

MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belgaum)



Autonomous Programmes

Bachelor of Engineering

DEPARTMENT

OF

INFORMATION SCIENCE AND ENGINEERING

SCHEME And SYLLABUS

2020 Admitted batch

VISION

The department will be a premier centre focusing on knowledge dissemination and generation to address the emerging needs of information technology in diverse fields.

MISSION

1. To make students competent to contribute towards the development of IT field
2. Promote learning and practice of latest tools and technologies among students and prepare them for diverse career options
3. Collaborate with industry and institutes of higher learning for Research and Development, innovations and continuing education
4. Developing capacity of teachers in terms of their teaching and research abilities
5. Develop software applications to solve engineering and societal problems

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates will be successful professionals in IT industry with good design, coding and testing skills, capable of assimilating new information and solve new problems

PEO2: Graduates will communicate proficiently and collaborate successfully with peers, colleagues and organizations

PEO3: Graduates will be ethical and responsible members of the computing profession and society

PEO4: Graduates will acquire necessary skills for research, higher studies, entrepreneurship and continued learning to adopt and create new applications

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon graduation, students with a degree B.E. in Information Science & Engineering will be able to:

1. Design and develop efficient information systems for organizational needs.
2. Adopt Latest Platforms & tools for implementing solutions.

Scheme of Evaluation (Theory Courses)

Assessment	Marks
FOUR assessments based on each module, each for 10 marks	10*4=40
Activities	10
SEE	50
Total	100

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous internal Evaluation in every lab session by the Course coordinator	30
Laboratory CIE conducted by the Course coordinator	20
SEE	50
Total	100

Examination	Maximum Marks	Minimum marks to qualify
CIE	50	20
EE	50	20

Scheme & Syllabus for II Year
B. E. - Information Science and Engineering
Admitted Year 2020

III Semester					
Course Code	Course Category	Course Title	L-T-P	Credits	Contact hours
20MA301	BS-7	Linear Algebra and Integral Transforms	3-1-0	4	5
20MA302	BS-8	Discrete and Combinatorial Mathematics	3-1-0	4	5
20IS303	PC-1	Digital Systems Design	3-0-1	4	5
20IS304	PC-2	Data Structures and Applications	4-0-0	4	4
20IS305	PC-3	Computer Organization and Architecture	3-0-0	3	3
20IS306	PC-4	Unix and Shell Programming	2-0-1	3	4
20IS307	PC-5	Data Structures and Applications Laboratory	0-0-1	1	2
20BCM301	BS	Bridge Course Mathematics -1 (Audit course for Diploma entry students)	3-0-0	-	-
20KNS/20KNB	HSM-2	Samskruthika Kannada / Balake Kannada (Kannada for Conversation)	0-2-0	1	2
20LSK	HSM-3	Language Skills (Mandatory Audit course)	0-2-0	-	2
Total Credits				24	32

IV Semester					
Course Code	Course Category	Course Title	L-T-P	Credits	Contact hours
20MA401	BS-9	Statistics and Complex analysis	3-1-0	4	5
20IS402	PC-7	Microprocessor and Microcontroller	3-0-0	3	3
20IS403	PC-8	Operating Systems	3-0-0	3	3
20IS404	PC-9	Design and Analysis of Algorithms	4-0-0	4	4
20IS405	PC-10	Software Engineering	4-0-0	4	4
20IS406	PC-11	Object Oriented Programming	3-0-0	3	3
20IS407	PC-12	Microprocessor and Microcontroller Laboratory	0-0-1	1	2
20IS408	PC-13	Algorithms Laboratory using Python	0-0-1	1	2
20BCM401	BS	Bridge Course Mathematics-2 (Audit course for Diploma entry students)	3-0-0	-	-
20SSK	HSM-4	Social Skills (Mandate Audit course)	0-1-0	-	2
Total Credits				23	28

20MA301 - Linear Algebra and Integral Transforms (3-2-0) 4

Exam: 3Hrs.
SEE: 50 Marks

Hours/Week: 5
Total Hours: 42

Course Objective:

The student will learn linear algebra, transform techniques, (Fourier transform and Laplace Transform) and application related problems.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Examine for linear dependency of vectors, solution of engineering applications problems connected with system of equations, based on the concept of rank of matrix.	1,2,3	-
2	Compute the Eigen values, linearly independent Eigen vectors, diagonalization of matrix, least square solution of system of equations, orthogonal basis of vector subspace and solve engineering application problems.	1,2,3	-
3	To represent the function/experimental data in terms of a Fourier series and apply Fourier transforms/inverse transform techniques on a given function	1,2,3	-
4	Apply transforms techniques, inverse transform techniques (Laplace transform,) on a given function and apply its concept to solve the differential equations, governing applications.	1,2,3	-
5	Model real life problems/engineering application-oriented problems and analyse the physics inherited in the application	1,2,3	

MODULE-1

Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of nonhomogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method.

Linearly dependent and linearly independent vectors, relation between rank of a matrix and number of linearly independent vectors in a matrix - Special matrices-matrix of rotation, reflection, translation, nullity of a matrix A. To find the matrix of transformation when the image of some points is given. Applications of solution of system of equations to balance the chemical equations, traffic problem, to find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietitian.

10 Hrs

MODULE-2

Linear Algebra: Eigen values and Eigen vectors, properties, Illustrative examples, applications- Stretching of an elastic membrane, to determine the growth of a population model.

Diagonalization and powers of 2×2 matrices, Diagonalization and powers of 3×3 matrices when Eigen values are already given, least square solution of system of equations- a matrix approach, Gram Schmidt process to find an orthogonal basis. Stability analysis of differential equations which

governs the dynamical systems using the concept of eigen value, eigen vectors.

10 Hrs

MODULE-3

Fourier Transforms and Inverse Fourier Transforms: – Properties of Fourier transform, Evaluation of Complex Fourier, Fourier sine & Fourier cosine transforms. Inverse complex Fourier transform, Inverse sine & Cosine transforms.

Fourier Series: Periodic functions and their graphical representation, to find Fourier series by change of interval method, illustrative examples from engineering field. Graph of Fourier series of a given function. To represent the experimental data as a Fourier series using the method - Practical harmonic analysis. Half range series method, application of Fourier series and Fourier transforms in engineering.

12 Hrs

MODULE-4

Laplace Transforms: Introduction, Definition, Importance of Laplace transform in engineering applications, properties, Laplace transform of standard functions, Laplace transform of derivatives, Laplace transform of periodic functions, unit-step functions and unit impulse functions (Dirac – delta function).

Inverse Laplace Transforms: Definition and general properties, Convolution theorem – illustrative examples, Initial value problems. To solve Applications of initial value problems in engineering using Laplace transform. 10 Hrs

Note - Theorems and properties without proof. Applicable to all the Modules.

Text books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Linear algebra by David clay, 3rd edition, Pearson education, 2002.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishers, 2nd edition, 2005.
2. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd., 8th Edition (Wiley student edition) 2004.

20MA302 - Discrete and Combinatorial Mathematics (3-2-0) 4

Exam: 3 Hrs.

Hours/Week: 5

SEE: 50 Marks

Total Hours: 42

Course Objective: Introduction of Discrete structures and principle of Combinatorics which may be employed as tools in the applications of Computer Science & Information Technology.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers	1,2	-
2	Apply induction hypotheses, various methods of proof methods in decision taking problems.	1,2	-

3	Solve combinatorial problems using counting principles.	1,2	-
4	Apply graph concepts to model and analyse problems of information science & engineering	1,2	-

MODULE-1

Set theory: A review of set operations, statements of laws of set theory, verification of set identities using Venn diagrams and Membership table. Illustrated examples.

Counting principles: Rule of addition, multiplication principle. Inclusion and Exclusion Principle for 2 and 3 sets, principles of permutation, combination, generalized permutation and generalized combination principle. Illustrative examples.

12 Hrs.

MODULE-2

Fundamentals of logic: Basic logic connectives and truth tables. Logical equivalence and Tautologies. Statement of laws of logic. Logic implication - Rules of inference theory.

Methods of proof: Using rules of inference theory, methods of direct and indirect proof.

10 Hrs.

MODULE-3

Relations: Cartesian products and relations, computer representation of a relation and directed graph, properties of relations, equivalence relations and partitions. Partially ordered set and Hasse diagram

Functions: Definition, various types of functions - one to one function, onto function, bijective function, invertible functions and function composition Application of Stirling numbers of second kind.

10 Hrs.

MODULE-4

Graph theory: Basic terminologies of a graph. discussion of connected and disconnected graphs, Euler and Hamilton graphs, Planar graphs and Graph colouring.

Trees: Definition, properties of a tree. weighed trees, prefix codes and biconnected components. Modelling of real-life problems using graphical approach and their analysis.

10 Hrs.

Text Books:

1. Discrete and Combinatorial Mathematics, R C Grimaldi, Pearson's publications, 5th edition, 2007.

Reference Books:

1. Discrete Mathematical Structures, by D. S. Malik & M. K. Sen, Thomson's Publications, First edition, 2006.

20IS303 - Digital Systems Design (3-0-2)4

Exam: 3 Hrs.

SEE: 50 Marks

Hours/Week: 5

Total Hours: 40

Course Objective: Students will be able to design synchronous and asynchronous circuits.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Describe the behaviour of basic components of Digital circuits & Apply different methods for simplifying Boolean equations	1	-

2	Analyse the working/Functionality of Different data processing circuits	2	-
3	Design and develop Verilog programs using VHDL & Ability to design efficient combinational and sequential logic circuit implementations from functional description of digital systems.	1,2	2
4	Carryout the task of designing efficient combinational and sequential logic circuit implementations from functional description of digital systems in a team and prepare a report.	1,2	2

MODULE – 1

Digital Logic: Overview of Basic Gates and Universal Logic Gates, AND-OR-Invert Gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Boolean Laws and Theorems, Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs, Quads, and Octets, Karnaugh Simplifications, Don't Care Conditions, Product-of-Sums method, Sum-of-Products method Simplification by Quine-McCluskey Method, Hazards and Hazard Covers, HDL Implementation Models. **10 Hrs.**

MODULE – 2

Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD-to-Decimal Decoders, Seven-segment Decoders, Encoders, EX-OR gates, Parity Generators and Checkers, Magnitude Comparator, Read Only Memory, Programmable Array Logic, Programmable Logic, HDL Implementation of Data Processing Circuits, Arithmetic Circuits: Arithmetic Building Blocks, The Adder-Subtractor. **10 Hrs.**

MODULE -3

Flip-Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS, D, JK Flip-Flops, JK Master-Slave Flip-Flops, Various Representations of Flip-Flops, Conversion of Flip-Flops – A synthesis example, HDL implementation of Flip-Flops, **Registers:** Registers: Types of Registers, Serial In-Serial Out, Serial In-Parallel Out, Parallel In-Serial Out, Parallel In-Parallel Out. Applications of Shift Registers, Register Implementation in HDL. **10 Hrs.**

MODULE -4

Counters: Asynchronous Counters, Synchronous Counters, Changing the Counter Modulus, Counter Design as a Synthesis Problem, **Design of Synchronous and Asynchronous Sequential Circuit:** Model Selection, State transition diagram, State Synthesis Table, Design Equations and Circuit Diagram, Implementation using Read Only Memory, State Reduction Technique, problems with Asynchronous sequential circuit; Design of Asynchronous Sequential Circuit. **10 Hrs.**

Practical Component:

1. Realize the behaviour of following gates:
i) AND ii) OR 3) NOT 4) NOR 5) NAND
2. Design and implement BCD to Excess-3 code converter.
3. Design and implement a Johnson Counter using 4-bit Shift Register IC.
4. Design and implement an Asynchronous Counter using 4 bit Binary Counter IC to count up from 0 to (n<15).
5. Design and implement a Full Adder using 4:1 multiplexer chip.
6. Design and implement: i) 4:1 Multiplexer ii) 2:4 Decoder using NAND gates.
7. Design and implement a 3 stage Asynchronous Counter using J-K flip flops to count down from 7 to n (n>0).
8. Given any 4-variable logic expression ($y = C' + A'D' + B'D'$), simplify using a Karnaugh Map and realize the simplified logic expression using 8:1 Multiplexer IC.
9. Realize Full Subtractor using NAND gates.
10. Simplify and realize given Boolean expressions using logic gates ($y = C' + A'D' + B'D'$).

Text Books:

1. Donald P Leach, Albert Paul Malvino and GoutamSaha, Digital Principles and Applications, 8th Edition, McGraw Hill, 2017

Reference Books:

1. A. Anand Kumar, Digital Electronics, PHI
2. R.P Jain, Modern Digital Electronics, TMH
3. Stephen Brown, ZvonkoRanesic , Fundamentals of Digital Logic with verilog Design, TMH,2006 1.
4. Charles H. Roth, Jr, Fundamentals of Logic Design, , 5th Edition, Thomson, 2004

MOOC Course:

1. Switching circuits and logic design <https://nptel.ac.in/courses/106/105/106105185/>
2. Digital Circuits and Systems SWAYAM IIT-Madras , https://swayam.gov.in/ndl_noc19_ee51

20IS304 - Data Structures and Applications (4-0-0) 4

Exam: 3Hrs.

SEE: 50 Marks

Hours/Week: 4

Total Hours: 50

Course Objective: Students will be able to use appropriate data structures for solving problems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe various operations on data structures like Arrays, Lists, Stacks, Queues and Trees	1	-
2.	Apply linear and non-linear data structures for solving problems.	2	1
3.	Design solutions for problems using appropriate data structures.	2	1

MODULE-1

Introduction to Data Structures: Definition, Classification of Data Structures Dynamic Memory Allocation – Introduction, Dynamic memory allocation, malloc, calloc, free and realloc. The Stack - Definition and examples: Primitive operations, Example. Representing stacks in C: Implementing the pop operation, testing for exceptional conditions, implementing the push operation. **Infix, postfix and prefix:** Basic definitions and examples, evaluating a postfix expression, Program to evaluate a postfix expression, converting an expression from infix to postfix, Program to convert an expression from infix to postfix.

12 Hrs.

MODULE-2

Recursion: Recursive definition and processes: Factorial function, Multiplication of natural numbers, Fibonacci sequence, Binary search, Properties of recursive definition or algorithm. **Recursion in C:** Factorial of a number, generation of Fibonacci numbers, Binary searching, Concept of Recursive chains, Towers of Hanoi problem, **Queues and lists:** The queue and its sequential representation: C implementation of queues, Insert operation, Priority queue, Array implementation of a priority queue. **Linked lists:** Inserting and removing nodes from a list, Linked implementation of stacks. Getnode and freenode operations, linked implementation of queues, linked list as a data structure, Example of list operations, Header nodes.

13 Hrs.

MODULE-3

Lists in C: Array implementation of lists, Limitations of array implementation, allocating and freeing dynamic variables, linked lists using dynamic variable, Queues as lists in C, Examples of list operations in C, Non integer and non-homogeneous lists. **Other list structures:** Circular lists, Stack as a circular list, Queue as a circular list, Primitive operations on circular lists, Josephus problem, Doubly linked lists.

12 Hrs.

MODULE-4

Trees - Binary trees: Operations on binary trees, Applications of binary trees. Binary tree representation: Node representation of binary tree, Internal and external node, Implicit array representation of binary trees, choosing a binary tree representation, Binary tree traversals in C, Threaded binary trees. Trees and their application: C representation of trees, General expressions as trees, evaluating an expression tree, constructing a tree.

13 Hrs

Text Books:

1. Yedidyah Langsam and Moshe J. Augenstein and Aaron M. Tenenbaum, Data structures using C and C++, PHI, 2006 Chapters 2, 3, 4, 5

Reference Books:

1. Data Structures: A Pseudo-code approach with C –Gilberg and Forouzan, 2nd edition, Cengage Learning, 2014.
2. M.G.Venkateshmurthy, Programming techniques through C - A beginner's companion, Pearson Education, Asia.
3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013.

MOOC:

1. Data Structures and algorithms <https://nptel.ac.in/courses/106/102/106102064/>

20IS305 - Computer Organization and Architecture (3-0-0) 3

Exam: 3Hrs.

Hours/Week: 3

SEE: 50 Marks

Total Hours: 40

Course Objective: Students will learn the concepts of Computer.

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

#	Course Outcomes	Mapping to PO	Mapping to PSO's
1	Describe the instruction execution mechanism of a computer, working of processing units, input/output operations, pipelining techniques and embedded systems.	1	-
2	Analyze different memory organizations and cache mapping policies and bus architectures.	1	-
3	Apply algorithms for arithmetic operations used in the ALU	2	-

MODULE-1

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters. Memory Location and Addresses. **Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device, Requests, Exceptions, Direct Memory Access. Self study component - Historical perspective

10 Hrs.

MODULE-2

Input/output Organization: Buses, Standard I/O Interfaces – PCI Bus, USB.

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions.

10 Hrs.

MODULE-3

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast multiplication-Bitpair Recoding of Multipliers, Integer Division, Floating-point Numbers and Operations - IEEE standard for floating point numbers, Arithmetic operations on floating point numbers, Guard bits and truncation, Implementing floating-point operations.

10 Hrs.

MODULE-4

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control. Pipelining- Basic Concepts, Embedded Systems: Embedded Processor Families Examples of Embedded Systems, Large Computer Systems-forms of Parallel Processing.

10 Hrs.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Svatopluk Zaky: "Computer Organization", 5th Edition, Tata McGraw Hill 2002

Reference Books:

1. William Stallings: "Computer Organization & Architecture", 7th Edition, PHI, 2006
2. David A Patterson, John L Hennessy, "Computer Organization and Design"- The Hardware/software Interface ARM Edition, 4th Edition, Elsevier, 2009

MOOC:

1. Computer Architecture and Organization <https://nptel.ac.in/courses/106/105/106105163/>

20IS306 -Unix and Shell Programming(2-0-1) 3

Exam: 3 Hrs.

SEE: 50 Marks

Hours/Week: 2

Total Hours: 30

Course Objective: The course provides a comprehensive introduction to UNIX user commands and utilities and students will develop Shell Programming and Vi editing skills.

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

#	Course Outcomes	Mapping to PO	Mapping to PSO;s
1	To understand the multi user UNIX OS and its basic features.	1	-
2	Design and develop shell programming, communication, System calls and terminology.	3	-
3	Interpret UNIX Commands, Shell basics, and shell environments.	2, 3	-
4	Demonstrate UNIX commands and execute Shell and AWK scripts.	4	-

MODULE-1

The Unix Operating System: The UNIX architecture and Command Usage: The UNIX Architecture, Features of UNIX, Locating Commands, Internal and External Commands, Command Structure, Flexibility of Command Usage, man - Browsing the Manual Pages On-line, Understanding The man Documentation. The File, What's

in a (File) name? The Parent – Child Relationship, The HOME Variable, Absolute Pathnames, Relative Pathnames, ls, The UNIX File System

Basic File Attributes: ls -l, The -d Option, File Ownership, Directory Permissions, Changing File Ownership.

8 Hrs.

MODULE-2

The Shell: The Shell's Interpretive Cycle, Shell Offerings, Pattern Matching, Escaping and Quoting, Redirection, Pipes, Command Substitution, Shell Variables. The Process: Process Basics, ps, System Processes (-e or -a), Mechanism of Process Creation, Internal and External Commands, Process States and Zombies, Running Jobs in Background, nice: Job Execution with Low Priority. Customizing the Environment: The Shells, Environment Variables, The Common Environment Variables, Aliases (bash and ksh). More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links and ln, The Directory and Directory Permissions, Modification and Access Times, find: Locating Files.

8 Hrs.

MODULE-3

Simple Filters: The Sample Database, Filters Using Regular Expressions: grep and sed, grep: Searching for a Pattern, Basic Regular Expressions (BRE), Extended Regular Expressions and egrep, sed: Stream Editor, Line Addressing, Using Multiple instructions, (-E and -F), Context Addressing, Writing Selected Lines to a File(w), Text Editing, Substitutions(s), Basic Regular Expression Revisited.

7 Hrs.

MODULE-4

Essential Shell Programming: Shell Scripts, read, Using Command Line Arguments, exit and Exit Status of command, The Logical Operators & and || - Conditional Execution, The if Conditional, Using test and [] to Evaluate Expressions, The case Conditional, expr, \$0-Calling a Script by Different Names, while, for, set, and shift. Awk - An Advanced Filter: Simple awk Filtering, Splitting a Line into Fields, printf: Formatting Output, Variables and Expressions, The Comparison Operators, Number Processing, Variables, The -f Option: Storing awk Programs in a File, The BEGIN and END Sections, Built-in Variables, Arrays, Functions, Control Flow - The if Statement, Looping with for, Looping with while.

7 Hrs.

Text Books:

1. Sumitabha Das, UNIX - Concepts and Applications, 4th Edition, Tata McGraw-Hill, 2006. (Chapters 1.2, 2.3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19)

Reference Books:

1. M. G. Venkateshmurthy, Unix & Shell Programming, Pearson Education, 2005
2. Behrouz A. Forouzan and Richard F. Gilberg, UNIX and Shell Programming - A Textbook, 1st Edition, Thomson Course Technology, 2005.
3. Kenneth Rosen, Douglas Host, James Farber and Richard Rosinski, The Complete Reference UNIX, Tata McGraw-Hill, 2000 Edition.

Practical component

1. a. Write a shell script that takes a valid directory name as an argument and recursively descend all the sub-directories, finds the maximum length of any file in that hierarchy and writes this maximum value to the standard output.

