks:

1. Operations Research, KantiSwaroop, P.K. Gupta, ManMohan, Sulthan Chand & Sons Education
2. Operations Research–An Introduction, HandyATaha–Pearson Education

References:

1. Taha.H.A, Operations Research : An Introduction, McMilan publishing Co., 1982. 7 th ed.
2. Ravindran A, Philips D.T & Solberg.J.J, Operations Research: Principles and practice, John Wiley & Sons, New York, 1987.
3. Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management. All India Traveler Book seller, Delhi.
4. Gillet.B.E., Introduction to Operations Research - A Computer oriented algorithmic approach, McGraw Hill, 1987.
5. Joseph.G.Ecker& Michael Kupper Schimd, Introduction to Operations Research, John Wiley & Sons, 1988.
6. Hillier.F.S & Liberman.G.J, Operations Research, Second Edition, Holden Day Inc, 1974.
7. Kanti Swarup, Gupta.P.K. & Man Mohan, Operations Research, S.Chand& Sons

ORGANIZATIONAL BEHAVIOUR
HSS ELECTIVE
SYLLABUS

Course Objectives:

- To understand the basic concepts of organizational behaviour, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behaviour in organizations, including communication, leadership conflicts and organizational change and how these are linked to and impact organizational performance.

Course Outcomes:

- Identifying fundamental aspects of organizational dynamics.
- Evaluate main theories of motivation and formulating suitable motivational strategies.
- Analyse the behaviour of individuals and groups in organizations.
- Understanding of Leadership theories and Leadership behaviour.
- Apply relevant theories, concepts to address important Organizational Behaviour questions.

SYLLABUS:

Organizational Behaviour: Concept of Organisation - Concept of Organizational Behaviour - Nature of Organizational Behaviour - Role of Organizational behaviour - Disciplines contributing to Organizational Behaviour.

Motivation: Definition - Nature of Motivation - Role of Motivation - Theories of Motivation: Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non-Verbal communication - Direction of communication: Downward, Upward and Horizontal communication.

Organizationalconflits: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Inter organisational conflict - Conflict management.

Organizational Change: Nature - Factors in Organizational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Textbooks:

1. L.M.Prasad: Organizational Beaviour, Sultan Chand & Sons, New Delhi -110002
2. K. Aswathappa: Organizational Behaviour, Himalaya Publishing House, New Delhi

Reference Books:

1. Stephen Robbins: Organizational Behaviour, Pearsons Education, New Delhi.

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
HSS ELECTIVE
SYLLABUS

Course Objectives:

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

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

- Understand the roles, skills and functions of management.
- Distinguish the different types of business organizations.
- Identify the factors involved in Production Operations Management.
- Diagnose organizational problems and take suitable decisions.
- Establish good Human Resource Management practices.
- Acquire necessary knowledge and skills required for organizing and carrying out

SYLLABUS:

Basic Concepts of Management: Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations**;** Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint Sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; Stages in Project formulation; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Textbooks:

1. Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai , (The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth),HImalayan Publishing House, 2018.

Reference Books:

1. Aryasri , A.R., Management Science, McGraw HIll Education (India Private Limited , New Delhi 2014.
2. Sheela, P. , and Jagadeswara Rao**,** K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

FINANCIAL MANAGEMENT FOR ENGINEERS
HSS ELECTIVE
SYLLABUS

Course Objectives:

- To provide awareness and understanding of the ways finance helps in reaching business objectives.
- To familiarise with the form, content and analysis of financial statements and the accounting principles and techniques.
- To Identify signals pointing to deterioration in financial condition and analyse the reasons for variances between the actual and budgeted results
- To facilitate in the improvement of organizations‘ performance by pointing out the importance of cost control, breakeven and variance analysis.
- To equip with the ability to communicate comfortably with Financial Executives and discuss the financial performance of the organization effectively.

Course Outcomes:

- Ability to Analyse financial statements
- Understanding costs and methods to reduce them
- Taking decisions regarding the price of the products services, or both
- Skill to practice different Budgeting Systems in organisations.

SYLLABUS:

Accounting concepts and systems - Elements of Financial Statements - Trading, Profit & Loss Statement- Cash Flow Statements - Notes to Accounts - Profits vs. Cash Flows

Analysis of Financial Statements - Financial Analysis - Financial Ratios and their Interpretations covering: Profitability Ratios; Liquidity Ratios; Return on Capital Ratios; - Management of Working Capital: Capital and Its Components - Working Capital Cycle - Working Capital Financing.

Management Decision Making- Cost concepts and its application in Decision Making - Types of cost – Direct & Indirect, Fixed & Variable - Cost Sheet - Cost Volume Profit Analysis - Understanding Cost behaviour – Cost concepts and its application in Decision Making - Relevance of Activity Based Costing - Marginal Costing - Make or Buy - Shut down or continue - Sell or process further - Domestic vs. Export Sales

Budgets and Budgetary Control- Different types of Budgets (Departmental, Function based, Cash, Master) - Budgeting systems (ABC / ZBB / Rolling/ Incremental / Planning) - Variance Analysis - Capital Budgeting and Investment Appraisals - Meaning of Capital Budgeting - Relevance of Capital Budgeting - Techniques of Capital Budgeting - Payback Period - Accounting Rate of Return - Net Present Value - Internal Rate of Return - Discounted Payback Period

Means of Finance- Financial Instruments - Shares, Debentures, Derivatives - Share Capital Vs. Term Loans- Leasing - Financial Markets - Capital Markets - Stock Exchanges.

Reference Books:

1. Finance for Non-Finance People by Sandeep Goal (2017), Publisher: Taylor and Francis.
2. Finance for Non-Finance Managers by B.K. Chatterjee (1988), Jaico Publishing House, Sold by Amazon
3. Finance for Nonfinancial Managers: Finance for Small Business, Basic Finance Concepts (Accounts and Finance) by Murugesan Ramaswamy (2021), Repro Books-On-Demand