- b. Write a shell script that accepts a path name and creates all the components in that path name as directories. For example, if the script is named mpc, then the command mpc a/b/c/d should create directories a, a/b, a/b/c, a/b/c/d.
- 2
 - a. Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permissions and otherwise output each file name followed by its permissions.
 - b. Write a shell script which accepts valid log-in names as arguments and prints their corresponding home directories, if no arguments are specified, print a suitable error message.
- 3
 - a. Create a script file called file-properties that reads a file name entered and outputs its properties.
 - b. Write shell script to implement terminal locking (similar to the lock command). It should prompt the user for a password. After accepting the password entered by the user, it must prompt again for the matching password as confirmation and if match occurs, it must lock the keyboard until a matching password is entered again by the user. Note that the script must be written to disregard BREAK, control-D. No time limit need be implemented for the lock duration.
- 4
 - a. Write a shell script that accepts one or more filenames as argument and convert all of them to uppercase, provided they exist in current directory.
 - b. Write a shell script that displays all the links to a file specified as the first argument to the script. The second argument, which is optional, can be used to specify in which the search is to begin. If this second argument is not present, the search is to begin in current working directory. In either case, the starting directory as well as all its subdirectories at all levels must be searched. The script need not include any error checking.
- 5
 - a. Write a shell script that accepts filename as argument and display its creation time if file exists and if it does not send output error message.
 - b. Write a shell script to display the calendar for current month with current date replaced by * or ** depending on whether the date has one digit or two digits.
- 6
 - a. Write a shell script to find a file/s that matches a pattern given as command line argument in the home directory, display the contents of the file and copy the file into the directory ~/mydir
 - b. Write a shell script to list all the files in a directory whose filename is at least 10 characters. (use expr command to check the length)
- 7
 - a. Write a shell script that gets executed displays the message either "Good Morning" or "Good Afternoon" or "Good Evening" depending upon time at which the user logs in.
 - b. Write a shell script that accepts a list of filenames as its argument, count and report occurrence of each word that is present in the first argument file on other argument files.

- 8
 - a. Write a shell script that determine the period for which a specified user is working on system and display appropriate message.
 - b. Write a shell script that reports the logging in of a specified user within one minute after he/she log in. The script automatically terminate if specified user does not log in during a specified period of time.
- 9
 - a. Write a shell script that accept the file name, starting and ending line number as an argument and display all the lines between the given line number.
 - b. Write a shell script that folds long lines into 40 columns. Thus any line that exceeds 40 characters must be broken after 40th, a "\ " is to be appended as the indication of folding and the processing is to be continued with the residue. The input is to be supplied through a text file created by the user.
- 10
 - a. Write an awk script that accepts date argument in the form of dd-mm-yy and displays it in the form if month, day and year. The script should check the validity of the argument and in the case of error, display a suitable message.
 - b. Write an awk script to delete duplicated line from a text file. The order of the original lines must remain unchanged.
- 11
 - a. Write an awk script to find out total number of books sold in each discipline as well as total book sold using associate array down table as given below. Electrical 34 Mechanical 67 Electrical 80 Computer Science 43 Mechanical 65 Civil 98 Computer Science 64
 - b. Write an awk script to compute gross salary of an employee accordingly to rule given below. If basic salary is < 10000 then HRA=15% of basic & DA=45% of basic If basic salary is >=10000 then HRA=20% of basic & DA=50% of basic.

20IS307 - Data Structures and Applications Laboratory (0-0-2) 1

Exam: 3 Hrs.
SEE: 50 Marks

Hours/Week: 2
Total Hours: 26

Course Objective: Students will apply appropriate data structures for solving problems.

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

#	Course Outcomes	Mapping to POs	Mapping to PSO's
1	Develop programs using pointers, structures, and files.	2,3	1
2	Develop program to solve a problem using data structures like stack, queue, list and tree.	2,3	1

1. Design and Implement a menu driven Program in C for the following Array operations:

- a. Creating an Array of N Integer Elements
- b. Display of Array Elements with Suitable Headings
- c. Inserting an Element (ELEM) at a given valid Position (POS)
- d. Deleting an Element at a given valid Position (POS)

2. Write a C Program to create a Sequential file with at least 5 records, each record having the structure shown below:

USN	Name	Marks1	Marks2	Marks3
Non-zero positive integer	25 characters	Positive integer	Positive integer	Positive integer

Write necessary functions

- a. To display all the records in the file.
 - b. To search for a specific record based on the USN.
3. Write a menu driven C Program to arrange a pile of dinner plates that you encounter when you eat at the local cafeteria: When you remove a plate from the pile, you take the plate on the top of the pile. This is exactly the plate that was added most recently to the pile by the dishwasher. If you want the plate at the bottom of the pile, you must remove all the plates on top of it to reach it (use integers to number dinner plates).
 4. Write recursive C Programs for
 - a. Searching an element in a given list of integers using the Binary search method.
 - b. Solving the Towers of Hanoi problem.
 5. Write a C Program to evaluate a valid suffix/postfix expression using stack. Assume that the suffix/postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).
 6. Write a menu driven C Program to simulate the working of a queue of vehicles on toll-tax bridge: The vehicle that comes first to the toll tax booth leaves the booth first. The vehicle that comes last leaves last. Therefore, it follows first-in-first-out (FIFO) strategy of queue (use integers to represent vehicles).
 7. Write a menu driven C Program to simulate the working of a Circular Queue of integers using an array. Provide the following operations:
 - a. Insert b. Delete c. Display
 8. Write a menu driven C Program using dynamic variables and pointers, to construct a Singly linked list of integers and perform insertion and deletion operations.
 9. Write a menu driven C Program using dynamic variables and pointers to construct a Stack of integers using Singly linked list and to perform the following operations:
 - a. Push b. Pop c. Display
 10. Write a menu driven C Program to perform insertion and deletion operations on a Doubly linked list where each node consists of integers.
 11. Write a menu driven C Program
 - a. To construct a binary search tree of integers.
 - b. To traverse the tree using all the methods i.e., In-order, Pre-order and Post-order.

20LSK - Language Skills(Mandatory Audit Course)(0-2-0) 0

SEE: 50 Marks

Hours/Week: 2
Total Hours: 20

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Communicate effectively and efficiently	10	-

Types of sentences: Affirmative/negative, Assertive/Interrogative/Imperative/Exclamatory. “WH” questions and Yes/No questions. Tenses: Forming sentences in various tenses with schematic illustrations. Active-passive voice. Direct and indirect speech. Parts of speech and their usage. Use of would have, could have, and should have in conversations with sample use case conversations.

Scheme of Evaluation:

CIE- 5 quizzes each for 10 marks.

SEE- One examination for 50 Marks at the end.

20KNS- Samskruthika Kannada (0-2-0) 1

Total Hours: 30

Hours/Week: 2

CIE :100

At the end of course, student will be able to

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1.	Understand Government order letters	P10	-
2.	Write Government order letters	P10	-

Chapter No.	Contents
1.	Kannada bashe - samkshipthavivarane (Brief Description of Kannada Language)
2.	Basha prayogadallaguvalopadoshagalumattuavugulanivaarane (Imperfections in language usage and their remedies)
3.	Lekhanachinhegalumattuavugalaupayoga (Punctuation marks and their use)
4.	Patra vyavahaara (Letter correspondences)
5.	Aadalithapatragalu (Letters of Administration)
6.	Sarakaradaaadeshapatragalu (Government order letters)
7.	Samkshipthaprabhandarachane, prabhandamattubashaantra

	(precise writing, essays and translation)
8.	Kannada shabdhasanghrahah (Kannada vocabulary)
9.	Computer haagumaahithitantrajana (Computer and Information Technology)
10.	Paaribhashikaaadalithakannadapadagalumattutaantrika/computerpaaribhashika padagalu (Kannada words for administration and computer technology)

20KNB - Balake Kannada (Kannada for Conversation) (0-1-0) 1

Total Hours: 30

Hours/Week: 2

CIE :100

Course Learning Objectives:

At the end of course student will be able to

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Understand Kannada language	P10	-
2.	Communicate (converse) in Kannada language	P10	-

Chapter No.	Contents
1.	Vyavaharika Kannada – Parichaya (Introduction to Vyavaharika Kannada)
2.	Kannada Aksharamalehaaguuchcharane (Kannada Alpabets and Pronunciation)
3.	Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication)
4.	Kannada in Conversations (Sambhashaneyalli Kannada)
5.	Activities in Kannada. (Kannada SambhashanegaagiChatuvatikegalu)

University Guidelines for CIE Procedure:

- CIE Marks in Vyavaharika Kannada and Aadalita Kannada shall be the sum of marks prescribed for tests and assignments. Marks prescribed for tests shall be 75 and that for the assessments be 25.

- ii) The CIE marks awarded for the tests shall be based on three tests generally conducted at the end of fifth, tenth and fifteenth week of each semester. Each test shall be conducted for a maximum of 25 marks and the final CIE marks shall be the sum of the marks of all the three tests.
- iii) The remaining 25 marks shall be awarded based on the evaluation of assignments/unit tests/written quizzes that supports to communication skills as per Bloom's Revised Taxonomy and Course/programme outcomes.
- iv) Final marks awarded shall be the sum of (ii) and (iii) for a maximum of 100 marks.
- v) The candidates shall write the test in Blue Books and also assignments/unit-tests/written quizzes in Blue Books/Notes which shall be preserved by the Principal/Head of the Department for at least six months after the announcement of University results and shall be made available for verification at the direction of the Registrar (Evaluation).

III Semester Bridge Course for Diploma Students

20BCM301 - Bridge Course Mathematics - I (3-0-0) 0 (Common to all branches of Engineering) (Mandatory Audit Course)

Exam: 3 Hrs.
SEE: 50 Marks

Hours/Week: 3
Total Hours: 42

Course outcomes: To introduce simple concepts of calculus and numerical methods

#	Course outcomes	Mapping to POs	Mapping to PSOs
1	Solve simple problems on determinants, matrix multiplication, partial differentiation, and integration.	1	-
2	Compute the roots of transcendental equations and interpolate when the experimental data is given	1	-
3	Expand the given function in terms of Taylor/ Macluarin's series	1	-

MODULE-1

Basic formulas: Partial fractions. **Matrices and determinants:** matrix multiplication, evaluation of determinants, finding inverse.

Differentiation-I: Review of limit and Continuity, differentiation- Basic formulas, Sum rule, product rule, quotient rule, chain rule and problems.

Differentiation-II: Taylor's series, and Maclaurin series of simple functions for single variable, simple problems

10 Hrs

MODULE-2

Partial differentiation: Definition, Illustrative examples on Partial differentiation, Total differentiation, chain rule, Differentiation of composite and implicit functions, Jacobians, illustrative examples and

problems, simple problems.

10 Hrs

MODULE-3

Integration: Basic formulas, Illustrative examples, evaluation of definite integrals, Integration by parts, Bernoulli's rule of Integration.

Integral calculus: Reduction formula for functions $\sin^n x$, $\cos^n x$ (without proof), Simple problems, Double & triple integration, simple problems with standard limits.

10 Hrs

MODULE-4

Numerical methods - Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method, Regula falsi method.

Numerical Interpolation-Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, central difference formulas- Bessel and Stirling formulas, illustrative examples

12 Hrs

Note - Theorems and properties without proof. Applicable to all the units.

TEXT BOOKS:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 40th edition (2007).
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tata McGraw Hill Publications, 8th edition (2007).

Reference books:

1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

20MA401 - Statistics and Complex Analysis (3-1-0)4

Exam: 3 Hrs.

SEE: 50 Marks

Hours/Week: 5

Total Hours: 42

Course objective: The student will study Statistics, probability and calculus of a complex valued function

Course outcomes: The student will be able to

#	Course Outcomes	Mapping to POS	Mapping to PSO's
1	Adopt statistical techniques such as correlation/regression, multiple regressions, curve fitting, to analyse the data and compute the input corresponding to the desired output.	1,2, 3	-
2	Predict the probability of happening, through the concepts of random variables (PDF), study the system applications, reliability of system through the suitable pdf, sampling theory	1,2, 3	-

3	Predict the behaviour of Markov chain based problems in the long run and study the correlation, covariance of random variables using joint PDF concept.	1,2, 3	-
4	Compute the problems connected with analytic functions, conformal mapping and analyse the geometry of a region in which $f(z)$ is defined so as to integrate $f(z)$, compute singularities, residues.	1,2, 3	2,3
5	Model real life problems/engineering application-oriented problems and analyse the physics inherited in the application	1,2, 3	

MODULE-1

Statistics: Curve fitting by least square method – Straight lines, parabola, (when the experimental output depends on one input) Correlation – Karl Pearson coefficient of correlation and Spearman's rank correlation coefficient. Physical interpretation of numerical value of the rank correlation coefficient. Linear Regression analysis (when the experimental output depends on one input). Illustrative examples from engineering field, multiple regression analysis. (When the experimental output depends on two inputs)

Probability: Discrete Random Variables: Definitions of PDF & CDF, Expectation and Variance. Binomial pdf, Illustrative examples. Poisson probability distribution function-examples

10 Hrs

MODULE-2

Continuous Random Variables: Definition of PDF and CDF, Expectation and Variance, illustrative examples. Uniform pdf, Normal/Gaussian pdf, discussion on the choice of PDF. Illustrative examples from engineering field.

Sampling Distribution: Introduction, Testing a hypothesis, central limit theorem-statement, Level of significance, Simple sampling of attributes, Test of significance for large samples, Comparison of large samples, Student's t-distribution, Chi-square distribution

12 Hrs

MODULE-3

Joint Probability Distribution & Stochastic Processes: Concept of joint probability, Joint distributions of discrete random variables, Independent random variables – problems. Joint expectation, co-variance and correlation.

Markov Chains: Introduction, stochastic matrices, fixed probability vectors and regular stochastic matrices.

Functions of a complex variable: Analytic functions. -Statement of Cauchy-Riemann equations in Cartesian form and illustrative examples, construction of an analytic function using Milne-Thomson method (Cartesian form). Illustrative examples from engineering field.

10 Hrs

MODULE-4

Harmonic functions and Conformal Mapping: Properties of Harmonic functions and Illustrative examples (Cartesian form) Definition of Conformal transformation and discussion of some standard transformations

$w = z^2, w = e^z, w = z + \frac{k^2}{z}$.) Bilinear transformation, Illustrative examples. Applications of conformal mapping.

Complex Integration: – Evaluation of line integrals, Statement of Cauchy's theorem, generalized Cauchy's Integral formula- illustrative examples. Brief introduction to Taylor and Lorentz series and illustrative examples, Zeros of an analytic function, Singularities and Residues. Calculation of residues, Evaluation of real definite integrals using Cauchy's residue theorem

10 Hrs

Note - Theorems and properties without proof. Applicable to all the units.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2016.
2. Erwin Kreyzig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd 9th edition, 2014.
3. B V Ramana Higher Engineering Mathematics, Tata McGraw Hill Publications, 2nd edition, 2007.

Reference Books:

1. Scott L. Miller, Donald G. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition, 2013.
2. Statistics for engineers and Scientists, William Navide, MacGraw hill education, India pvt. Ltd., 3rd edition 2014.
3. T. Veerarajan: "Probability, Statistics and Random Process ", 3rd Edition, Tata McGraw Hill Co., 2008.
4. Theory and problems of probability, Seymour lipschutz and marc lars lipson, schaums out line series, 2nd edition

20IS402 - Microprocessor and Microcontroller (3-0-0) 3

Exam: 3 Hrs.

SEE: 50 Marks

Hours/Week: 3

Total Hours: 40

Course Objective: To make familiar with importance and applications of Microprocessor and Microcontroller.

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

#	Course Outcomes	Mapping to PO	Mapping to PSO's
1	Ability to understand the complete architecture of the 8086 processor and the segmented memory management.	1,2	-
2	Write the assembly language programs of moderate complexity	1,2	-
3	Explain the ARM microcontroller and its components	1,2	-

MODULE-1

The 8086/8088 Processors: Register Organization of 8086, Architecture, Signal descriptions of 8086, Physical memory organization, General bus operation, I/O Addressing capability, Special processor activities, 8086 Machine language Instruction formats, addressing modes of 8086, Instruction set of 8086/8088.

10 Hrs

MODULE-2

8086/8088 Instruction Set & Assembler Directives: Assembler Directives and Operators. Instruction Set. The art of Assembly Language Programming with 8086/8088: A few machine level programs, Machine coding the programs. **10 Hrs**

MODULE-3

ARM embedded systems: The RISC design philosophy, The ARM design philosophy, embedded system hardware, Embedded system software, registers, current program status register, pipeline, exceptions, interrupts and vector table, core extensions, architecture revisions, arm processor families, data processing instructions, branch instructions. **10 Hrs**

MODULE-4

Introduction to the ARM instruction set: Load store instructions, software interrupt instructions, program status register instructions, loading constants, ARMv5E extensions, conditional execution, data processing instructions, Single load store instructions, stack instructions, software interrupt instruction. Core of the embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components. **10 Hrs**

Text books:

1. Ajoy Kumar Ray & Kishor M Bhurchandi, Advanced Microprocessors and Peripherals, 2nd Edition, TMH, 2006.
2. ARM system developer's guide, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.
3. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd edition

Reference Book:

1. Douglas V. Hall, Microprocessors and Interfacing Programming and Hardware, 2nd Edition, TMH, 2006
2. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015
3. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008

MOOC:

1. Microprocessors and Microcontroller <https://nptel.ac.in/courses/108/105/108105102/>

20IS403 -Operating Systems (3-0-0)3

Exam: 3Hrs.

Hours/Week: 3

SEE: 50 Marks

Total Hours: 40

Course Objective: Students will be able to implement different components of operating systems.

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

#	Course Outcomes	Mapping to PO	Mapping to PSO'
1	Describe the functions and basic concepts of operating systems	1	-
2	Apply different mechanisms for handling deadlock	1, 2	1
3	Analyze various algorithms for process scheduling, disk scheduling, memory management, synchronization mechanism, Threads	2	-
4	Work effectively in a team in Implement different algorithms	2	-

MODULE -1

Introduction to Operating Systems, System Structures: What Operating Systems Do? Computer System Architecture; Operating System Structure; Operating System Operations; Operating System Services; System Calls; Types of System Calls; System Programs, **Process Management:** Process Concept; Operations on Processes; Inter-Process Communication. Multi-Threaded Programming: Overview; Multithreading Models; Signal Handling.

10 Hrs.

MODULE – 2

Process Management (contd.): Process Scheduling: Basic Concepts; Scheduling Criteria; Scheduling Algorithms; **Process Synchronization:** The Critical Section Problem; Peterson's Solution; Synchronization Hardware; Semaphores; Classic problems of Synchronization, Monitors- Usage, Dining-Philosophers solution using monitors.

10 Hrs.

MODULE – 3

Deadlocks: System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock. **Memory Management:** Memory Management Strategies: Background; Swapping; Contiguous Memory Allocation; Paging; Structure of Page Table; Segmentation.

10 Hrs.

MODULE – 4

Virtual Memory Management: Background; Demand Paging; Page Replacement. **Storage Management:** Secondary Storage Structures, Protection: Mass Storage Structures; Disk Structure; Disk Scheduling; Swap Space Management. Protection: Goals of Protection, Principles of Protection, Domain of Protection-Domain Structure, Access Matrix, Implementation of Access Matrix.

10 Hrs.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th Edition, Wiley India, 2009.

Reference Books:

1. D.M Dhamdhere: Operating Systems - A Concept Based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
3. Harvey M. Deitel: Operating Systems, 3rd Edition, Pearson Education, 2004. Operating systems: Ekta walia, Khanna Publishing house, Delhi

MOOC:

1. Fundamentals of Operating System <https://nptel.ac.in/courses/106/105/106105214/>

20IS404 - Design and Analysis of Algorithms (4-0-0) 4

Exam: 3Hrs.

SEE: 50 Marks

Hours/Week: 4

Total Hours: 50

Course Objective: Students will be able to apply different algorithm design strategies, develop and analyse algorithms for solving problems.

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

#	Course Outcomes	Mapping to PO	Mapping to PSOs
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1.	Describe basic knowledge of algorithm analysis, algorithm design strategies and NP problems	-	-
2.	Apply algorithms for a given computational problem	1	1
3.	Analyze asymptotic runtime complexity of a given algorithm	2	1
4.	Design solution for a given scenario using suitable algorithm design strategy	3	1

MODULE-1

Introduction: Notion of Algorithm, Fundamentals of algorithmic problem solving, important problem types, Fundamental data structures. **Fundamentals of the Analysis of Algorithm Efficiency:** Analysis framework, Asymptotic notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples. **Brute Force:** Selection Sort and Bubble Sort, Sequential Search and String Matching, Exhaustive search.

13 Hrs.

MODULE-2

Divide-and-Conquer: Binary Search, Merge Sort, Quick Sort, Binary tree traversals and related properties, Multiplication of large integers, Strassen's Matrix multiplication. **Decrease-and-Conquer:** Insertion Sort, Depth First and Breadth First Search, Topological sorting, Algorithms for generating combinatorial objects.

13 Hrs.

MODULE-3

Transform-and-Conquer: Pre-sorting, Balanced Search Trees, Heaps and Heap Sort, Problem reduction. Space and Time Trade-off: Sorting by counting, Input enhancement in string Matching (only Horspool), Hashing. **Dynamic Programming:** Computing a Binomial coefficient, Warshall's Algorithm, Floyd's algorithms, The Knapsack problem.

12 Hrs.

MODULE-4

Greedy Technique: Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm, Huffman trees, **Limitations of Algorithm Power:** Lower-bound arguments, Decision trees, P, NP and NP-Complete Problems, coping with the Limitations of Algorithm Power: Backtracking, Branch-and-bound.

12 Hrs.

Text Books:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson Education, 2017.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Introduction to Algorithms, 3rd Edition PHI
2. Horowitz E., Sahani S., Rajasekharan S., Computer Algorithms, Galgotia Publications

MOOC

1. Design and Analysis of Algorithms <https://nptel.ac.in/courses/106/106/106106131/>

20IS405 - Software Engineering (4-0-0) 4

Exam: 3 Hrs.

SEE: 50 Marks

Hours/Week: 4

Total Hours: 50

Course Objective: Students will be able to apply Software Engineering practices for project development.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
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1	Analyse a system for identifying the software requirements	2	2
2	Apply software process activities during system design	2	2
3	Describe the need for software quality and maintenance	1	2
4	Function effectively in a team and present solutions to problems	3,9,10	2

MODULE-1

Introduction: Professional Software Development, Software Engineering Ethics. Case studies. Software Processes: Software process. **Software Processes:** Process activities coping with change, The Rational Unified Process. **Agile Software Development:** Agile methods. Plan-driven and agile development Extreme programming. Agile project management. Scaling agile methods.

13 Hrs.

MODULE-2

Requirements Engineering: Functional and non-functional requirements. The software Requirements Document. Requirements Specification, Requirements Engineering Processes. Requirements Elicitation and Analysis. Requirements validation. Requirements Management. System Models: Context models. Interaction models. Structural models. Behavioural models. Model-driven engineering. Design and Implementation: Object-oriented design using the UML.

13 Hrs.

MODULE-3

Design and Implementation: Design patterns, Implementation issues, Open source development. Software Testing: Development testing, Test-driven development, Release testing, User testing. **Software Evolution:** Evolution processes, Program evolution dynamics. Software maintenance, Legacy system management

12 Hrs.

MODULE-4

Project Planning: Software pricing. Plan-driven development. Project scheduling, Agile planning. Estimation techniques. Quality Management: Software quality, Software standards. Inspections. Software measurement and metrics.

12 Hrs.

Text Books:

1. Ian Sommerville, "Software Engineering", 9th Edition, Person Education, 2014. (Chapters:1,2,3,4,5,7,8,9,21,22)

Reference Books:

1. Roger S. Pressman, "Software Engineering - A Practitioners Approach", 7th Edition, McGraw-Hill, 2007.
2. Waman S. Jawadekar, "Software Engineering Principles and Practice", Tata McGraw-Hill, 2004.
3. Software Engineering: A Concise introduction to Software Engineering by Pankaj Jalot, Springer.

MOOC:

1. Software Engineering <https://nptel.ac.in/courses/106/105/106105182/>

20IS406 - Object Oriented Programming (3-0-0)3

Exam: 3Hrs.

SEE: 50 Marks

Hours/Week: 3

Total Hours: 40

Course Objective: Students will be able to apply object oriented programming concepts in development of applications.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Understand the fundamental concepts of Object Oriented Principles	PO2	-
2.	Analyse the importance of inheritance, package and interfaces	PO2	
3.	Apply exception handling, event handling and threads for problem solving	PO2	-
4.	Develop solutions for real time problems using Object - Oriented principles	PO2	

MODULE-1

Introduction to C++ : Object Oriented Technology, Disadvantages of Conventional Programming, Programming Paradigms, key concepts of Object-Oriented Programming.

Functions in C++: Introduction, the main () function in C and C++, Parts of function, Inline Function.
Classes and Objects: Introduction, Structures in C and C++, Declaring objects, Defining member functions, characteristics of member functions, Static Member Variables and Functions, Array of Objects, Objects as Function arguments, Friend Function

Constructors and Destructors: Introduction, Constructors and Destructors, Characteristics of constructors and Destructors, Applications with constructors, Constructors with arguments, overloading with constructors, constructors with default arguments, copy constructors, Destructors

10 Hrs

MODULE-2

Introduction to Java: Java and Java Applications, How Java Changed the Internet, Java Development Kit(JDK), The Byte Code, Servlets, The Java Buzzwords, Object-Oriented Programming, Simple Java Programs using Control Statements and Blocks of code, Lexical Issues.

Introducing Classes, Objects and Methods: Class Fundamentals, Declaring Objects, Object Reference Variables, Methods, Constructors, The this keyword, Garbage collection, Overloading Methods and constructors, Argument Passing, Returning Objects, Recursion, Access Control, Nested and Inner Classes.

10 Hrs

MODULE-3

Inheritance, Packages and Interfaces: Inheritance Basics, Using Super, Multilevel Hierarchy, When Constructors are called, Method Overriding, Abstract Classes. Packages, Access Protection, Importing Packages, Interfaces.

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and Catch, Multiple catch Clauses, Nested try Statements, throw, Java's Built-in Exceptions.

10 Hrs

MODULE-4

Multi Threading: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Synchronization, Interthread Communication, The Modern way of Suspending, Resuming, and Stopping Threads.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

10 hrs

Text Books:

1. Ashok N.Kamthane “Object Oriented Programming with ANSI & Turbo C++”.
2. Herbert Schildt, “Java the Complete Reference, 10th Edition, Tata McGraw Hill, 2018

Reference Books:

1. Saurav Sahay “Object Oriented Programming with C++ ”, 2nd Ed, Oxford University Press, 2006
2. E Balaguruswamy, Programming with Java A Primer, Tata McGraw Hill companies.
3. Y. Daniel Liang, “Introduction to JAVA Programming, Brief Version”, 9th Edition, Pearson Education, 2014.
4. Kogent Learning Solutions, “Java 6 Programming Black Book”, Dreamtech Publication, 2014.

20IS407 –Microprocessor and Microcontroller Laboratory (0-0-2)1

Exam: 3 Hrs.

Hours/Week: 2

SEE: 50 Marks

Total Hours: 26

Course Objectives: Ability to develop assembly language code and solve simple real life problems using ARM microcontroller.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Develop ALP using 8086 processor.	3,5	-
2	Develop interfacing programs using ARM microcontroller.	3,5	-

MODULE- 1

Write an ALP to -

1. Perform binary search on given 'n' 8 - bit and 16 - bit numbers.
2. Reverse a given string and check whether it is a palindrome or not.
3. Generate and print the first n Fibonacci numbers.
4. perform the bubble sort on given n 8-bit numbers.
5. find out whether given sub string is present or not in main string of characters.
6. Compute Binomial coefficient using recursive procedure, assume n and r are non-negative integers.
7. Write ALP macros, to read a character from the key board in a module and to display a character from the module.
8. Simulate a Decimal up counter to display 00 to 99

MODULE-2

Develop and demonstrate

1. Interfacing the Logic Controller Interface.

2. Interfacing the 7-segment display interface.
3. Interfacing the Stepper Motor.
4. Interfacing the Keyboard

20IS408 - Algorithms Laboratory using Python (0-0-2) 1

Exam: 3 Hrs.
SEE: 50 Marks

Hours/Week: 2
Total Hours: 26

Course Objectives:

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Develop program for a given problem using appropriate algorithm design techniques	2,3	1
2	Perform analysis of algorithms	2	1

Implement the following using C++/Python Language.

1. Employees in an organization need to be grouped for a tournament based on their ages. Sort the ages using Merge sort and find the time required to perform the sorting.
2. Students in a department need to be selected for a high jump competition based on their height (integer values only). Sort the heights of students using Quick sort and find the time required for the sorting.
3. Print all the nodes reachable from a given starting node in a graph using Depth First Search method and Breadth First Search. Also check whether a graph is connected.
4. Obtain the topological ordering of vertices in a given digraph.
5. Implement Horspool algorithm for String Matching.
6. Sort a given set of elements using the Heap sort method.
7. Implement Floyd's algorithm and Warshall's algorithm for a given graph.
8. There are n different routes from hostel to college. Each route incurs some cost. Find the minimum cost route to reach the college from the hostel using Prim's algorithm.
9. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm
10. Implement 0/1 Knapsack problem using dynamic programming.
11. Implement N Queen's problem using Backtracking.

20BCM401 - Bridge Course Mathematics - II (3-0-0)3 **(Common to all branches of Engineering)** **(Mandatory Audit Course)**

Exam: 3 Hrs.
SEE: 50 Marks

Hours/Week: 3
Total Hours: 40

Course outcomes: Having studied this course, students will be

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Able to identify suitable methods to solve the differential equations analytically	1	-
2	Able to solve first order first degree D E, integration problems and simple PDE problems using numerical methods.	1	-
3	Able to solve problems on Gradient, Divergence, Curl of a vector valued function and apply its physical meaning to the engineering applications	1	-

MODULE-1

Differential Equations: Solution of first order first degree differential equations- Variable separable methods, Homogeneous Equations, Exact differential equations Illustrative examples from engineering field. Linear & Bernoulli's differential equations, Illustrative examples from engineering field.

10 Hrs

MODULE-2

Differential Equations: Solution of second and higher order equations with constant coefficient by inverse differential operator method $f(D)y = e^{ax}$, $f(D)y = \cos(ax + b)/\sin(ax + b)$, $f(D) = ax^2 + bx + c$ $f(D)y = e^{ax}\cos(bx + c)/e^{ax}\sin(bx + c)$, $f(D)y = x\cos(ax + b)/x\sin(ax + b)$ (Simple problems). Illustrative examples from engineering field.

Numerical solution of first order first degree ordinary differential equations: Taylor series method, Runge-Kutta method of fourth order, Milne's Predictor corrector methods.

10 Hrs

MODULE-3

Solution of Partial Differential Equations: Solving PDE by variable separable method, to find all possible solutions of one dimensional wave equation, one dimensional Heat flow equation and two dimensional Laplace's equation by the method of separation of variables, numerical solution of Laplace equation by finite difference approximation method using standard five point formula and diagonal five point formula. Numerical solution of Poisson equation by finite difference approximation method using standard five point formula and iterative formulas.

10 Hrs

MODULE-4

Numerical Integration: Computation of line integral by trapezoidal rule, Simpson's 1/3rd rule, Weddle's rule, Simpson's 3/8th rule, Illustrative examples from engineering field.

Vector Algebra: vector addition, Multiplication (Dot and Cross product), Triple products, vector differentiation, velocity, acceleration of a vector point function, Gradient, divergence, curl. **10 Hrs**

Note - Theorems and properties without proof. Applicable to all the units.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 40th edition (2007).
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tata McGraw Hill Publications, 8th edition (2007).

Reference books:

1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002, N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

20SSK - Social Skills (Mandatory Audit Course) (0-1-0) 0

SEE: 50 Marks

Hours/Week: 2
Total Hours: 30

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Address in public with confidence	10	-
2	Write effective email writing	10	-
3	Exhibit impressive body language	10	-

Verbal Aptitude: Use of proper form of verbs, error detection/correction, passage, Just A Minute, (JAM) Group discussion, Pick and speak, email writing

Scheme of Evaluation:

CIE- 3 quizzes each for 10 marks. Group Discussion and Pick & Speak for 10 marks and Email writing for 10 marks.

SEE- One examination for 50 Marks at the end.

Scheme & Syllabus for III Year
B. E. - Information Science and Engineering
Admitted Year 2020

V Semester					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
PC-14	20IS501	Python Application Programming	3-0-1	4	5
PC-15	20IS502	Theoretical Foundations of Computation	2-1-0	3	4
PC-16	20IS503	WEB Programming	3-0-1	4	5
PC-17	20IS504	Database Management Systems	3-0-1	4	5
HSM-4	20IS505	Information Systems	3-0-0	3	3
PC-18	20IS506	Data Communications	3-0-0	3	3
PROJ-1	20IS507	Mini Project-1 (Database and Java Application)	0-0-2	2	2
HSM-5	20CIP	Constitution of India and Professional Ethics (Mandatory Audit course)	2-0-0	-	2
HSM-6	20AAD	Analytical Ability Development	0-1-0	1	2
Total Credits				24	31

VI Semester					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
PC-19	20IS601	Information Storage and Management	3-0-0	3	3
PC-20	20IS602	Computer Networks	3-0-1	4	5
PC-21	20IS603	Artificial Intelligence	4-0-0	4	4
HSM-7	20IS604	Management, Entrepreneurship and IPR	3-0-0	3	3
PROJ-2	20IS605	Mini Project – 2	0-0-2	2	2
PE-1	20IS651	Elective - 1	3-0-0	3	3
OE-1	20OEEX	Open Elective - 1	3-0-0	3	3
PC-22	20SW01	SWAYAM course -1 (Mandatory Audit Course)	-	-	-
HSM-8	20ARD	Aptitude Reasoning Development (Mandatory Audit course)	0-2-0	-	2
HSM-9	20EVS	Environmental Studies (Mandatory Audit course)	2-0-0	-	2
Total Credits				22	27

Elective Group I		Open Electives	
20IS651	Internet of things	20OEIS61	Web Technologies
20IS652	C# and .NET	20OEIS62	Java Programming
20IS653	Advance Java	20OEIS63	Internet of Things
20IS654	Computer Graphics & Visualization	20OEIS64	Python Programming
20IS655	Data Warehousing and Mining	20OEIS65	Data Science

Course Title	Python Application Programming		
Course Code	20IS501	L-T-P	(3-0-1) 4
Exam	3 Hrs.	Hours/Week	5
SEE	50 Marks	Total Hours	36L+14P
Course Objective: Students will be able to design and implement python applications related to regular expression, file handling, network programming and GUI. Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Demonstrate proficiency in handling of loops and creation of functions.	2,3,5	1
2.	Identify the methods to create and manipulate lists, tuples and dictionaries	2,3,5	1
3.	Discover the commonly used operations involving regular expressions and file system.	2,3,5	1
4.	Implement Internet programming and Graphical User Interface using python modules	2,3,5	1
MODULE-1			9 Hrs.
Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit. Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling.			
MODULE-2			9 Hrs.
Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, Manipulating Strings: Working with Strings, Useful String Methods			
MODULE-3			9 Hrs.
Pattern Matching with Regular Expressions: Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function			
MODULE-4			9 Hrs.
Internet Programming: Introduction, What is client /server architecture? Sockets: Communication Endpoints, Network Programming in Python, The socket server Model, Transferring files.			

GUI Programming: Tkinter, Introduction, Tkinter and python programming, Tkinter examples, A Brief Tour of other GUIs, Related modules and Other GUIs

Text Books:

1. Al Sweigart, "Automate the Boring Stuff with Python", 1st Edition, No Starch Press, 2015.
2. Core Python Application Programming, Wesley J Chun, 3rd Edition, Pearson Publication, 2016.

Reference Books:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
2. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

Practical Component

Guided Experiments

1. Write a python program to impliment
 - i). ask a user to enter his name and print a welcome message by appending the entered name
 - ii). print the length of the entered name
 - iii). ask a user to enter his name and print the age in next year
2. Write a python program to print all Prime numbers in the given Interval
3. Write a Python program to create a simple function to check whether the number passed as an argument to the function is even or odd.
4. write a Python program to find the largest number in given list.
5. Write python program to check if a string is palindrome or not

Open ended Experiments

1. Write a python program to Guess the Number
2. Write a python to add Bullets to Wiki Markup
3. Write a python program to extract Phone Number and Email Address
4. impliment the Multiclipboard using python
5. Demonstrate the simple TCP/UDP client server for data sharing.
5. Using tkinter module create an student enrolment GUI.

Course Title	Theoretical Foundations of Computation																						
Course Code	20IS502	L-T-P	(2-1-0) 3																				
Exam	3 Hrs.	Hours/Week	4																				
SEE	50 Marks	Total Hours	40																				
Course Objective: The course provides a basic understanding of theory of computation and students will be able to design various kinds of automata, formal languages and grammars as a first step towards learning advanced topics such as compiler design. Course outcomes: At the end of course, student will be able to: <table border="1"> <thead> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to PO's</th><th>Mapping to PSO's</th></tr> </thead> <tbody> <tr> <td>4.</td><td>Understand the fundamental concepts of formal languages and automata theory</td><td>1</td><td>-</td></tr> <tr> <td>5.</td><td>Design DFAs, NFAs, and perform conversions among them</td><td>3</td><td>-</td></tr> <tr> <td>6.</td><td>Design regular expressions, context free grammars, Push Down Automata and Turing machines for different levels of formal languages</td><td>3</td><td>-</td></tr> <tr> <td>7.</td><td>Construct and simulate different kinds of automata using simulation tool</td><td>5</td><td>-</td></tr> </tbody> </table>				#	Course Outcomes	Mapping to PO's	Mapping to PSO's	4.	Understand the fundamental concepts of formal languages and automata theory	1	-	5.	Design DFAs, NFAs, and perform conversions among them	3	-	6.	Design regular expressions, context free grammars, Push Down Automata and Turing machines for different levels of formal languages	3	-	7.	Construct and simulate different kinds of automata using simulation tool	5	-
#	Course Outcomes	Mapping to PO's	Mapping to PSO's																				
4.	Understand the fundamental concepts of formal languages and automata theory	1	-																				
5.	Design DFAs, NFAs, and perform conversions among them	3	-																				
6.	Design regular expressions, context free grammars, Push Down Automata and Turing machines for different levels of formal languages	3	-																				
7.	Construct and simulate different kinds of automata using simulation tool	5	-																				
MODULE-1			10 Hrs.																				
Introduction to Finite Automata: The Central Concepts of Automata Theory, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Epsilon-Transitions, Equivalence of NFA and DFA. Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions																							
MODULE-2			10 Hrs.																				
Regular Expressions and Languages (Contd.): Pumping lemma for regular languages, Applications of Regular Expressions, Equivalence and Minimization of Automata. Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context Free Grammars, Ambiguity in Grammars.																							
MODULE-3			10 Hrs.																				
Pushdown Automata: Introduction and construction of Pushdown Automata, Acceptance by final state and empty stack, Equivalence of PDA's and CFG's Turing Machines: Introduction to Turing Machine, Construction of Turing Machine.																							
MODULE-4			10 Hrs																				

Turing Machines (contd.): Programming Techniques for Turing Machines, Restricted Turing machines, Turing Machines and Computers, The Universal Turing Machine, Introduction to undecidable problems, Post's Correspondence Problem.

Text Books:

2. J.P.Hopcroft, Rajeev Motwani, J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3rd Edition, 2007

Reference Books:

1. John Martin, "Introduction to Languages and Theory of Computation", Tata McGraw-Hill, 2003.
4. Peter Linz, "An Introduction to Formal Languages and Automata", 4th Edition, Narosa Publishing House, 2007
- An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013.

Course Title	Web Programming																		
Course Code	20IS503	L-T-P	(3-0-1) 4																
Exam	3 Hrs.	Hours/Week	5																
SEE	50 Marks	Total Hours	36L+14P																
Course Objective: Students will be able to develop web applications. Course Outcomes: At the end of the course, student will be able to: <table> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to PO</th><th>Mapping to PSOs</th></tr> <tr> <td>1.</td><td>Explain the fundamentals of world wide web and web programming languages such as HTML, XHTML, Java script, PHP, AJAX and mysql database system.</td><td>1</td><td>-</td></tr> <tr> <td>2.</td><td>Apply the different scripting languages for dynamic web page development.</td><td>1</td><td>-</td></tr> <tr> <td>3.</td><td>Design and develop web solutions for given requirements.</td><td>3</td><td>2</td></tr> </table>				#	Course Outcomes	Mapping to PO	Mapping to PSOs	1.	Explain the fundamentals of world wide web and web programming languages such as HTML, XHTML, Java script, PHP, AJAX and mysql database system.	1	-	2.	Apply the different scripting languages for dynamic web page development.	1	-	3.	Design and develop web solutions for given requirements.	3	2
#	Course Outcomes	Mapping to PO	Mapping to PSOs																
1.	Explain the fundamentals of world wide web and web programming languages such as HTML, XHTML, Java script, PHP, AJAX and mysql database system.	1	-																
2.	Apply the different scripting languages for dynamic web page development.	1	-																
3.	Design and develop web solutions for given requirements.	3	2																
MODULE-1			9 Hrs.																
Fundamentals of Web: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, HTTP, Security. XHTML:Origins and Evolution of HTML and XHTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Tables, Forms, The Audio Element, The Video Element, Syntactic Difference between HTML and XHTML.																			
MODULE-2			9 Hrs.																
Cascading Style Sheets: Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Colour, Alignment of Text, The Box Model, Background Images, The and <div> Tags, Conflict Resolution. The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, ControlStatements, Object Creation, and Modification, Arrays, Functions, Constructors, Pattern Matching Using Regular Expressions, Errors in Scripts.																			
MODULE-3			9 Hrs.																
JavaScript and XHTML Documents: The JavaScript Execution Environment, The Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from The Text Box and Password Elements																			

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colours and Fonts.	
Introduction to XML: Introduction, uses of XML, The Syntax of XML, XML Document Structure	
MODULE-4	9 Hrs.
Introduction to PHP: Origins and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives, Operations and Expressions, Output, ControlStatements, Arrays, Functions, Pattern Matching. Database Access Through the Web: Relational Databases, An introduction to Structured Query Language (Review), Architectures for Database Access, The MySQL Database System, Database Access with PHP and MySQL.	
Text Books: 1. Robert W. Sebesta, "Programming the World Wide Web", 8th Edition, Pearson Education, 2014.	
Reference Books: 1. Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2014 2. James Lee, Brent Ware, "Open Source Web Development with LAMP", Pearson Education, 2013	

Practical Component
Guided Experiments 1. Develop and demonstrate a XHTML document that illustrates the use external style sheet, ordered list, table, borders, padding, color, and the tag. 2. Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected. 3. Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. 4. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, Name of the College, Brach, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

5. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
6. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
7. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
8. Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Open ended Experiments

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problem:
Input: A number n obtained using prompt

Output: The first n Fibonacci numbers
2. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:
Input: A number n obtained using prompt

Output: A table of numbers from 1 to n and their squares using alert
3. Develop and demonstrate a XHTML file that includes Javascript script that uses functions for the following problems:
Parameter: A string

Output: The position in the string of the left-most vowel
4. Develop and demonstrate a XHTML file that includes Javascript script that uses functions for the following problems:
Parameter: A number

Output: The number with its digits in the reverse order
5. Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
6. Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Course Title	Database Management Systems																						
Course Code	20IS504	L-T-P	(3-0-1) 4																				
Exam	3 Hrs.	Hours/Week	5																				
SEE	50 Marks	Total Hours	36L+14P																				
Course Objective: Students will acquire the concepts of databases, and application of SQL for solving problems. Course Outcomes: At the end of the course, student will be able to: <table> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to PO's</th><th>Mapping to PSO's</th></tr> <tr> <td>1</td><td>Explain the concepts of Database Management Systems and its applications.</td><td>1</td><td>-</td></tr> <tr> <td>2</td><td>Design ER diagram for real world applications and develop SQL queries.</td><td>3</td><td>-</td></tr> <tr> <td>3</td><td>Apply normalizations for relation scheme.</td><td>2</td><td>-</td></tr> <tr> <td>4</td><td>Explain the issues in transaction management.</td><td>1</td><td>-</td></tr> </table>				#	Course Outcomes	Mapping to PO's	Mapping to PSO's	1	Explain the concepts of Database Management Systems and its applications.	1	-	2	Design ER diagram for real world applications and develop SQL queries.	3	-	3	Apply normalizations for relation scheme.	2	-	4	Explain the issues in transaction management.	1	-
#	Course Outcomes	Mapping to PO's	Mapping to PSO's																				
1	Explain the concepts of Database Management Systems and its applications.	1	-																				
2	Design ER diagram for real world applications and develop SQL queries.	3	-																				
3	Apply normalizations for relation scheme.	2	-																				
4	Explain the issues in transaction management.	1	-																				
Module-1			9Hrs																				
Introduction: Introduction, an example, Characteristics of Database approach, Actors on the Screen, Workers Behind the Scene, Advantages of Using DBMS Approach. Data Models, Schemas and Instances, Three-schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment. Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship Types of Degree Higher Than Two.																							
Module-2			9Hrs																				
Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations, Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra, Relational Database Design Using ER- to-Relational Mapping. SQL: SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Basic Queries in SQL.																							
Module-3			9Hrs																				
SQL(contd.): More Complex SQL Queries, Insert Delete and Update Statements in SQL, Specifying Constraints as Assertion and Trigger, Views (Virtual Tables) in SQL, Schema Change Statements in SQL.																							

Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.	
Module-4	9Hrs
Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock - Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery. NoSQL: An overview of NoSQL, Characteristics of NoSQL, NoSQL storage types, Advantages and Drawbacks of NoSQL,.	
Text Books: 1. Elmasri and Navathe,: Fundamentals of Database Systems", 7th Edition, Addison-Wesley,2015. 2. Raghu Ramakrishnan and Johannes Gehrke," Database Management Systems", 3rd Edition, McGraw-Hill,2007 3. Getting Started with NoSQL by GauravVaish	
Reference Books: 1. Silberschatz, Korth and Sudarshan: "Database System Concepts", 6th Edition, Mc-Graw Hill, 2010. 2. C.J. Date, A. Kannan, S. Swamynatham: "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.	
MOOC: 1. Database Management Systemshttps://nptel.ac.in/courses/106/105/106105175/	
Laboratory Plan Perform the following programs using MySQL. 1.Consider the following schema: EMPLOYEE (Ename, Ssn, Bdate, Sex, Address,salary,Mgrssn, Dno) DEPARTMENT (Dname, Dnumber, Mgrssn, Mgr_start_date) PROJECT (Pname, Pnumber, Plocation, Dnum) WORKS_ON (Essn, Pno, Hours) DEPENDENT(Essn,Dependent_name,Sex) Create above tables by specifying primary key, foreign key and other suitable constraints.	

Insert atleast 5 tuples to each created table.

- i. Retrieve the name and address of all employees who work for the "ISE" department.
- ii. For each employee, retrieve the employee's name and the name of his or her immediate supervisor
- iii. Find the sum of all salaries of all employees
- iv. For each department, retrieve the department number, the number of employees in the department and their average salary.

2. Consider the following relation schema:

SAILORS (Sid: integer, Sname: string, Rating: integer, Age: real)

BOATS (Bid: integer, Bname: string, Color: string)

RESERVES (sid: integer, Bid: integer, Day: date)

Create above tables by specifying primary key, foreign key and other suitable constraints.

Insert atleast 5 tuples to each created table.

Design a database to satisfy the above requirements and answer following queries

- i. Find all sailors with a rating above 7
- ii. Find the names of sailors who have reserved boat number 103
- iii. Find the names of sailors who have reserved a red boat
- iv. Find the names of sailors who have reserved a red or a green boat

3. Consider the following relation schema:

STUDENT (Snum: integer, Sname: string, Major: string, Level: string, Age: integer)

CLASS (Cname: string, Meets at: string, Room: string, Fid: integer)

ENROLLED (Snum: integer, Cname: string)

FACULTY (Fid: integer, Fname: string, Deptid: integer)

The meaning of these relations is straightforward; for example, enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

- i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
- ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
- iii. Find the names of all students who are enrolled in two classes that meet at the same time.
- iv. Find the names of faculty members who teach in every room in which some class is taught.

4. Consider the relation schema for book dealer database:

AUTHOR (Author-id:int, Name:string, City:string, Country:string)

PUBLISHER (Publisher-id:int, Name:string, City:string, Country:string)

CATALOG (Book-id:int, Title:string, Author-id:int, Publisher-id:int, Category-id:int, Year:int, Price:int)

CATEGORY (Category-id:int, Description:string)

ORDER-DETAILS (Order-no:int, Book-id:int, Quantity:int)

Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleast five tuples for each relation.

- i. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
- ii. Find the author of the book which has maximum sales.
- iii. Demonstrate how you increase the price of books published by a specific publisher by 10%
- iv. List any department that has all its adopted books published by a specific publisher

5. Consider the schema for Movie Database:

ACTOR (Act_id, Act_Name, Act_Gender) DIRECTOR (Dir_id, Dir_Name, Dir_Phone)

MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)

MOVIE_CAST (Act_id, Mov_id, Role)

RATING (Mov_id, Rev_Stars)

Write SQL queries to

Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleast five tuples for each relation.

1. List the titles of all movies directed by 'Hitchcock'.

2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015.
4. Update rating of all movies directed by 'Steven Spielberg' to 5.

6. Consider the following database for a banking enterprise

BRANCH (branch-name: String, branch-city: String, assets: real)

ACCOUNTS (accno: int, branch-name: String, balance: real)

DEPOSITOR (customer-name: String, customer-street: String, customer-city: String)

LOAN (loan-number: int, branch-name: String, amount: real)

BORROWER (customer-name: String, loan-number: int)

Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleast five tuples for each relation.

- i. Find all the customers who have at least two accounts at the Main branch.
- ii. Find all the customers who have an account at all the branches located in a specific city.
- iii. Demonstrate how you delete all account tuples at every branch located in a specific city.

Note: Queries other than the listed can be asked in Evaluation

Course Title	Information Systems																		
Course Code	20IS505	L-T-P	(3-0-0)3																
Exam	3 Hrs.	Hours/Week	3																
SEE	50 Marks	Total Hours	40																
Course Objective: Students will be able to develop Information System solutions like ERP, CRM, and managerial issues relating to information systems. Course Outcomes: At the end of the course, student will be able to: <table border="1"> <thead> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to POs</th><th>Mapping to PSOs</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Explain basic principles and working of information technology and the role of information systems in business processes.</td><td>1</td><td>1</td></tr> <tr> <td>2.</td><td>Articulate the importance of CRM, ERP, E-commerce, DSS and articulate the details of associated processes.</td><td>2</td><td>1</td></tr> <tr> <td>3.</td><td>Apply the principles of information systems to a given business scenario.</td><td>-</td><td>-</td></tr> </tbody> </table>				#	Course Outcomes	Mapping to POs	Mapping to PSOs	1.	Explain basic principles and working of information technology and the role of information systems in business processes.	1	1	2.	Articulate the importance of CRM, ERP, E-commerce, DSS and articulate the details of associated processes.	2	1	3.	Apply the principles of information systems to a given business scenario.	-	-
#	Course Outcomes	Mapping to POs	Mapping to PSOs																
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2.	Articulate the importance of CRM, ERP, E-commerce, DSS and articulate the details of associated processes.	2	1																
3.	Apply the principles of information systems to a given business scenario.	-	-																
MODULE-1			10 Hrs.																
Foundations of IS in Business: Information Systems in Business: Introduction, The Real World of Information Systems, The Fundamental Role of IS in Business, Types of IS, System Concepts: A Foundation, Components of an Information System, Information System Resources. Case studies :business intelligence, innovating with IT, business success, IT processes, spark batteries Competing with IT: Fundamentals of Strategic Advantages: Strategic IT, Competitive Strategy Concepts, The Competitive Advantage of IT, The Value Chain and Strategic IS, Reengineering Business Processes: The Role of IT, Creating a Virtual Company, Building a Knowledge-Creating Company. Case studies :IT risks and value, business on smart phones, trading securities, reinventing IT, automotives																			
MODULE-2			10Hrs.																

Electronic Business Systems: Enterprise Business Systems: Introduction, Cross-functional Enterprise Applications, Enterprise Application Integration, Transaction Processing Systems, Enterprise Collaboration Systems, Functional Business Systems: Introduction, Marketing Systems, Manufacturing Systems. Case studies: enterprise architects, nationwide insurance, Cisco systems ,strategic IT,dishtee.com Enterprise Business Systems: Customer Relationship Management: Introduction, What is CRM? The Three Phases of CRM, Benefits and Challenges of CRM, Trends in CRM, Enterprise Resource Planning: Introduction, What is ERP? Benefits and Challenges of ERP, Trends in ERP. Case studies : DirecTV, Kennametal, supply chains, Berlin packaging, relationship with dealers	
MODULE-3	10 Hrs.
Electronic Commerce Systems: Electronic Commerce Fundamentals: Introduction, The Scope of E-Commerce, Essential E-Commerce Processes, Electronic Payment Processes, E-Commerce Applications and Issues: E-commerce Application Trends, Business-to- Consumer e-Commerce. Case studies : star bucks, LinkedIn, entellium, royal bank, egurucool.com Decision Support Systems: Decision Support in Business: Introduction, Decision Support Systems (DSS), Management Information Systems, On-line Analytical Processing, Executive Information Systems, Knowledge Management Systems, Business and Artificial Intelligence (AI), Expert Systems. Case studies : Valero energy, virtual stores, Goodyear, Hillman group, Indian distributors	
MODULE-4	10 Hrs.
Security and Ethical Challenges: Security, Ethical and Societal Challenges of IT: Introduction, Ethical Responsibility of Business Professionals, Computer Crime, Privacy Issues, Health Issues, Security Management of IT: Introduction, Tools of Security Management, Internetworked Security Defences. Case studies: texashealth, Wyoming medical centre, challenges in IT,BCD travel, phishing	

Enterprise and Global Management of IT: Managing IT: Business and IT, Managing IT, Business/ IT Planning, Managing the IS Function, Managing Global IT: The International Dimension, Global IT Management, Cultural, Political and Geo - Economic Challenges, Global Business/ IT Applications, Global IT Platforms, Global Data Access Issues, Global Systems Development.

Case studies: reinventing IT at BP, Cadbury, Toyota, unified global operations, RFID implementation

Text Books:

1. James A. O' Brien, George M. Marakas, "Management Information Systems", 10th Edition, Tata McGraw Hill, 2018. Chapters: 1, 2, 7, 8, 9, 10, 13 and 14

Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon, "Management Information System - Managing the Digital Firm" 9th Edition, Pearson Education, 2018
2. W.S. Jawadekar, "Management Information Systems", Tata McGraw Hill 2016.

MOOC

1. Management Information Systems <https://nptel.ac.in/courses/110/105/110105148/>

Course Title	Data Communications		
Course Code	20IS506	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to learn basic concepts of data communications and solve different techniques in error detection and correction Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Describe the layered organization of computer networks, representation and conversions of data and signals, Working of various Media, SONET and ATM	1	1
2.	Apply Line coding, Multiplexing and Error handling techniques	1	1
3.	Analyze the need for different protocols in data link layer	2	1
MODULE-1			10 Hrs.
1. Introduction: Data Communications, Networks, Network Types, Network Models: Protocol Layering, TCP/IP Protocol Suite, The OSI Model. (1.1-1.3,2.1-2.3) 2. Introduction to Physical Layer: Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance, Digital Transmission: Digital-to-Digital Conversion - Line Coding, Line Coding Schemes. (3.1-3.6,4.1,4.1.1,4.1.2)			
MODULE-2			10 Hrs.
3. Digital Transmission (Contd.): Block Coding and Scrambling, Analog-to-Digital Conversion, Transmission Modes, Analog Transmission: Digital-to-Analog Conversion, Analog-to-Analog Conversion.(4.1.3,4.1.4,4.2,4.3,5.1,5.2) 4. Transmission Media: Introduction, Guided Media, Unguided Media: Wireless.(7.1-7.3)			
MODULE-3			10 Hrs.
5. Switching: Introduction, Circuit-Switched Networks, Packet Switching. Introduction to Data-Link Layer: Introduction, Link-Layer Addressing (8.1-8.3,9.1,9.2,9.2.1,9.2.2) 6. Error Detection and Correction: Introduction, Block Coding, Cyclic Codes, Checksum, Forward Error Correction.(10.1-10.5)			

MODULE-4	10 Hrs.
7. Data Link Control: DLC Services, Data-Link Layer Protocols, HDLC (11.1-11.3) 8. Other Wired Networks: Cable Networks, SONET, Architecture, layers ,ATM	
Text Books: Text Book: 1. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, Tata 2013.	
Reference Books: 1. Alberto Leon-Garcia and Indra Widjaja, “Communication Networks - Fundamental Concepts and Key Architectures”, 2nd Edition Tata McGraw-Hill, 2004. 2. William Stallings, “Data and Computer Communication”, 9th Edition, Pearson Education, 2014	
MOOC 1. Computer Networks https://nptel.ac.in/courses/106105183	

Course Title	Mini Project – 1 (Database and Java Application)		
Course Code	20IS507	L-T-P	(0-0-2) 2
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	26

Students should form batches of 3-4 members and develop database applications using Oracle/MySQL/Microsoft SQL as backend and Java as front end.

#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Identify a real life/engineering problem, and conduct investigation to address the problem	1,2	-
2.	Apply software engineering principles in planning & designing the solution to the chosen problem	1,2,3	2
3.	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2
4.	Test and study the performance of the developed system	3,5	1,2
5.	Communicate effectively with team members and mentors, make presentations and prepare technical document	9,10,11,12	2
6.	Use ethical practices in all endeavours	8	-
7	Share the responsibilities for carrying out the project & playing individual roles appropriately	9	-

Performance Indicators	Low	Medium	High
Literature Survey and Problem Definition (5 Marks)	Literature Survey not pertaining to the title of the project (2 M)	Incomplete literature survey and improper problem definition (3-4 M)	Extensive literature survey with clear state of the art problem definition (5M)
Effective Formulation of Design strategies (10 Marks)	Has no coherent strategies for problem solving (2 - 4 M)	Has some strategies for problem -solving, but does not apply them consistently (5-7 M)	Formulates strategies for solving problems (8-10 M)
Implementation Techniques (10 Marks)	No proper technique for implementation (2 - 4 M)	Has some techniques but does not apply them consistently (5-7 M)	Uses well defined implementation techniques (8-10 M)
Verification of the results (5 Marks)	No attempt at checking the incorrect solution. (2 M)	The solution is correct, but not visualized efficiently (3-4 M)	The solution is correct and visualized in an efficient way (5M)

Presentation/ communication (10 Marks)	Disorganized and ineffective presentation (2 - 4 M)	Organized, but ineffective presentation (5-7 M)	Effective organized presentation (8-10 M)
Report Preparation (10 Marks)	Disorganized and contents not sufficient (2 - 4 M)	Organized but not good content wise (5-7 M)	Effectively organized and well framed contents (8-10 M)

The mini project work is to be carried out in three phases:

- **Project Phase I** - Students in consultation with the guides shall carry out literature survey to finalize the topic of the project. Evaluation of the project and its feasibility is done at the end of two weeks.
- **Project Phase II** - Students are expected to present the system analysis, Requirements Specification, design carried out/ algorithms developed and intermediate results at the end of six weeks.
- **Project Phase III** - Final internal evaluation shall be taken up during this phase. This includes presentation, project demonstration and report
- **The continuous evaluation of the project phases** – I, II, and III shall be carried out by the committee consisting of Head of the department, Guide and other faculty.

Course Title	Constitution of India and Professional Ethics (Mandatory Audit Course)		
Course Code	20CIP	L-T-P	(2-0-0) 0
Exam	-	Hours/Week	2
CIE	50 Marks	Total Hours	26
Course Objective: Objective of the course is to make students learn the basic concepts and understand the fundamental rights and professional ethics to apply in engineering profession and to make the learners fundamentally strong engineers. Course Outcomes: After the completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	
1	Enumerate the significance of the preamble of the Constitution, the fundamental rights and duties.	12	
2	Discuss the principles of Freedom of Speech and Expression as a professional.	10,12	
3	Analyse and interpret the present scenario of the nation versus the constitutional provisions.	6,12	
4	Communicate effectively the professional and ethical responsibility as an engineer and acquire applicational competence.	8,9,10	
Module - 1			6 Hrs
Constitution of India: Evolution of Constitution of India. Salient Features of the Constitution. Preamble. Fundamental Rights-Restrictions and Important cases.			
Module - 2			5 Hrs
Relevance of Directive Principles of State Policy. Significance of Fundamental Duties. Union Executive- The President and Vice President, Prime Minister, Council of Ministers. Parliament.			
Module - 3			9 Hrs
State Executive-The Governor, Chief Minister, Council of ministers. Legislature. The Judiciary. Elections. Special provisions relating to certain classes- Scheduled Castes, Scheduled Tribes, women, children and backward classes. Emergency provisions.			
Module - 4			6 Hrs
Professional Ethics: Scope and aims of engineering ethics. Responsibility of Engineers. Impediments to Responsibility. Honesty, Integrity and Reliability of Engineers. Risk, Safety and Liability in Engineering. Case Studies. Code of Ethics for Engineers.			
Text Books: 1. Jain M.P, Indian Constitutional Law, 6th Edition, (New Delhi; Lexis Nexis, 2018). 2. Charles E Harries, Michael S Pritchard and Michael J Rabins, Engineering Ethics, Cengage, 2012.			
Reference Books: 1. Shukla V.N., Constitution of India, (Lucknow: Eastern Book Agency,2019). 2. Basu D.D., Introduction to the Constitution of India, 24th edition, (New Delhi; Lexis Nexis, 2019). 3. Pylee M.V., An Introduction to Constitution of India, Vikas Publishing. 4. Pandey J. N., Constitutional Law of India, Central Law Agency, 2019.			
Scheme of Evaluation CIE marks: 50 1. CIE1-25 marks (Module1 & 2 Objective type-5 marks & Descriptive type-20 marks) 2. Quiz-20 marks (Module-3) 3. Assignment -05 marks (Module-4)			

Course Title	Analytical Ability Development		
Course Code	20AAD	L-T-P	(0-1-0) 1
Exam	-	Hours/Week	2
SEE	50 marks	Total Hours	26
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply analytical skills to solve problems	10	-
Speed, distance and time, Numbers, Clock and calendar, Permutations & combinations, Probability, Ratios and proportions, Profit & loss, Percentage, Simple & compound interest, <u>Scheme of Evaluation:</u> CIE- 5 quizzes each for 10 marks. SEE- One examination for 50 Marks at the end.			

Course Title	Information Storage and Management		
Course Code	20IS601	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: The course provides an insight into information storage technology and architecture, different backup, archive and replication technologies and also storage infrastructure security aspects. Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe the architecture of a Data Centre environment with RAID and Intelligent Storage Systems	1,3	-
2.	Understand and interpret various SAN technologies, storage virtualization concepts and different backup strategies	1, 4	-
3.	Classify the applications as per their requirements and select relevant SAN solutions	1	-
4.	Understand different SAN management strategies to fulfil business continuity requirements	1	-
MODULE-1			10 Hrs.
Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, DBMS, Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host access to data, DAS, Storage design based on application requirements and disk performance, disk native command queuing. Data Protection - RAID: RAID Implementation methods, RAID Array Components, RAID techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, , Hot Spares. Intelligent Storage Systems: Components of an Intelligent Storage System, Types of intelligent storage systems.			
MODULE-2			10 Hrs.
Fibre Channel Storage Area Networks: Fibre Channel Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: General – Purpose Servers vs. NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization.			
MODULE-3			10 Hrs.
Object-Based and Unified Storage : Object-Based Storage Devices, Content-Addressed Storage, CAS Use Cases, Unified Storage.			

Introduction to Business Continuity : Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and restore Operations, Backup Topologies.	
MODULE-4	10 Hrs
Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking changes to source and replica, Restore and Restart Considerations, Creating Multiple Replicas. Remote Replication : Modes of remote replication, Remote Replication Technologies.	
Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking.	
Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities.	
Text Books: 1. G.Somasundaram, Alok Shrivastava (Editors): Information Storage and Management, EMC Education Services, Wiley India, 2nd Edition 2012	
Reference Books: 1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2009. 2. Robert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003 3. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002. 4. Additional resource material on www.emc.com/resource-library/resourcelibrary.esp	

Course Title	Computer Networks		
Course Code	20IS602	L-T-P	(3-0-1) 4
Exam	3 Hrs.	Hours/Week	5
SEE	50 Marks	Total Hours	36L+14P
Course Objective: Develop an understanding of computer networks from design and performance perspectives Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Describe the functions of Ethernet, Virtual LANs, Connecting devices and different protocols at the Network, Transport and Application Layers	1	-
2.	Analyze different Protocols at MAC sub layer, Network and Transport Layers	2	-
3.	Design networks applying Internetworking concepts and appropriate IP addressing for a given problem.	3	
4.	Conduct various experiments on network designs using different tools and debug the same.	5	-
MODULE-1			9 Hrs.
1. Media Access Control: Random Access,ALOHA,CSMA,CSMA/CD,CSMA/CA Controlled Access, Channelization. Wired LANs: Ethernet: Ethernet Protocol. (12.1 to 12.3,13.1) 2. Ethernet (Contd): Standard Ethernet., Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet Connecting Devices. (13.2,13.2.1.1,3.2.2,13.3 to 13.5)			
MODULE-2			9 Hrs.
3. Introduction to Network Layer: Network Layer Services,Packetizing,Routing and Forwarding, Packet Switching, Network Layer Performance, IPV4 Addresses – Address Space, Classful Addressing, Classless Addressing(18.1,18.2 to 18.4 upto 18.4.3) 4. Network Layer Protocols: Internet Protocol (IP), ICMPv4, Unicast Routing: Introduction. Routing Algorithms,Distance vector routing,link state routing. (19.1, 19.2,20.1,20.2.1,20.2.2)			
MODULE-3			9 Hrs.

5. Multicast Routing: Introduction, Multicasting Basics. Intradomain Multicasting Protocols – Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF). Intradomain Multicasting Protocols ,Protocol Independent Multicast (PIM), Interdomain Multicasting Protocols (21.1 to 21.4) 6. Next Generation IP: IPV6 Addressing, The IPv6 protocol, Transition from IPv4 to IPv6, Transport Layer: Introduction to Transport-Layer Transport Layer Protocols - Simple Protocol, Stop-and- Wait Protocol.(22.1,22.2,22.4,23.1,23.2)	
MODULE-4	9 Hrs.
7. Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol – up to Flow Control (Excluding: State Transition Diagram).(24.1 t 24.3) 8. Introduction to Application Layer: Introduction, Client-Server Programming, Standard Client Server Protocols: World Wide Web and HTTP(25.1,25.2,26.1)	
Text Books: 1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw-Hill, 2013	
Reference Books: 1. Alberto Leon-Garcia and Indra Widjaja, Communication Networks - Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw- Hill, 2004 2. William Stallings, Data and Computer Communication, 9th Edition, Pearson Education, 2014.	
MOOC 2. Computer Networks https://nptel.ac.in/courses/106105183	
Practical Component	
Guided Experiments	
Perform the following programs using C/C++ and any Network Simulator Tool 1. Write and execute a program for distance vector algorithm to find the suitable path for transmission between sender and receiver. 2. Write and execute a program to find 16-bit and 32-bit checksum Fletcher and Adler checksum methods. 3. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present. 4. Suppose Alice wants her friends to encrypt email messages before sending them to her. Write a program to help her friends to encrypt and decrypt the data. (RSA algorithm). 5. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped. 6. Simulate a four node point-to-point network with the links connected as follows: n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP. 7. Simulate the transmission of ping messages over a network topology consisting of 6 nodes. 8. Simulate an Ethernet LAN using n nodes, change error rate and data rate and compare throughput.	

9. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
10. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

Course Title	Artificial Intelligence		
Course Code	20IS603	L-T-P	(4-0-0) 4
Exam	3 Hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	40 P
Course Objective: Students will be able to apply the concepts of Artificial Intelligence to construct knowledge based systems Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Describe different types of Artificial Intelligence agents, search strategies	2	1
2.	Analyze different search strategies for a given problem.	3	1
3.	Solve the given problem using different search strategies	3	1
4.	Design simple knowledge based systems using first-order logic	2	1
MODULE-1			10 Hrs.
Introduction: What is AI? Intelligent Agents: Agents and environment; Good behaviour: The Concept of Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents. Example problems; Searching for solution; Uninformed search strategies: Breadth-first search, Uniform-cost search			
MODULE-2			10 Hrs.
Uninformed search strategies : Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search. Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Optimality of A*, Memory-bounded heuristic search;			
MODULE-3			10Hrs.
Local Search Algorithms and Optimization Problems: Hill-climbing search, Simulated annealing, Local beam search, Genetic algorithms On-line search agents and unknown Environments: Online search problems, Online search agents, online local search, learning in online search.			
MODULE-4			10 Hrs.
Logical Agents: Knowledge-based agents; The Wumpus world; First-Order Logic: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic, Knowledge engineering in first-order logic. Inference in first-order logic: propositional versus first-order inference, uniform and lifting, forward chaining, backward chaining, resolution			
Text Books: 1. Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, Third edition, Pearson, 2014.			
Reference Books: 1. Artificial Intelligence, Elaine Rich, Kevin Knight and Shivashankar B Nair, Third edition, McGraw-Hill Education, 2015. 2. Introduction to Artificial Intelligence and Expert Systems, Dan W Patterson, Pearson, 2015			
MOOC 1. https://www.edx.org/course/artificial-intelligence-uc-berkeleyx-cs188-1x 2. https://www.udacity.com/course/intro-to-artificial-intelligence--cs271			

3. <https://www.class-central.com/subject/ai>

Course Title	Management, Entrepreneurship and IPR		
Course Code	20IS604	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Student will analyse various concepts of different styles of motivation, company leadership, power and authority.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Describe the functions of management activities such as planning , organization and staffing, directing and controlling.	11	-
2	Explain the importance of entrepreneurship and entrepreneurial process.	11	-
3	Prepare a project report for a given business requirement.	10	-
4	Recognize the Basic Principles of IP laws like Patents	11	-

MODULE-1	10 Hrs.
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Management: Introduction - Meaning - Nature and Functions of Management, Importance & Definition of Management, Management Functions, Roles of a Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art or Profession – Development of Management Thought - Early Management Approaches, Modern Management Approaches

Planning: Nature, Importance and Forms of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Making Planning Effective – Decision Making – Meaning, Types of Decisions, Steps in Decision Making, Common Difficulties in Decision – Making.

MODULE-2	10 Hrs.
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Organization and Staffing: Meaning and Process of Organizing - Principles of Organizing - Types of Organization - Departmentalization - Committees - Centralization Vs Decentralization of Authority and Responsibility, MBO, Nature and Importance of Staffing - Process of Selection & Recruitment (in brief), Business Ethics and Corporate Governance.

Directing & Controlling: Requirements of Effective Direction, Motivation Theories, Communication – Importance, Purpose- Leadership Styles, Meaning and Steps in Controlling, Need for Control, Essentials of

Effective Control System.	
MODULE-3	10 Hrs.
Entrepreneur: Meaning of Entrepreneur: Importance of an Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an Emerging Class, Concept of Entrepreneurship - Evolution Entrepreneurship - Development of Entrepreneurship, Stages in Entrepreneurial Process, Role of Entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship - Its Barriers Institutional support: Introduction, Institutional Finance, Different Schemes – SSIDC, KVIC, DIC.	
MODULE-4	10 Hrs.
Patents: Introduction, Origin and meaning of the term patent, Objective of a patent law, the legislative provisions regulating patents, principles underlying the patent law in India, patentable invention. Procedure for obtaining patent: Submission of application, Filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license. Copy Right: Meaning and characteristics of copy right, Indian copy right law, requirement of copy right, Illustrations copy right in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording. Author and Ownership of copy right: Ownership of copy right, Contract of service, Contract for service, rights conferred by copy right, terms of copy right, license of copy right. Infringement of copy right: Acts which constitute infringement, general principle, direct and indirect evidence of copying.	
Text Books: 1. P.C. Tripathi, P.N. Reddy, Principles of Management, Tata McGraw-Hill, 5th Edition 2019. 2. Vasant Desai, Dynamics Entrepreneurial Development & Management, Himalaya Publishing House, 2018. 3. Dr. T Ramakrishna: Basic principles and acquisition of Intellectual Property Rights, CIPRA, NSLIU - 2018. 4. Dr. B. L. Wadehra: Intellectual Property Law Handbook, Universal Law Publishing Co. Ltd., 2017.	
Reference Books: 1. S. S. Khanka, "Entrepreneurship Development", S. Chand & Co., 2018. 2. Dr. T Ramakrishna: Ownership and Enforcement of Intellectual Property Rights, CIPRA, NSLIU - 2017. 3. Intellectual Property Law (Bare Act with short comments), Universal Law Publishing Co. Ltd., 2017.	
MOOC 1. Entrepreneurship https://nptel.ac.in/courses/110/106/110106141/	

Course Title	Mini Project - 2		
Course Code	20IS605	L-T-P	(0-0-2)2
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	26

Students should form batches of 3-4 members and develop web-based applications using XHTML, Javascript, PHP, MYSQL and other latest tools.

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

#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Identify a real life/engineering problem, and conduct investigation to address the problem	1,2	-
2.	Apply software engineering principles in planning & designing the solution to the chosen problem	1,2,3	2
3.	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2
4.	Test and study the performance of the developed system	3,5	1,2
5.	Communicate effectively with team members and mentors, make presentations and prepare technical document	9,10,11,12	2
6.	Use ethical practices in all endeavours	8	-
7	Share the responsibilities for carrying out the project & playing individual roles appropriately	9	-

Rubrics:

Performance Indicators	Low	Medium	High
Literature Survey and Problem Definition (5 Marks)	Literature Survey not pertaining to the title of the project (2 M)	Incomplete literature survey and improper problem definition (3-4 M)	Extensive literature survey with clear state of the art problem definition (5M)
Effective Formulation of Design strategies (10 Marks)	Has no coherent strategies for problem solving (2 - 4 M)	Has some strategies for problem -solving, but does not apply them consistently (5-7 M)	Formulates strategies for solving problems (8-10 M)
Implementation Techniques (10 Marks)	No proper technique for implementation (2 - 4 M)	Has some techniques but does not apply them consistently (5-7 M)	Uses well defined implementation techniques (8-10 M)

Verification of the results (5 Marks)	No attempt at checking the incorrect solution. (2 M)	The solution is correct, but not visualized efficiently (3-4 M)	The solution is correct and visualized in an efficient way (5M)
Presentation/ communication (10 Marks)	Disorganized and ineffective presentation (2 - 4 M)	Organized, but ineffective presentation (5-7 M)	Effective organized presentation (8-10 M)
Report Preparation (10 Marks)	Disorganized and contents not sufficient (2 - 4 M)	Organized but not good content wise (5-7 M)	Effectively organized and well framed contents (8-10 M)

Initially Students will be taught the basic concepts about XHTML, Javascript, PHP, MYSQL and following programming exercises are carried out to understand the concepts.

9. Develop and demonstrate a XHTML document that illustrates the use of external style sheet, ordered list, table, borders, padding, color, and the tag.
10. Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
11. Using Javascript script, develop a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
12. Using PHP and MySQL, develop a program to accept book information viz. Accession Number, Title, Authors, Edition and Publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

After the completion of above exercises a mini project work is to be carried out in three phases:

- **Project Phase I (5 marks)**- Students in consultation with the guides shall carry out literature survey to finalize the topic of the project. Evaluation of the project and its feasibility is done at the end of two weeks.
- **Project Phase II(25 marks)** - Students are expected to present the system analysis, Requirements Specification, design carried out/ algorithms developed and intermediate results at the end of six weeks.
- **Project Phase III (20 marks)**- Final internal evaluation shall be taken up during this phase. This includes presentation, project demonstration and report

The continuous evaluation of the project phases – I, II, and III shall be carried out by the committee consisting of Head of the department, Guide and other faculty.

Course Title	SWAYAM course -1 (Mandatory Audit Course)
Course Code	20SW01
Students should take one compulsory Swayam course-1 from the list of subjects offered by NPTEL and should clear that subject. This audit course will be considered only after submission of Certificate of completion issued by NPTEL. Note: In case the course is not cleared student will not be awarded with degree certificate.	

Course Title	Aptitude Reasoning Development (Mandatory Audit Course)		
Course Code	20ARD	L-T-P	(0-2-0) 0
SEE	50 Marks	Hours/Week	3
		Total Hours	45
Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply Logical reasoning and deductions for given situations	1	-
Introduction and concepts of Logical reasoning, Illustrative examples, Logical analysis. Technical aptitude on C and C++. Language fundamental. Illustrative programs. MCQs on coding constructs, error detection, finding the output of code segments. <u>Scheme of Evaluation:</u> CIE- 5 quizzes each for 10 marks. SEE- One examination for 50 Marks at the end.			

Course Title	Environmental Studies (Mandatory Audit Course)		
Course Code	20EVS	L-T-P	(2-0-0) 0
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	26
Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes (CO)		Mapping to POs
1.	Acquire an awareness of and sensitivity to the total environment and its allied problems.		7, 10
2.	Develop strong feelings of concern, sense of ethical responsibility for the environment and the motivation to act in protecting and improving it.		6,8
3.	Analyze and evaluate environmental measures in real world situations in terms of ecological, political, economical, societal and aesthetic factors.		6, 8, 9
MODULE-1			4 Hrs
Environment: Definition, Ecosystem, Balanced ecosystem, Effects of human activities on environment Agriculture Housing Industry Mining and Transportation.			
MODULE-2			8 Hrs
Natural Resources: Water resources, Availability and Quality, Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources - Forest Resources - Material Cycles - Carbon, Nitrogen and Sulphur Cycles.			
MODULE-3			7 Hrs
Pollution: Effects of pollution - Water pollution - Air pollution Land pollution - Noise pollution.			
MODULE-4			7 Hrs
Current Environmental issues of importance: Acid Rain, Ozone layer depletion - Population Growth, Climate change and Global warming. Environmental Impact Assessment and Sustainable Development Environmental Protection - Legal aspects. Water Act and Air Act.			
Text Books:			
1. Environmental Studies - Dr. D.L Manjunath, Pearson Education -2006			
2. Environmental Studies - Dr. S. M. Prakash - Elite Publishers - 2006			
Reference Books:			
1. Environmental Studies - Benny Joseph - Tata McGraw ill- 2005			
2. Principles of Environmental Science and Engineering P. Venugopala Rao, Prentice Hall of India.			
3. Environmental Science and Engineering - Meenakshi, Prentice Hall India.			

Courses for Elective Group - I

Course Title	Internet of Things		
Course Code	20IS651	L-T-P	(2-0-1)3
Exam	3 hrs	Hours/Week	3
SEE	50 Marks	Total Hours	28L+12P

Course Objective: Students will be able to develop IOT applications.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the fundamentals and applications of IoT, its Architecture, Design Principles and Standards	1	-
2.	Apply programming skills to design IoT applications	3	-
3.	Analyze IoT system management		2
4.	Design and Implement applications of IoT and make presentation in team	5, 10	2

MODULE-1	8 Hrs
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Introduction to Internet of Things: Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems.

IoT levels and deployment template Domain specific IoTs, - IoT levels, Introduction, Home Automation; Cities; Environment; Energy; Retail; Logistics; Agriculture; Industry; Health & Lifestyle.

MODULE-2	8 Hrs
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IoT and M2M IoT System management with NETCONF-YANG Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software defined networking, network function virtualization Need for IoT Systems management; SNMP; Network Operator Requirements; NETCONF; YANG; IoT Systems management with NETCONFYANF; NETOPEER.

MODULE-3	8 Hrs
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IoT platform Design Methodology - IoT Design Methodology; Introduction; Case Study on IoT System for Weather Monitoring, motivation for using python.

IoT Physical Devices and End points - What is an IoT device; Exemplary Device- Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Other IoT devices.

MODULE-4			8 Hrs
IoT Physical Servers & Cloud Offerings: Designing a Restful Web API, Amazon Web Services for IoT, AmazonEC2, Amazon Auto Scaling, AmazonS3, Amazon RDS			
Case studies illustrating IoT Design: Introduction to IOT Design, Home Automation, Smart Lighting, Home Intrusion Detection, Cities, Smart Parking.			
Text Books:			
1. Internet of Things - A Hands on Approach, ArshdeepBahga and Vijay Madisetti Universities Press, 2015			
Reference Books:			
1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012.			
2. Vijay Madisetti, ArshdeepBahga, Internet of Things: A Hands-On Approach Vijay Madisetti, 1st Edition ISBN-10: 0996025529, 2014			
MOOC:			
1. Design for Internet of things https://nptel.ac.in/courses/108/108/108108098/			
Course Title	C# & .NET Technologies		
Course Code	20IS652	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to develop online applications using C# & .Net Technologies			
Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSO's
1	Understand the fundamentals of C# language.	1	-
2	Use .NET framework for developing web applications (L2)	1	-
3	Design and develop applications in C# (		
MODULE-1			10 Hrs.

The Philosophy of .NET : Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.**Building C# Applications :** Introducing C# -- What is C#? Why is C#? Evolution of C#. Characteristics of C#, Applications of C#. The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe).

MODULE-2

10 Hrs.

C# Language Fundamentals: Overview of C# -- Introduction, A Simple C# Program, Namespaces, Adding Comments, Main Returning a Value, Using Aliases for Namespace Classes, Passing strings objects to WriteLine method, Command Line Arguments, Main with a Class, providing Interactive input, Using Mathematical functions, Mutiple Main methods, Compile Time Errors, Program Structure, Program Coding Style. Literals, Variables and Data Types -- Data types, Value types, Reference types, Default values, Constant variables, Scope of variables, Boxing and Unboxing. Operators and Expressions – Introduction, Arithmetic Operators, Relational operators, Logical operators, Assignment operators, Increment and Decrement operators, Conditional operator, Bitwise operators, Special Operators, Type Conversions. Decision Making and Branching- The Switch statement. Decision Making and Looping: The foreach statement, Jumps in LoopsTrees. Methods in C# -- Introduction, Declaring Methods, The Main Method, Invoking Methods, Nesting of Methods, Method Parameters, Pass by Value, Pass by Reference, The Output Parameters, Variable Argument Lists, Methods Overloading. Handling Arrays – One-Dimensional Arrays, Creating an Array, Two- Dimensional Arrays, Variable- Size Arrays, The System.Array Class. Manipulating Strings -- Creating Strings, String Methods, Inserting Strings, Comparing Strings, Finding Substrings, Mutable Strings, Arrays of Strings, Regular Expressions. Structures and Enumerations – Structures, Structs with Methods, Nested Structs, Difference between Classes and Structs, Enumerations, Enumerator Initialization, Enumerator Base Types, Enumerator Type Conversion

MODULE-3

10 Hrs.

Object- Oriented Programming with C#: Classes and Objects -- Introduction, Basic principles of OOP, Defining a Class, Adding Variables and Methods, Member Access Modifiers, Creating Objects, Accessing Class members, Constructors, Overloaded Constructors, Static Members, Static Constructors, Private Constructors, Copy Constructors, Destructors, Member Initialization, The this reference, Nesting of Classes, Constant Members, Read-only Members, Properties, Indexers. Inheritance and Polymorphism: Introduction, Classical Inheritance, Containment Inheritance, Defining a Subclass, Visibility Control, Defining Subclass Constructors, Multilevel Inheritance, Hierarchical Inheritance, Overriding Methods, Hiding Methods, Abstract Classes, Abstract Methods, Sealed Classes: Preventing Inheritance, Sealed Methods, Polymorphism.

Interface, Operator Overloading: Multiple Inheritances: Introduction, Defining an Interface, Extending an Interface, Implementing Interfaces, Interfaces and Inheritance, Explicit Interface Implementation, Abstract Class and Interfaces. Operator Overloading: Introduction, Over loadable Operators, Need for Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Comparison Operators.	
MODULE-4	10 Hrs.
Delegates, Events and Managing Console I/O Operation: Delegates - Introduction, Delegates, Delegate Declaration, Delegate Methods, Delegate Instantiation, Delegate Invocation, Using Delegates, Multicast Delegates, Events. Managing Console I/O Operations: Introduction, The Console Class, Console Input and Output, Formatted Output, Numeric Formatting, Standard Numeric Format, Custom Numeric Format. Exceptions and Multithreading: Managing Errors and Exceptions - Introduction, What is Debugging? Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch statements, The Exception Hierarchy, General Catch Handler, Using Finally statement, Nested Try Blocks, Throwing our Own Exceptions, Checked and Unchecked Operators, Using Exceptions for Debugging. Multithreading in C# -- Introduction, Understanding the System.Threading Namespace, Creating and Starting a Thread. Scheduling a Thread, Synchronising Threads, Thread Pooling.	
Text Books: 1. Andrew Troelsen: Pro C# with .NET 3.0, Special Edition, Dream tech Press, India, 2007. 2. E. Balagurusamy: Programming in C#, A PRIMER, Third Edition, 2012,Tata McGraw Hill	
Reference Books: 3. Tom Archer: Inside C#, WP Publishers, 2001.	

Course Title	Advanced Java		
Course Code	20IS653	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: At the end of the course the students will be able to use J2EE concepts to create an application package.

Course Outcomes: After the completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes:

#	Course Outcomes	Mapping to PO	Mapping to PSO's
1	To be able to design java programs which may be generic demonstrating enumeration, autoboxing capability and event handling.	1	-
2	Design applets and GUI with Java Swing.	1	-
3	Employing java collection framework whenever required.	2	-
4	Use Servlets and JSP to add Dynamic contents, data requests handling and Session tracking.		

MODULE-1	10 Hrs.
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Enumeration, Autoboxing and Generics -Enumeration fundamentals, values() and valuesOf() Methods, Java Enumerations are class types, example, Type Wrappers, Autoboxing, **Generics** – What are generics? A simple generics example, Generic class with two type parameters, General form of generic class, Bounded types, Using wildcard arguments, Creating Generic method, Generic Interfaces.

Event Handling - Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

MODULE-2	10 Hrs.
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Applets - Applet basics, A complete Applet Skeleton, Applet Initialization and Termination, A key Aspect of an Applet Architecture, Requesting Repainting, using the status window, Passing parameters to Applets. **User Interface components with Swing** -The origin and Design philosophy of swing, Components and containers Layout managers, A first simple swing Example Event Handling, Creating a swing applet, Exploring Swing Controls- JLabel and ImageIcon, Jtextfield The Swing Buttons, JTabbedPane, JScrollPane, Jlist, JCombobox, Trees.

MODULE-3	10 Hrs.
The Collections Framework – Collections overview, The collection Interfaces, The collection classes, Accessing collection via an iterator, Storing user defined classes in collections. Java 2 Enterprise Edition Overview, Database Access- Overview of J2EE and J2SE. The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data types; Exceptions	
MODULE-4	10 Hrs.
Servlets and JSP - Background, Lifecycle of a sevelet, Development options, Using Tomcat, A simple servlet, The Servlet API, javax.servlet Package, Reading Servlet parameters, The javax.servlet.http Package, Handling HTTP Request and Responses, Using Cookies, Session tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects. RMI -. Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side. Java Beans – What is a Java Bean? Advantages of Java Beans, Bound and Constrained Properties, Persistence, Customizer, The Java Beans API, A Bean Example.	
Text Books: 1. Carl Hamacher, Zvonko Vranesic SfwatZaky: "Computer Organization", 5th Edition, Tata McGraw Hill 2002	
Reference Books: 1. Advanced Java Programming ,Uttam.K.Roy , Oxford Press,2015 2. Java Fundamentals Herbert Schildt Dale Skrien, Mc GrawHill 2013 3. Y. Daniel Liang: Introduction to JAVA Programming, 6th Edition, Pearson Education, 2007. 4. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.	

Course Title	Computer Graphics & Visualization																		
Course Code	20IS654	L-T-P	(3-0-0)3																
Exam	3 Hrs.	Hours/Week	3																
SEE	50 Marks	Total Hours	40																
Course Objective: Students will be able to develop interactive computer graphics applications. Course Outcomes: At the end of the course, student will be able to: <table> <tr> <th>#</th><th>Course Outcomes (CO)</th><th>Mapping to POs</th><th>Mapping to PSOs</th></tr> <tr> <td>1.</td><td>Explain principles and techniques of computer graphics hardware and software</td><td>1</td><td>-</td></tr> <tr> <td>2.</td><td>Apply graphics algorithms and geometric transformations</td><td>3</td><td>2</td></tr> <tr> <td>3.</td><td>Explain 2D and 3D viewing, lighting and shading</td><td>1</td><td>-</td></tr> </table>				#	Course Outcomes (CO)	Mapping to POs	Mapping to PSOs	1.	Explain principles and techniques of computer graphics hardware and software	1	-	2.	Apply graphics algorithms and geometric transformations	3	2	3.	Explain 2D and 3D viewing, lighting and shading	1	-
#	Course Outcomes (CO)	Mapping to POs	Mapping to PSOs																
1.	Explain principles and techniques of computer graphics hardware and software	1	-																
2.	Apply graphics algorithms and geometric transformations	3	2																
3.	Explain 2D and 3D viewing, lighting and shading	1	-																
MODULE-1			10 Hrs																
Introduction: Applications of Computer Graphics, A Graphics System, Images, Physical and Synthetic, Imaging Systems, The Synthetic Camera Model, The Programmer's Interface, Graphics Architectures. Graphics Programming: Programmable Pipelines, Performance Characteristics. Graphics Programming: The Sierpinski Gasket, Programming Two-Dimensional Applications. The OpenGL API, Primitives and Attributes																			
MODULE-2			10 Hrs																
The OpenGL API (contd.): Color, Viewing, Control Functions, The Gasket Program, Polygons and Recursion, The Three-Dimensional Gasket. Input and Interaction: Interaction, Input Devices, Clients and Servers, Display lists, Display Lists and Modeling, Programming Event-Driven Input, Menus, Picking, A Simple CAD Program.																			
MODULE-3			10 Hrs																
Geometric Objects and Transformations-1: Scalars, Points, and Vectors, Three-Dimensional Primitives, Coordinate Systems and Frames, Modeling a Colored Cube, Affine Transformations. Geometric Objects and Transformations-2: Rotation, Translation and Scaling, Transformations in Homogeneous Coordinates, Concatenation of Transformations, OpenGL Transformation Matrices, Interfaces to Three-Dimensional Applications.																			
MODULE-4			10 Hrs																
Viewing: Classical and Computer Viewing, viewing with a Computer, Positioning of the camera, Simple Projections, Projections in OpenGL, Hidden-Surface Removal, Interactive Mesh Displays.																			

Lighting and Shading: Light and Matter, Light Sources, The Phong Lighting Model, Computation of Vectors, Polygonal Shading, Approximation of a Sphere by Recursive Subdivisions, Light Sources in OpenGL, Specification of Materials in OpenGL.			
Text Book:			
1. Edward Angel, "Interactive Computer Graphics", A Top-Down Approach with OpenGL, 5th Edition, Addison-Wesley, 2008.			
Reference Books:			
1. F.S. Hill Jr., "Computer Graphics Using OpenGL", 2nd Edition, Pearson Education, 2001.			
2. Donald Hearn and Pauline Baker, "Computer Graphics - OpenGL Version", 2nd Edition, Pearson Education, 2003.			
MOOC:			
1. Introduction to Computer Graphics https://nptel.ac.in/courses/106/102/106102065/			

Course Title	Data Warehousing and Mining		
Course Code	20IS655	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objectives: Students will be able to select the right data mining technique to extract useful patterns. Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSO
1	Explain fundamentals of data classification, clustering, association Analysis and applications of data mining	1	-
2	Analyse the quality of data and process of data mining.	2	-
3	Apply the appropriate classification methods for classifying data and analyze the association between the objects & different clustering approaches.	1, 2	1
4	Choose the proper data model for designing the data warehouse	3	-
MODULE-1			10 Hrs
Introduction Data: Why Data Mining? What is Data Mining? What kinds of data can be mined? What kinds of patterns can be mined?, Which technologies are used? Major issues in data mining. Getting to know your data: Data objects and attribute types, Basic statistical description of data: measuring the central tendency, Measuring the dispersion of data, measuring data similarity and dissimilarity			
MODULE-2			10 Hrs
Data Pre-processing: Data Pre-processing: An overview, Data cleaning, Data integration, Data Reduction: overview of data reduction strategies, wavelet transforms, Principal component analysis, attribute subset			

selection, Data Transformation: minmax normalization and Z-score normalization. **Data Warehouse and online**

Analytical processing: Data Warehouse: Basic Concepts, Data Warehouse modelling: Data cube and OLAP, Data warehouse design and usage: A business analysis framework for data warehouse design, Data warehouse design process, Datawarehouse usage for information processing.

MODULE-3

10 Hrs

Classification: Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction, Rule-based classification, K- Nearest-neighbour Classifier. **Mining frequent patterns Association and correlations:** basic concepts and methods: Basic Concepts, Frequent itemset mining methods: Apriori Algorithm, generating association rules from frequent item sets, Improving the efficiency of Apriori, A Pattern growth Approach for Mining Frequent itemsets.

MODULE-4

10 Hrs

Cluster Analysis: Basic Concepts and Methods, Cluster Analysis, Partitioning Methods, Agglomerative versus divisive hierarchical clustering, DBSCAN **Data Mining Trends and research frontiers:** Data mining Applications, Data mining and society, Data mining trends.

Text Books:

1. Jiawei Han and Micheline Kamber, Jian Pei: Data Mining – Concepts and Techniques, 3rd Edition, Morgan Kaufmann series, 2006.

Reference Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2007.
2. K.P.Soman, Shyam Diwakar, V. Ajay, Insight into Data Mining–Theory and Practice, PHI, 2006.

MOOC:

1. Data Mining <https://nptel.ac.in/courses/106/105/106105174/>

Open Electives

Course Title	Web Technologies																		
Course Code	20OEIS71	L-T-P	(3-0-0)3																
Exam	3 Hrs.	Hours/Week	3																
SEE	50 Marks	Total Hours	40																
Course Objective: Students will be able to develop web applications. Course Outcomes: At the end of the course, student will be able to: <table border="1"> <thead> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to POs</th><th>Mapping to PSOs</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Explain the fundamentals of world wide web and web programming languages such as HTML, XHTML, Java script, PHP, AJAX and mysql database system.</td><td>1</td><td>-</td></tr> <tr> <td>2.</td><td>Apply the different scripting languages for dynamic web page development.</td><td>1</td><td>-</td></tr> <tr> <td>3.</td><td>Design and develop web solutions for given requirements.</td><td>3</td><td>2</td></tr> </tbody> </table>				#	Course Outcomes	Mapping to POs	Mapping to PSOs	1.	Explain the fundamentals of world wide web and web programming languages such as HTML, XHTML, Java script, PHP, AJAX and mysql database system.	1	-	2.	Apply the different scripting languages for dynamic web page development.	1	-	3.	Design and develop web solutions for given requirements.	3	2
#	Course Outcomes	Mapping to POs	Mapping to PSOs																
1.	Explain the fundamentals of world wide web and web programming languages such as HTML, XHTML, Java script, PHP, AJAX and mysql database system.	1	-																
2.	Apply the different scripting languages for dynamic web page development.	1	-																
3.	Design and develop web solutions for given requirements.	3	2																
Module - 1			10 Hrs																

Fundamentals of Web: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, HTTP, Security. XHTML: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Tables, Forms, The Audio Element, The Video Element, Syntactic Difference between HTML and XHTML.			
Module - 2			10 Hrs
Cascading Style Sheets: Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Colour, Alignment of Text, The Box Model, Background Images, The and <div> Tags, Conflict Resolution. The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation, and Modification, Arrays, Functions, Constructors, Pattern Matching Using Regular Expressions, Errors in Scripts.			
Module - 3			10 Hrs
JavaScript and XHTML Documents: The JavaScript Execution Environment, The Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from The Text Box and Password Elements Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colours and Fonts. Introduction to XML: Introduction, uses of XML, The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS.			
Module - 4			10 Hrs
Introduction to PHP: Origins and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives, Operations and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching. Database Access Through the Web: Relational Databases, An introduction to Structured Query Language (Review), Architectures for Database Access, The MySQL Database System, Database Access with PHP and MySQL.			
Text Books: 1. Robert W. Sebesta, "Programming the World Wide Web", 8th Edition, Pearson Education, 2014.			
Reference Books: 1. Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2014 2. James Lee, Brent Ware, "Open Source Web Development with LAMP", Pearson Education, 2013			
Course Title	Java Programming		
Course Code	20OEIS62	L-T-P	(3-0-0) 3

Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Students will be able to understand fundamentals of object-oriented programming in Java and be able to use the Java SDK environment to design simple Java programs.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply object-oriented principles to develop solutions using Java programming	2	-
2	Apply exception handling and threads to problem solving	2	-
3	Develop applets to handle events and suitable GUI using swings	3	-
4	Explain concepts of servlets and networking	1	-

MODULE-1	10 Hrs
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Introduction to Java: Java and Java Applications, How Java Changed the Internet, Java Development Kit (JDK), The Byte Code, Servlets, The Java Buzzwords, Object-Oriented Programming, Simple Java Programs using Control Statements and Blocks of code, Lexical Issues, Data Types, Variables, and Arrays : The primitive Types, Integers, Floating-Point Types, Characters, Booleans, Literals, Variables, Type Conversion and Casting, Arrays, Strings, Operators : Arithmetic, Bitwise, Relational, Boolean Logical, Assignment Operator, The ? Operator, Operator Precedence, Java's Selection Statements, Iteration Statements, Jump Statements. **Introducing Classes, Objects and Methods:** Class Fundamentals, Declaring Objects, Object Reference Variables, Methods, Constructors, The this keyword, Garbage collection, Overloading Methods and constructors, Argument Passing, Returning Objects, Recursion, Access Control, Nested and Inner Classes.

MODULE-2	10 Hrs
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Inheritance, Packages and Interfaces: Inheritance Basics, Using Super, Multilevel Hierarchy, When Constructors are called, Method Overriding, Abstract Classes. Packages, Access Protection, Importing Packages, Interfaces. **Exception Handling, Multi Threaded Programming:** Exception-Handling Fundamentals, Exception types, Uncaught Exceptions, Using try and Catch, Multiple catch Clauses, Nested try Statements, throw, Java's Built-in Exceptions. The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Synchronization, Interthread Communication, The Modern way of Suspending, Resuming, and stopping Threads.

MODULE-3	10 Hrs
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Event Handling, The Applet Class: Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model,

Adapter Classes, Inner Classes. The Applet Class: Two Types of Applets, Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, Requesting Repainting, Using the Status Window, The HTML APPLET tag, Passing Parameters to Applets, getDocumentbase() and getCodebase(), ApletContext and showDocument(), The AudioClip Interface, The AppletStub Interface, Output to the Console. Java Beans, Introducing Swing: What is a Java Bean?, Advantages of Java Beans, Bound and Constrained Properties, Persistence, The Java Beans API, A Bean Example. The Origins of Swing, Two Key Swing Features, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Create a Swing Applet.	
MODULE-4	10 Hrs
Exploring Swing: JLabel and ImageIcon, JTextField, The Swing Buttons, JTabbedPane, JScrollPane, JList, JComboBox, JTable. Servlets and Introduction to Networking: Servlets-Background, The Life Cycle of a Servlet, Using Tomcat for Servlet Development, A Simple Servlet, The Servlet API, The javax.servlet Package, Reading Servlet Parameter, The javax.servlet.http Package, Handling HTTP Requests and Responses, Using Cookies, Session Tracking. Networking- Networking Basics, The Networking Classes and Interfaces, URL, URL Connection, TCP/IP Server Sockets, Datagrams.	
Text Books: 1. Herbert Schildt, "Java the Complete Reference", 9th Edition, McGraw-Hill Education, 2014.	
Reference Books: 1. Y. Daniel Liang, "Introduction to JAVA Programming, Brief Version", 9th Edition, Pearson Education, 2014. 2. Kogent Learning Solutions, "Java 6 Programming Black Book", Dreamtech Publication, 2014.	
MOOC: 1. Programming in Java https://nptel.ac.in/courses/106/105/106105191/	

Course Title	Internet of Things		
Course Code	20OEIS63	L-T-P	(3-0-0)3
Exam	3 hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to develop IOT applications. Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the fundamentals and applications of IoT, its Architecture, Design Principles and Standards	1	-
2.	Apply programming skills to design IoT applications	3	-
3.	Analyze IoT system management		2
4.	Design and Implement applications of IoT and make presentation in team	5, 10	2
MODULE-1			10 Hrs
Introduction to Internet of Things: Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT levels and deployment template Domain specific IoTs, - IoT levels, Introduction, Home Automation; Cities; Environment; Energy; Retail; Logistics; Agriculture; Industry; Health & Lifestyle.			
MODULE-2			10 Hrs
IoT and M2M IoT System management with NETCONF-YANG Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software defined networking, network function virtualization Need for IoT Systems management; SNMP; Network Operator Requirements; NETCONF; YANG; IoT Systems management with NETCONFYANF; NETOPEER. IoT platform Design Methodology - IoT Design Methodology; Introduction; Case Study on IoT System for Weather Monitoring, motivation for using python.			
MODULE-3			10 Hrs

IoT Systems, Logical Design using Python- Introduction; Installing Python, Python Data Types & Data structures; Control Flow; Functions; Modules; Packages; File Handling; Date/Time Operations; Classes; Python Packages of Interest of IoT	
IoT Physical Devices and End points - What is an IoT device; Exemplary Device- Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Other IoT devices.	
MODULE-4	10 Hrs
IoT Physical Servers & Cloud Offerings: Designing a Restful Web API, Amazon Web Services for IoT, AmazonEC2, Amazon Auto Scaling, AmazonS3, Amazon RDS	
Case studies illustrating IoT Design: Introduction to IOT Design, Home Automation, Smart Lighting, Home Intrusion Detection, Cities, Smart Parking.	
Text Books: 1. Internet of Things - A Hands on Approach, ArshdeepBahga and Vijay Madisetti Universities Press, 2015	
Reference Books: 1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012. 2. Vijay Madisetti, ArshdeepBahga, Internet of Things: A Hands-On Approach Vijay Madisetti, 1st Edition ISBN-10: 0996025529, 2014	
MOOC: 1. Design for Internet of things https://nptel.ac.in/courses/108/108/108108098/	

Practical component

1. Design an interface circuit to controlled light by push button switch using esp8266
2. Design an interface circuit with 16 x 2I cd and ESP 8266 to display "hello world!" on LCD
3. Design an interface circuit for OLED withSP 8266 and write a program to display "MCE" on OLED.
4. Designan interface circuit to rotate DC motor in clockwise and anticlock wise direction using ESP 8266 and demonstrate the same.
5. Design an interface circuit for ultra-sonic sensor (hc - sr04) with ESP 8266. Write a programto measure the distance and displayiton LCD.
6. Design an interface circuit for ultra-sonic sensor (hc- sr04) with ESP 8266. Write a program to measure the distance and display iton LCD.
7. Design an interface circuit for DHT 11 (temperature and humidity) sensor with ESP8266. Write program to display temperature and humidity on serial monitor
8. Design an interface circuit for DHT 11 (temperature and humidity) sensor with ESP8266. Write program to display temperature and humidity on blink app. (using blink server).

Course Title	Python Programming		
Course Code	20OEIS64	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to develop python programs for real time problems Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe Syntax, Semantics, create Functions, Handle Strings and Files ,Lists, Dictionaries and Regular expressions in Python	2	
2.	Implement Object Oriented Programming concepts in Python	2,3	
MODULE-1			10 Hrs
Why should you learn to write programs-Creativity and motivation, Computer hardware architecture, Understanding programming, Words and sentences, Conversing with Python, Terminology: Interpreter and compiler, Writing a program, What is a program ?The building blocks of programs, What could possibly go wrong? Variables, expressions and statements-Values and types, Variables, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, Modulus operator ,String operations, Asking the user for input, Comments. Conditional execution-Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Catching exceptions using try and except, Short-circuit evaluation of logical expressions. Functions-Function calls, Built-in functions, Type conversion functions, Math functions, Random numbers, Adding new functions, Definitions and uses, Parameters and arguments, Fruitful functions and void functions, Why functions?			
MODULE-2			10 Hrs
Iteration- Updating variables, The while statement, Infinite loops, Finishing iterations with continue, Definite loops using for, Loop patterns, Counting. Strings- A string is a sequence, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, String methods, Parsing strings, Format operator. Files- Persistence, Opening files, Text files and lines, Reading files, Searching through a file. Lists-A list is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments			
MODULE-3			10 Hrs

Dictionaries -Dictionary as a set of counters, Dictionaries and files, Looping and dictionaries, Advanced text parsing Tuples -Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignment with dictionaries, The most common words, Using tuples as keys in dictionaries, Sequences: strings, lists, and tuples - Oh My!. Regular Expressions -Character matching in regular expressions, Extracting data using regular expressions, Combining searching and extracting, Escape character	
MODULE-4	10 Hrs
Classes and objects -User-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable Copying, Classes and functions -Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods -Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The <code>__str__</code> method, Operator overloading, Type-based dispatch, Polymorphism	

Text Books: 1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016. (http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf) 2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)
Reference Books: 1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

Course Title	Data Science																						
Course Code	20OEIS65	L-T-P	(3-0-0)3																				
Exam	3 Hrs.	Hours/Week	3																				
SEE	50 Marks	Total Hours	40																				
Course objective: Apply the principles of data science for solving real time problems. Course Outcomes: At the end of course, student will be able to: <table> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to POs</th><th>Mapping to PSOs</th></tr> <tr> <td>1.</td><td>Describe various Data Science process like statistical modelling, Exploratory data analysis, Data visualization.</td><td>1,2</td><td>-</td></tr> <tr> <td>2.</td><td>Identify the appropriate Machine Learning Algorithms to use in applications to fit a model to the given data.</td><td>3, 5</td><td>1</td></tr> <tr> <td>3.</td><td>Apply various feature selection algorithms for effective decision making.</td><td>3,4</td><td>1</td></tr> <tr> <td>4.</td><td>Create effective visualization for the given data using R</td><td>4</td><td>1</td></tr> </table>				#	Course Outcomes	Mapping to POs	Mapping to PSOs	1.	Describe various Data Science process like statistical modelling, Exploratory data analysis, Data visualization.	1,2	-	2.	Identify the appropriate Machine Learning Algorithms to use in applications to fit a model to the given data.	3, 5	1	3.	Apply various feature selection algorithms for effective decision making.	3,4	1	4.	Create effective visualization for the given data using R	4	1
#	Course Outcomes	Mapping to POs	Mapping to PSOs																				
1.	Describe various Data Science process like statistical modelling, Exploratory data analysis, Data visualization.	1,2	-																				
2.	Identify the appropriate Machine Learning Algorithms to use in applications to fit a model to the given data.	3, 5	1																				
3.	Apply various feature selection algorithms for effective decision making.	3,4	1																				
4.	Create effective visualization for the given data using R	4	1																				
MODULE-1			10 Hrs																				
Introduction: What is Data Science? Big Data and Data Science hype - and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets needed. Statistical Inference - Populations and samples, Statistical modelling, probability distributions, fitting a model.																							
MODULE-2			10 Hrs																				
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms - Linear Regression.																							
MODULE-3			10 Hrs																				

k-Nearest, Neighbors (k-NN), k-means. One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam	
Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam Data Wrangling: APIs and other tools for scrapping the Web.	
MODULE-4	10 Hrs
Feature Generation and Feature Selection Motivating application: user (customer) retention, Feature Generation Feature Selection algorithms, Filters; Wrappers; Decision Trees, Random Forests	
Data Visualization - Data Visualization History, What Is Data Science, Redux?, A Sample of Data Visualization Projects	
Text Book: 1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly 2014.	
Reference Books: 1. Jure Leskovek, Anand Rajaraman and Jeffery Ullman. Mining of Massive Datasets. V2.1, Cambridge University Press. 2004. 2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013. 3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.	
MOOC: 1. Introduction to data Analytics nptel.ac.in/courses/110106064/E-Books: a) An Introduction to Data Science. By J. Stanton, 2013. 2. Data Science https://drive.google.com/file/d/0B6iefdnF22XQeVZDSkxjZ0Z5VUE/edit	

Scheme & Syllabus for IV Year
B. E. Information Science and Engineering
Admitted Year 2020

VII Semester					
Course Category	Course Code	Course Title	L-T-P In hrs	Credits	Contact hours
PC-25	20IS701	Cryptography, Network Security and Cyber Law	3-0-0	3	3
PC-26	20IS702	Cloud Computing	3-0-0	3	3
PC-27	20IS703	Machine Learning	3-0-2	4	5
PC-28	20ID01	Industry Driven Course	1-0-0	1	2
PROJ-3	20IS704	Main Project Phase 1	0-0-2	1	2
PE-2	20IS7XX	Elective II	3-0-0	3	3
PE-3	20IS7XX	Elective III	3-0-0	3	3
OE-1	20OEISXX	Open Elective – 2	3-0-0	3	3
PC-29	20SW02	SWAYAM course - 2 (Mandatory Audit Course)	-	0	0
Total Credits				21	23

Elective Group II		Elective Group III		Open Electives	
20IS751	User Interface Design	20IS761	Big Data Technologies	20OEIS71	Data Warehousing & Mining
20IS752	Digital Image Processing	20IS762	Service Oriented Architecture	20OEIS72	Internet of Things
20IS753	Enterprise Resource Planning	20IS763	Principles of Programming Languages	20OEIS73	Introduction to Java Programming
20IS754	Mobile Computing Applications	20IS764	Robotic Process Automation	20OEIS74	Data Science

VIII Semester					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
SR-1	20IS801	Seminar on Advanced Topics	0-2-0	1	-
PROJ-4	20IS802	Main Project Work Phase 2	0-0-10	10	9
IN	20IS803	Internship (two weeks)	0-0-1	1	-
PC-30	20IS804	Software Testing	3-0-0	3	3
PE-5	20IS8XX	Elective - IV	3-0-0	3	3
PE-6	20IS8XX	Elective - V	3-0-0	3	3
Total Credits				21	11

SR: Seminar Technical is based on Research paper of recent years on Technology Trends in Healthcare, Finance etc.

IN: Summer/Winter Internship (with any company during mandatory internship of at least TWO/FOUR weeks during the vacation period).

Elective Group-IV		Elective Group-V	
20IS85 1	Data Science	20IS861	Block Chain Technology
20IS85 2	Pattern Recognition	20IS862	Object Oriented Modelling and Design
20IS85 3	System Modelling & Simulation	20IS863	Information Retrieval Methods
20IS85 4	Parallel Computing	20IS864	Deep Learning
20IS85 5	Internet Engineering	20IS865	Natural Language Processing

Course Title	CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW		
Course Code	20IS701	(L-T-P)C	(3-0-0) 3
Exam	3 Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: The course provides a basic understanding of the fundamentals of Cryptographic techniques and various algorithms used to provide security services. Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe the basics of cryptographic techniques, principles & practices, Cyber security and cyber law.	1	-
2.	Apply cryptographic techniques to secure the data in transit.	2	-
3.	Analyze different cryptographic techniques to handle security threats	2	-
4.	Elucidate and adopt Cyber security and Cyber law	8	-
MODULE – 1			10 Hrs.
Overview: Computer Security Concepts. The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms. A Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques. Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles.			
MODULE – 2			10 Hrs.
Asymmetric Ciphers: Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie Hellman Key Exchange. Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions. Digital Signatures: Digital Signatures, NIST Digital Signature Algorithm. Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificate.			
MODULE -3			10 Hrs.
User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos, Remote User-Authentication Using Asymmetric Encryption, Federated Identity Management, Personal Identity Verification. Network and Internet Security: Network Access Control and Cloud Security: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control, Cloud Computing, Cloud Security Risks and Countermeasures.			
MODULE -4			10 Hrs.
Transport-Level Security: Web Security Considerations, Secure Sockets Layer Transport Layer Security, HTTPS, Secure Shell (SSH). Cyber Law: IT act aim and objectives, Scope of the act, Major Concepts, Important Provisions, Attribution, acknowledgement, and dispatch of electronic records. Regulation of certifying authorities, Penalties and adjudication, The cyber regulations appellate tribunal.			

Text Books:

1. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, 2014.
2. Bernard Menezes, "Cryptography, Network Security and Cyber Laws", Cengage Learning, 2010 Edition.

Reference Books:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, Pearson Education India, 2016.
2. Atul Kahate, "Cryptography and Network Security", 3rd edition, Tata McGraw-Hill, 2011.

MOOC Course:

1. Cryptography and Network Security <https://nptel.ac.in/courses/106/105/106105031/>

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]													
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2		3												
CO3		2												
CO4								2						

Course Title	CLOUD COMPUTING		
Course Code	20IS702	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Elucidate the concepts of Cloud Computing architecture and its design challenges	2	-
2	Describe the principles of Parallel and Distributed Computing.	2	-
3	Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.	3	-
4	Apply principles of best practice in cloud application design and management.	3	-
Module - 1			10 Hrs.
Cloud computing basics: cloud computing overview, deployment models applications, intranets and the cloud first movers in the cloud. Your organization and cloud computing: when you can use cloud Computing, benefits limitations, security concerns, regulatory issues.			
Module - 2			10 Hrs.
Cloud computing with the titans: Google, Microsoft, Amazon, salesforce.com the business case or Going to the cloud: cloud computing services, how those applications help your business, deleting your datacenter, thomsons routers. Cloud computing technology: hardware and infrastructure clients, security, network, services.			
Module - 3			10 Hrs.
Cloud storage: overview, cloud storage providers, standards: application, client, infrastructure, service. Cloud computing at work: software as a service: overview, driving forces, company offerings, industries. Software plus services: overview, mobile device integration, providers, Microsoft online.			
Module - 4			10 Hrs
Software plus services Developing applications: Google, Microsoft, troubleshooting, Application management. Local clouds and thin clients: virtualization in your organization, server solutions, thin clients, case study. Migrating to the cloud: cloud services for individuals, cloud services aimed at mid market, enterprise class cloud offerings, migration.			
Text Books: 1. Cloud Computing- A practical approach, McGraw Hill publication, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter 2022			
Reference Books: 1. Cloud Computing: Theory and Practice, Dan C Marinescuc, first edition, MK publishers 2017. 2. Mastering Cloud Computing, McGraw Hill publication, RajkumarBuyya, Christian Vecchiola, S. Thamarai Selvi 2021			
MOOC: 1. Cloud Computing https://nptel.ac.in/courses/106/105/106105167/			

Course Articulation Matrix

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Course Title		MACHINE LEARNING	
Course Code	20IS703	L-T-P	(3-0-2)4
Exam Hours	3 Hrs.	Hours / Week	5
SEE	50 Marks	Total Hours	48L+10P
Course Objective: To apply the techniques of machine learning for real time problems. Course Outcomes (COs) : Upon completion of the course, students shall be able to:			
#	Course outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe and Apply preprocessing, Modeling, Evaluation and concept learning for the given problem.	2,3	-
2.	Depict and Apply supervised and unsupervised machine learning algorithms for solving the given problem	3	1
3.	Illustrate and utilize the Neural networks, Bayesian learning and other forms learning for the given problem	3	1
4.	Conduct experiments for demonstrating machine learning algorithms and data visualization methods.	3,5	1
MODULE 1			12 Hrs.
Introduction to Machine learning: Human learning and its types, Machine learning and its types, Applications, tools and issues in machine learning, Activities in machine learning, Types of data, Exploring structure of data, Data quality and Preprocessing. Modelling and Evaluation: Introduction, Selecting a model, training a model, model representation and interpretability, Evaluating performance of a model.			
MODULE 2			12 Hrs.
Learning Problems and Concept Learning: Well Posed learning problems, Designing a Learning systems, Concept Learning Tasks, Search, Find-S, Version Spaces and Candidate Elimination Algorithm, Inductive bias. Supervised Learning: Introduction, example, classification model, classification learning steps, Common algorithms –KNN, decision tree, Random forest model.			
MODULE 3			12 Hrs.
Supervised Learning: SVM, Regression-Simple linear regression, Multiple linear regression, Assumptions in Regression analysis. Unsupervised Learning: Supervised Vs Unsupervised, Application, clustering, Finding pattern using Association rule.			
MODULE 4			12 Hrs.
Basics of Neural Networks: Exploring the artificial neuron, Types of activation function, Early implementations of ANN, Architectures of NN, Learning process in ANN, Backpropagation algorithm. Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Bayesian Belief Networks Other types of Learning – Representation learning, Active Learning, Instance based Learning, Association rule Learning, Ensemble learning			

Practical Component

1. Demonstration of Python Libraries for Machine Learning-Pandas, Sklearn, numpy, matplotlib.
2. Demonstration of Exploratory Data Analysis and Data Visualization.
3. Implement the concept learning algorithms.
 4. Implementing classification Algorithms
 7. Implement Regression algorithms
9. Implement a clustering algorithm using K-means clustering for the given dataset.
 10. Implement simple neural networks.

- | |
|--|
| Text Books:
Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019
Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013 |
|--|

Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019
Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013

1. Hands-on machine learning with scikit-learn and tensorflow, Concepts, Tools, and Techniques to Build Intelligent Systems. [O'Reilly Media](#), [Aurélien Géron](#), Second Edition, 2019.
2. EthemAlpaydin, Introduction to Machine Learning, 2nd Ed., PHI Learning Pvt. Ltd., 2013
3. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer; 1st edition, 2001

- e-Books:
1. <https://www.oreilly.com/library/view/hands-on-machine-learning/9781492032632/>

1. <https://www.oreilly.com/library/view/hands-on-machine-learning/9781492032632/>

1. https://swayam.gov.in/nd1_noc19_cs52/preview
2. <https://www.coursera.org/learn/machine-learning/>
3. <https://nptel.ac.in/courses/106106139/>

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[illegible][illegible]

Course Title	Industry Driven Course		
Course Code	20ID01	(L-T-P)C	(1-0-0)1
Exam		Hours/Week	1
SEE		Total Hours	15L
Course Objective: Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Develop android applications using views, intents, fragments and graphics.	1,2,3,5	1,2
2.	Design an application using Internal and external database.	3,5	1
3.	Design an application using image capturing	3,5	1
4.			
	Hour 1: Module 1 - Introduction to Mobile App Development (1 hour) 1.1 Overview of Mobile App Development Hour 2: Module 1 - Introduction to Mobile App Development (1 hour) 1.2 Setting up the Development Environment Hour 3: Module 2 - Basic App Structure and UI Development (1 hour) 2.1 Creating a New Project Hour 4: Module 2 - Basic App Structure and UI Development (1 hour) 2.2 User Interface (UI) Design (Part 1) Hour 5: Module 2 - Basic App Structure and UI Development (1 hour) 2.2 User Interface (UI) Design (Part 2) Hour 6: Module 2 - Basic App Structure and UI Development (1 hour) 2.3 Handling User Input Hour 7: Module 3 - Programming Logic and Control Structures (1 hour) 3.1 Basic Programming Concepts (Part 1) Hour 8: Module 3 - Programming Logic and Control Structures (1 hour) 3.1 Basic Programming Concepts (Part 2) Hour 9: Module 3 - Programming Logic and Control Structures (1 hour) 3.2 Loops and Iteration Hour 10: Module 4 - Data Handling and Storage (1 hour) 4.1 Working with Data (Part 1)		

	Hour 11: Module 4 - Data Handling and Storage (1 hour) 4.1 Working with Data (Part 2) Hour 12: Module 4 - Data Handling and Storage (1 hour) 4.2 User Preferences and Local Storage Hour 13: Module 5 - Building Interactive Features (1 hour) 5.1 Introducing Interactivity Hour 14: Module 5 - Building Interactive Features (1 hour) 5.2 Implementing Navigation (Part 1) Hour 15: Module 5 - Building Interactive Features (1 hour) 5.2 Implementing Navigation (Part 2)	
Text Books: 1. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart		
Reference Books: 1. "Android Design Patterns: Interaction Design Solutions for Developers" by Greg Nudelman		
MOOC Course: https://onlinecourses.swayam2.ac.in/nou21_ge41/preview		

Course Title	Main Project Phase 1		
Course Code	20IS704	L-T-P	(0-0-1)1
		CIE	100 Marks
Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Identify a problem, through Extensive literature Survey leading to publication of a survey paper.	1,2	-
2.	Plan & design the solution to the chosen problem	3	2
3.	Make oral presentation and documentation of the work carried out	9,10	-
During VII semester, Candidates in consultation with the guides shall carry out literature survey to finalize the topic of the project. Students are expected to present the project synopsis, system analysis, Requirements Specification and should publish a technical paper on Literature Survey. • Project Phase 1 – Team Formation , Topic Selection & Guide allotment • Project Phase 2 – Extensive Literature Survey , Problem Definition • Project Phase 3 – System Design, Report Preparation and Publication The evaluation of the project phases shall be carried out by the evaluation committee comprising of project guide & other faculty members. The committee will be constituted by the project coordinator in consultation with the Head of the department. The topic chosen during Mini Project 3 will be continued & implemented during eighth semester			
Performance Indicators	Low	Medium	High
Literature Survey and Problem Definition (30 Marks)	Literature Survey not pertaining to the title of the project	Incomplete literature survey and improper problem definition	Extensive literature survey with clear state of the art problem definition
Design (10 Marks)	Has no coherent strategies for problem Solving	Has some strategies for problem – solving, but does not apply them consistently	Formulates strategies for solving problems
Presentation/ communication (20 Marks)	Disorganized and ineffective presentation	Organized, but ineffective presentation	Effective organized presentation
Report Preparation (20 Marks)	Disorganized and contents not sufficient	Organized but not good content wise	Effectively organized and well framed contents
Paper Publication (10Marks)	Paper submitted & awaiting results	National conference International Conference	Journal
Punctuality(Project Dairy Maintenance) (10 marks)	Not meeting the guide regularly	Meeting regularly but doesn't document details of every session	Up to date dairy maintenance

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-

Course Title	USER INTERFACE DESIGN		
Course Code	20IS751	(L-T-P)C	(3-0-0)3
Exam	3Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply the concepts and principles of User Interface Design and evaluate User Interfaces. Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Describe the theories and design processes of interactive systems	1	-
2	Identify the desirable features of User interfaces and visualization techniques	1	-
3	Analyze different types of user interfaces, devices and quality of service issues	2	-
4	Design appropriate user interface for the given requirement	3	-
MODULE – 1			10Hrs.
Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivations, Universal Usability, Goals for our Profession. Guidelines, Principles, and Theories: Introduction, Guidelines, Principles, Theories. Managing Design Processes: Introduction, Organizational Design to Support Usability, the Four Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, and Social Impact Statement for Early Design Review, Legal Issues. Evaluating Interface Designs: Introduction, Expert Reviews, and Usability Testing and Laboratories, Survey Instruments.			
MODULE – 2			10Hrs.
Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, Discussion of Direct Manipulation. Menu Selection, Form Fill-in, and Dialog Boxes: Introduction, Task Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement through Menus, and 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 Abbreviation, Natural Language in Computing.			
MODULE -3			10Hrs.
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, Non anthropomorphic Design, Display Design, Web Page Design, Window Design, and Colour.			

[illegible]

Course Title	DIGITAL IMAGE PROCESSING		
Course Code	20IS752	(L-T-P)C	(3-0-0) 3
Exam	3 Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to develop image processing applications.			
Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe the fundamental concepts of digital image processing	1	-
2.	Apply the concept of filters for image enhancement in spatial and frequency domains	2	-
3.	Apply different algorithms for image segmentation	2	-
4.	Analyze different image compression techniques	2	-
MODULE – 1			10 Hrs.
Introduction: What is Digital Image Processing, Examples of fields that use Digital Image Processing, Fundamentals steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, Image Sampling and Quantization, Basic relationships between pixels.			
MODULE – 2			10 Hrs.
Intensity Transformations and Spatial Filtering: Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering. Filtering in the Frequency Domain: Background, Preliminary Concepts, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters			
MODULE -3			10 Hrs.
Image Compression: Fundamentals –Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Fidelity Criteria, Image Compression Models. Some Basic Compression Methods - Huffman coding, Arithmetic Coding, Run-Length Coding, LZW coding, Bit-Plane Coding			
MODULE -4			10 Hrs.
Image Segmentation: Fundamentals, Point, Line, and Edge Detection, Thresholding- Foundation, Basic Global Thresholding, Optimum Global Thresholding Using Otsu's Method Image Segmentation Continued: Region-based segmentation, Segmentation by morphological watersheds, the use of motion in Segmentation			
Text Books:			
1. Rafael C. Gonzalez, Richard E. Woods: "Digital Image Processing", 3rd Edition, Pearson Education, 2012.			
Reference Books:			
1. Anil K. Jain: "Fundamentals of Digital Image Processing", Prentice-Hall of India Pvt. Ltd., 2011.			
2. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.			
MOOC Course:			
1. Digital Image Processing https://nptel.ac.in/courses/117/105/117105135/			

Course Articulation Matrix

[illegible]

Course Title	Enterprise Resource Planning		
Course Code	20IS753	(L-T-P)C	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective:

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Explain the significance and benefits of concepts in Enterprise Resource Planning	1,12	-
2.	Describe the social and ethical responsibilities of a professional	8,12	-
3.	Elucidate the dynamics of Industrial ,Financial Systems, SAP MFG/PRO and ERP Marketing	8,10,12	-
4.	Apply the concept of ERP package to Financial systems.	12	-

MODULE – 1

10 Hrs.

Enterprise Resource Planning: An Overview, Accommodating Variety, Integrated Management Information, Seamless Integration, Supply Chain Management, Resource Management, Integrated Data Model, Scope, Technology, Benefits of ERP, Evolution, ERP revisited, ERF and its Modern Enterprise. Business Engineering and ERP: An overview, what is Business Engineering? Significance, Principles, BRP, ERP and IT, Business Engineering with Information Technology, ERP and Management Concerns. Business Modelling for ERP: An Overview, Building Business Model.

MODULE – 2

10 Hrs.

ERP- Implementation: An overview, Role of Consultants, Vendors and Users, Customization, Precautions, ERP-Post Implementation Options, ERP- Implementation Methodology, Guidelines for Implementation. The ERP Domain-1: An Overview, MFG/PRO, IFS/Avalon- Industrial and Financial Systems.

MODULE -3

10 Hrs.

The ERP Domain-2: Baan IV, SAP, SAP R/3 Applications, Example of an Indian ERP Package, The arrival of ERP. ERP and the Competitive Advantage: An Overview, ERP and the Competitive strategy. Marketing of ERP– 1: An overview.

MODULE -4

10 Hrs.

Marketing of ERP–2, TQM–1: Market Dynamics and Competitive Strategy, Total Quality Management. TQM–2, Case Studies: TQM - ISO 9000, An overview, Mercedes-Benz, KeeHin Industries, Bull Electronics Angers Plant Manufacturers, Twentieth Century Companies, Ameritech, Essar Steel. Jindal Iron and Steel Company. Godrej Soaps and Associated Companies, Indian Renewable Energy Development Agency, ERP Handles Pressure, Sara ERP Case Study-Hawkins Cookers Ltd., A Wholesome Enterprise Application.

Text Books:

1. Vinod Kumar Garg., N. K. Venkatakrishnan, Enterprise Resource Planning - Concepts and Practice, PHI. 2003.
2. S. Sadagopan, Enterprise Resource Planning, PHI, 1999.

Reference Books:

1. Ellen F. Monk, Bret Wagner, Concepts in Enterprise Resource Planning, Cengage Learning India, 4th edition, 2013

- Reference Books:**
1. Ellen F. Monk, Bret Wagner, Concepts in Enterprise Resource Planning, Cengage Learning India, 4th edition, 2013

MOOC Course:

1. Enterprise Resource Planning<https://nptel.ac.in/courses/110/105/110105083/>

- MOOC Course:**
1. Enterprise Resource Planning<https://nptel.ac.in/courses/110/105/110105083/>

[illegible][illegible]

Course Title	MOBILE COMPUTING AND APPLICATIONS		
Course Code	20IS754	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply solutions to mobile computing applications.			
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes (CO)	Mapping to POs	Mapping to PSOs
1.	Elucidate the various methodologies used in Wireless Communication Networks.	2	-
2.	Analyze various protocols of all layers for mobile and adhoc wireless communication networks.	2	-
3.	Demonstrate and apply the knowledge for cellular networks design	2	-
4.	. Develop skills of finding solutions and building software for mobile computing applications using wireless languages and J2ME	2	-
MODULE-1			10Hrs.
Introduction: Mobile computing, Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing, Global system for mobile communication(GSM), Short Service Message (SMS), GSM Architecture, Entities, Call services,PLMN Interfaces,GSM Addresses and Identifiers,Network Aspects in GSM, Mobility Management,GSM Frequency Allocation,Mobile Computing Over SMS, Short Message Service(SMS), Value Added Services through SMS			
MODULE-2			10 Hrs.
GPRS: GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. CDMA 3G and WiMAX : Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data.			
MODULE-3			10 Hrs.
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6,Mobile OS .			
MODULE-4			10 Hrs.
Mobile Internet Applications: Thin client Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.			
Text Books:			
1. Dr. Ashok Talukder, Ms Roopa Yavagal , Mr . Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 7th Edition, TataMcGraw Hill, 2017.			
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley, 2018.			
Reference Books:			
1. Raj kamal: Mobile Computing, Oxford University Press, 2016.			
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2015.			
MOOC:			
https://archive.nptel.ac.in/courses/106/106/106106147/			

Course Atriculation Matrix:														
Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2												
CO2		2												
CO3		2												
CO4			2											

Courses for Elective – III

Course Title	BIG DATA TECHNOLOGIES		
Course Code	20IS761	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Acquire the knowledge, skills and tools to manage big data			
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe big data concepts, database models and big data techniques	1	-
2.	Describe architectural elements of HDFS, Map Reduce, YARN, Spark and Storm	1	-
3.	Apply big data concepts and techniques to address issues in a given scenario	1	1
4.	Design Map reduce solution or Hbase query for a given problem	3	1
Module - 1			10 Hrs
Introducing Hadoop and Seeing What It's Good for – Big Data and the Need for Hadoop, The Origin and Design of Hadoop, Examining the Various Hadoop Offerings. Use Cases for Big Data in Hadoop – The Keys to Successfully Adopting Hadoop, Log Data Analysis, Data Warehouse Modernization, Fraud detection, Risk modeling, Social Sentiment Analysis, Image Classification, Graph Analysis, To Infinity and Beyond.			
Storing Data in Hadoop: The Hadoop Distributed System – Data Storage in HDFS, Sketching Out the HDFS Architecture, HDFS Federation, HDFS High Availability.			
Module - 2			10 Hrs
MapReduce Programming – Thinking in Parallel, Seeing the Importance of MapReduce, Doing Things in Parallel: Breaking Big Problems into Many Bite-Size Pieces, Writing MapReduce Applications, Getting Your Feet Wet: Writing a Simple MapReduce Application.			
Frameworks for Processing Data in Hadoop: YARN and MapReduce – Running Application Before Hadoop 2, Seeing a World Beyond MapReduce, Real-time and Streaming Applications. Statistical Analysis in Hadoop – Pumping Up Your Statistical Analysis, Machine Learning with Mahout, R on Hadoop.			
Module - 3			10 Hrs
Hadoop and the Data Warehouse: Friends or Foes? – Comparing and Contrasting Hadoop with Relational Databases, Modernizing the Warehouse with Hadoop.			
Extremely Big Tables: Storing Data in HBase – Say Hello to HBase, Understanding the HBase Data Model, Understanding the HBase Architecture, Taking HBase for a Test Run, Getting Things Done with HBase, HBase and the RDBMS world.			
Module - 4			10 Hrs
Introducing Spark: Spark's Background and History, Common Use Cases for Spark, Understanding How Spark Processes Information, How Spark Benefits the Entire Organization, Core Spark Technology Components, Comparing Hadoop/MapReduce and Spark, Spark's Open-Source Challenges.			
How Spark, Hadoop and MapReduce Work Together: Choosing the Optimal Big Data Solution, Big Data in Action. Storm – What is storm? Storm architecture, Why Storm? Industry Use cases of storm (refer online material for storm)			

Text Books:

1. Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, Roman B. Melnyk, Hadoop for Dummies John Wiley & Sons, Inc, 2014, ISBN: 978-1-118-60755-8
2. Robert D. Schneider and Jeff Karmiol, Spark for Dummies®, 2nd IBM Limited Edition, John Wiley & Sons, Inc, 2019, ISBN: 978-1-119-57697-6 (pbk); 978-1-119-57696-9 (ebk)

Reference Books:

1. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2014.
2. Eric Sammer, Hadoop Operations other text for spark and storm, O'Reilley, 2012.

MOOC:

1. Big Data Computing: <https://nptel.ac.in/courses/106/104/106104189/>

Course Title	Service Oriented Architecture		
Course Code	19IS762	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Describe MEP's, Coordination, Orchestration and Choreography in Web Services, their protocols and service layers	1	-
2	Describe Addressing issues, Policies related to web services	2	-
3	Apply basic WS-BPEL language constructs	3	-
4	Analyze the security aspects related to web services	2	-

Module - 1	10 Hrs
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Introduction of SOA, Evolution of SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common Tangible Benefits of SOA, An SOA Timeline (from XML to Web Services to SOA), The Continuing Evolution of SOA (Standards Organizations and Contributing Vendors).

Web Services and Primitive SOA: The Web Services Framework, Services (as Web services), Service Descriptions (with WSDL), Messaging (with SOAP).

Module - 2	10 Hrs
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Web Services and Contemporary SOA-1: Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Business Activities.

Web Services and Contemporary SOA-2: Orchestration, Choreography, Addressing, Reliable Messaging, Correlation.

Module - 3	10 Hrs
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Web Services and Contemporary SOA-3: Policies, Metadata Exchange, Security, Notification and Eventing. Principles of Service–Orientation: Services–Orientation and the Enterprise, Anatomy of a Service–Oriented Architecture, Common Principles of Service–Orientation, How Service Orientation Principles Inter Relate, Service–Orientation and Object–Orientation, Native Web Service Support for Service–Orientation Principles.

Module - 4	10 Hrs
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Service Layers: Service–Orientation and Contemporary SOA, Service Layer Abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Service Layer Configuration Scenarios.

Business Process Design: WS–BPEL Language Basics, WS–Coordination Overview, Service–Oriented Business Process Design, WS–Addressing Language Basics, WS–Reliable Messaging Language Basics.

Text Books:

1. Thomas Erl, Service-Oriented Architecture – Concepts, Technology, and Design, Pearson Education, 2008.

Reference Books:

1. Eric Newcomer, Greg Lomow, Understanding SOA with Web Services, Pearson Education, 2009.

MOOC:

1. Service Oriented Architecture <https://www.coursera.org/learn/service-oriented-architecture>

Course Title	PRINCIPLES OF PROGRAMMING LANGUAGES		
Course Code	20IS763	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
MODULE-1			10 Hrs.
Introduction; Names, Scope, and Bindings – 1: Language design; Programming language spectrum; why study programming languages? Compilation and interpretation; Programming environments. Names, scope, and bindings: Concept of binding time; Object lifetime and storage management; Scope rules and implementing scope.			
Names, Scope, and Bindings – 1; Control Flow – 1: The binding of reference environments; Binding within a scope; Separate compilation. Control Flow – 1: Expression evaluation.			
MODULE-2			10 Hrs.
Control Flow – 2: Structured and unstructured flow; Sequencing; Selection; Iteration; Recursion; Non-determinacy Data Types – 1: Type systems; Type checking; Records and variants; Arrays			
MODULE-3			10 Hrs.
Data Types – 2: Strings; Sets; Pointers and recursive types; Lists; Files and Input/output; Equality testing and assignment Subroutines and Control Abstraction – 1: Review of stack layout; Calling sequences; Parameter passing; Generic subroutines and modules; Exception handling.			
MODULE-4			10 Hrs.
Control Abstraction – 2; Data Abstraction, Object Orientation: Control abstraction – 2: Coroutines Data Abstraction, Object Orientation: Object oriented programming; Encapsulation and Inheritance; Dynamic method binding; Multiple inheritance; Object oriented programming revisited Functional Languages, Logic Languages, Scripting Languages: Functional Languages: Origins; Concepts; An overview of scheme; Evaluation order revisited; Higher-order functions; Functional programming in perspective. Logic Languages: Concepts; Prolog; Logic programming in perspective. Scripting Languages: Common characteristics.			
Text Books: 1. Michael L. Scott: Programming Language Pragmatics, 2nd Edition, Elsevier, 2006. (Chapters 1.1 to 1.5, 3 excluding the sections on CD, 6 excluding the sections on CD, 7 including the sections on CD, 8 excluding the sections on CD, 9 including the sections on CD, 10 excluding the sections on CD, 11 excluding the sections on CD, 13.1. Note: Text Boxes titled Design & Implementation are excluded) 2.			
Reference Books: 1. Ravi Sethi: Programming languages Concepts and Constructs, 2nd Edition, Pearson Education, 1996. 2. R Sebesta: Concepts of Programming Languages, 8th Edition, Pearson Education, 2008. 3. Allen Tucker, Robert Nonan: Programming languages, Tata McGraw-Hill, 2002.			
MOOC: 1. Principles of Programming Languages https://nptel.ac.in/courses/106/102/106102067/			

Course Title	ROBOTIC PROCESS AUTOMATION		
Course Code	20IS764	(L-T-P)C	(3-0-0)3
Exam	3Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective:

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Elucidate application and implementation of RPA	1	-
2	Apply suitable techniques to handle User Events and various types of Exceptions and strategies.	2	-
3	Analyze the facility for scheduling bots and specifying the time intervals and communicate the same	3,5,9,10	1
4	Conduct experiments with workflow to get the optimal output from a Bot.	4,5	2

MODULE – 1

10 Hrs.

What is Robotic Process Automation?: What is Robotic Process Automation? Scope and techniques of automation Robotic process automation, About UiPath, The future of automation.

Record and Play: Record and Play, UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio.

MODULE – 2

10 Hrs.

Sequence, Flowchart, and Control Flow: Sequence, Flowchart, and Control Flow, Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example, using Sequence and Control flow. Data Manipulation: Data Manipulation, Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example

MODULE -3

10 Hrs.

Taking Control of the Controls: Taking Control of the Controls, Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping,

Tame that Application with Plugins and Extensions: Tame that Application with Plugins and Extensions, Terminal plugin, SAP automation, Java plugin.

MODULE -4

10 Hrs.

Handling User Events and Assistant Bots: Handling User Events and Assistant Bots, What are assistant bots? Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event.

Exception Handling, Debugging, and Logging: Exception Handling, Debugging, and Logging, Exception handling

Managing and Maintaining the Code: Managing and Maintaining the Code, Project organization.

Text Books:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath by Alok Mani Tripathi, Packtpub, March 2018.

Reference Books:

1. Learning Service Now by Tim Woodruff, Packtpub, March 2017.
2. Service Now Automation by Ashish Rudra Srivastava, Packtpub.

MOOC Course:

1. <https://www.coursera.org/specializations/roboticprocessautomation#courses>

Course Articulation Matrix:

Course Outcomes	Program Outcomes [POs]													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
COs														
CO1	1													
CO2		2												
CO3			3	3									1	
CO4			3		3				3				2	

Course Title	DATA WAREHOUSING AND MINING																		
Course Code	200EIS71	(L-T-P)C	(3-0-0)3																
Exam	3 Hrs	Hours/Week	4																
SEE	50 Marks	Total Hours	40																
Course Objective: Students will be able to select appropriate data mining techniques to extract useful patterns. Course outcomes: At the end of course, student will be able to: <table> <tr> <th>#</th><th>Course Outcomes</th><th>Mapping to PO's</th><th>Mapping to PSO's</th></tr> <tr> <td>1</td><td>Describe the data quality and data pre-processing techniques</td><td>1</td><td>-</td></tr> <tr> <td>2</td><td>Apply data mining algorithm for, Classification, Association and cluster Analysis</td><td>3</td><td>-</td></tr> <tr> <td>3</td><td>Describe the design of Data Warehouse , Modelling and usage</td><td>1</td><td>-</td></tr> </table>				#	Course Outcomes	Mapping to PO's	Mapping to PSO's	1	Describe the data quality and data pre-processing techniques	1	-	2	Apply data mining algorithm for, Classification, Association and cluster Analysis	3	-	3	Describe the design of Data Warehouse , Modelling and usage	1	-
#	Course Outcomes	Mapping to PO's	Mapping to PSO's																
1	Describe the data quality and data pre-processing techniques	1	-																
2	Apply data mining algorithm for, Classification, Association and cluster Analysis	3	-																
3	Describe the design of Data Warehouse , Modelling and usage	1	-																
MODULE – 1			10Hrs																
Introduction: Data: Why Data Mining? What is Data Mining? What kinds of data can be mined?, What kinds of pattern can be mined?, Which technologies are used? Major issues in data mining. Getting to know your data: Data objects and attribute types, Basic statistical description of data: measuring the central tendency, Measuring the dispersion of data, measuring data similarity and dissimilarity.																			
MODULE – 2			10Hrs																
Data Pre-processing: Data Pre-processing: An overview, Data cleaning, Data integration, Data Reduction: overview of data reduction strategies, wavelet transforms, Principal component analysis, attributes subset selection, Data Transformation: min-max normalization and Z-score normalization. Data Warehouse and online Analytical processing: Data Warehouse: Basic Concepts ,Data Warehouse modelling : Data cube and OLAP , Data warehouse design and usage: A business analysis frame work for data warehouse design, Data warehouse design process, Data warehouse usage for information processing.																			
MODULE -3			10 Hrs																
Classification: Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction, Rule-based classification, K- Nearest-neighbour Classifier. Mining frequent patterns Association and correlations: Basic Concepts and Methods: Basic Concepts, Frequent item set mining methods: Apriori Algorithm, generating association rules from frequent item sets, Improving the efficiency of Apriori, A Pattern growth Approach for Mining Frequent item sets.																			
MODULE -4			10 Hrs																
Cluster Analysis: Basic Concepts and Methods, Cluster Analysis, Partitioning Methods, Agglomerative versus divisive hierarchical clustering, DBSCAN. Data Mining Trends and research frontiers : Data Mining Applications , Data mining and society, Data mining trends.																			

1. Jiawei Han and Micheline Kamber: Data Mining – Concepts and Techniques, 4th Edition, Morgan Kaufmann, 2018.

Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2020.

1. K.P.Soman, Shyam Diwakar, V. Ajay, Insight into Data Mining—Theory and Practice, PHI, 2006.

1. Datawarehousingandmining<https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/>

[illegible]

Course Title	INTERNET OF THINGS		
Course Code	200EIS72	(L-T-P)C	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40hrs
Course Objective: Students will be able to develop IOT applications Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the fundamentals and applications of IoT, its Architecture, Design Principles and Standards	1	
2	Apply programming skills to design IoT applications	3	
3	Analyze IoT system management	2	2
4	Design and Implement applications of IoT and make presentation in team	5,10	2
MODULE – 1			10 Hrs
Introduction to Internet of Things: Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT levels and deployment template Domain specific IoTs, - IoT levels, Introduction, Home Automation; Cities; Environment; Energy; Retail; Logistics; Agriculture; Industry; Health &Lifestyle.			
MODULE – 2			10 Hrs
IoT and M2M IoT System management with NETCONF-YANG Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software defined networking, network function virtualization Need for IoT Systems management; SNMP; Network Operator Requirements; NETCONF; YANG; IoT Systems management with NETCONFYANF; NETOPEER. IoT platform Design Methodology - IoT Design Methodology; Introduction; Case Study on IoT System for Weather Monitoring, motivation for using python.			
MODULE -3			10 Hrs
IoT Physical Devices and End points - What is an IoT device; Exemplary Device- Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Other IoT devices. IoT Physical Servers & Cloud Offerings: Designing a Restful Web API, Amazon Web Services for IoT, AmazonEC2, Amazon Auto Scaling, AmazonS3, Amazon RDS.			
MODULE -4			10 Hrs
Case studies illustrating IoT Design: Introduction to IOT Design, Home Automation, Smart Lighting, Home Intrusion Detection, Cities, Smart Parking. Data Analytics for IOT- Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis.			
Text Books: 1. Internet of Things - A Hands on Approach, ArshdeepBahga and Vijay Madisetti Universities Press, 2015			
Reference Books: 1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012. 2. Vijay Madisetti, ArshdeepBahga, Internet of Things: A Hands-On Approach Vijay Madisetti, 1st Edition ISBN-10: 0996025529, 2014			

MOOC Course:

Design for Internet of things <https://nptel.ac.in/courses/108/108/108108098/>

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2			2											
CO3		3												2
CO4					3					3				3

Course Title	Introduction to Java Programming		
Course Code	20OEIS73	(L-T-P)C	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective:			
Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Comprehend the fundamental concepts Object Oriented Programming.	1	1
2.	Apply Object Oriented constructs for program development.	3	1
3.	Identify the syntax & logical errors in a java program for identifying bugs.	2	
MODULE – 1			10 Hrs
Object Oriented Concepts and Java: Concepts of Object-Oriented programming language: Object, Class, message passing, inheritance, encapsulation, and polymorphism, relationships among objects, Difference between OOP and other conventional programming – advantages and disadvantages of OOP. Introduction to Java: Java and Java Applications, How Java Changed the Internet, Java Development Kit(JDK), The Byte Code, Servlets, The Java Buzzwords, Object-Oriented Programming, Simple Java Programs using Control Statements and Blocks of code, Lexical Issues, Data Types, Variables, and Arrays : The primitive Types, Integers, Floating-Point Types, Characters, Booleans, Literals, Variables, Type Conversion and Casting, Arrays, Strings, Operators : Arithmetic, Bitwise, Relational, Boolean Logical, Assignment Operator, The ? Operator, Operator Precedence. Program Control Statements: Input characters from the Keyword, if statement, Nested ifs, if-else-if Ladder,			
MODULE – 2			10 Hrs
Program Control Statements: Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Use break, Use continue, Nested Loops. Introducing Classes, Objects and Methods: Class Fundamentals, Declaring Objects, Object Reference Variables, Methods, Constructors, The this keyword, Garbage collection, Overloading Methods and constructors, Argument Passing.			
MODULE -3			10 Hrs
Inheritance, Packages and Interfaces: Inheritance Basics, Using Super, Multilevel Hierarchy, When Constructors are called, Method Overriding, Abstract Classes, Interfaces. Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and Catch, Multiple catch Clauses, Nested try Statements, throw and throws			
MODULE -4			10 Hrs
Multi Threading: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(), Synchronization, Inter thread Communication Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model;			

Text Books:

1. Herbert Schildt, “Java the Complete Reference, 9th Edition, Tata McGraw Hill, 2018
2. E Balaguruswamy, Programming with Java A Primer, Second Edition, Tata McGraw Hill companies.

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2. E Balaguruswamy, Programming with Java A Primer, Second Edition, Tata McGraw Hill companies.

Reference Books:

1. Y. Daniel Liang, “Introduction to JAVA Programming, Brief Version”, 9th Edition, Pearson Education, 2014.
2. Kogent Learning Solutions, “Java 6 Programming Black Book”, Dreamtech Publication, 2014.

1. Y. Daniel Liang, "Introduction to JAVA Programming, Brief Version", 9th Edition, Pearson Education, 2014.
2. Kogent Learning Solutions, "Java 6 Programming Black Book", Dreamtech Publication, 2014.

MOOC Course:

[illegible][illegible]

Course Title	DATA SCIENCE		
Course Code	20OEIS74	(L-T-P)C	(3-0-0)3
Exam	3Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Apply the principles of data science for solving real time problems			
Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mappin to PSO'
1	Describe various Data Science process like statistical modelling, Exploratory data analysis, Data visualization.	1	-
2	Apply suitable Machine Learning Algorithms for a given scenario	3	1
3	Develop effective visualization for the given data using R	5	1
MODULE – 1			10 Hrs
Introduction: What is Data Science? Big Data and Data Science hype - and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets needed. Statistical Inference - Populations and samples, Statistical modelling, probability distributions, fitting a model.			
MODULE – 2			10 Hrs
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms - Linear Regression			
MODULE -3			10 Hrs
k-Nearest, Neighbors (k-NN), k-means. One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web.			
MODULE -4			10 Hrs
Feature Generation and Feature Selection Motivating application: user (customer) retention, Feature Generation Feature Selection algorithms, Filters; Wrappers; Decision Trees, Random Forests Data Visualization - Data Visualization History, What Is Data Science, Redux?, A Sample of Data Visualization Projects			
Text Books: 1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly.2014.			

Course Title	Seminar on Advanced Topics		
Course Code	20IS801	L-T-P	(0-2-0) 1
Exam	3 Hrs.	Hours/Week	-
SEE	50 Marks	Total Hours	-

Course Objective: Promotes engaged learning, critical thinking and presentation skills on advanced technical topics

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Analyze different research papers in academic field	1,2,12	-
2.	Depict recent advances in engineering and technology and document them	1, 10	-
3	Realize the importance of communication skills and presentation skills	9, 10	-

Seminar topic must be selected by students in consultation with their respective final year project guide and the selected topic must reflect recent advances in engineering and technology and should be relevant to current trends. The topics must be selected from recent IEEE papers or reputed journals.

Seminar Evaluation Rubrics

Level of Performance			
Criteria	High	Medium	Low
Synopsis Submission (10)	In time Submission and Topic relevant to current trends - 10 marks	Delay in submission and relevant topic- 8 marks	Late submission - 6 marks
Seminar Report (25)	Report contents relevant to the topic, adheres to appropriate style. Reports regularly to guide - 25 marks	Writing clear and effective for the most part and minor errors in adherence with appropriate style guidelines- 22 marks	Ineffective presentation for chosen content - 19 marks
Organization of PPT slides (15)	Demonstrates proficiency in slides, logical sequence and visuals (use of colours/fonts/hyperlinks) - 15 marks	Not enough logical sequence and visuals - 12 marks	Poor organization of slides and visuals -09 marks
Knowledge/Q&A (15)	Answers all questions with explanations and elaborations - 15 marks	Answers average number of questions -12marks	Fails to answer questions related to topic- 09 marks
Literature Survey and references (15)	Clear and effective writing and adherence to appropriate literature reviewed and properly cited - 15 marks	Moderate number of References reviewed - 12 marks	Inadequate survey 09 marks
Presentation Skills (20)	Clear and effective Communication - 20 marks	Communication is clear - 15 marks	Lacks communication skills- 10 marks

Course Articulation Matrix														
Course Outcomes	Program Outcomes [POs]													
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14
CO1	3	3										3		
CO2	3									3				
CO3									3	3				

Course Title	Main Project Work Phase-2		
Course Code	20IS802	L-T-P	(0-0-10) 10
Exam	3 Hrs.	Hours/Week	2
CIE	50 Marks	SEE	100 Marks

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

#	Course Outcomes	Mapping to PO	Mapping to PSOs
1	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2
2	Communicate effectively with team members and mentors, make presentations and prepare technical document	9,10,11,12	2
3	Use ethical practices in all endeavours	8	-
4	Share the responsibilities for carrying out the project & playing individual roles appropriately	9	-

The project teams will implement the design of the project started in their seventh semester.

Rubrics :

Performance Indicators	Low	Medium	High
Implementation Techniques / Verification of the results (50)	No proper technique for implementation	Has some techniques but does not apply them consistently	Uses well defined implementation techniques
Presentation/ communication (20)	Disorganized and ineffective presentation	Organized, but ineffective presentation	Effective organized presentation
Report Preparation (20)	Disorganized and contents not sufficient	Organized but not good content wise	Effectively organized and well framed contents
Technical Paper (10)	Paper not submitted to conference/Journal	Paper submitted	Paper Accepted/ published

The project work is to be carried out in two phases:

Project Phase I (30M) - First internal evaluation shall be taken up during this phase. This includes presentation on fine tuning of SRS & Design carried out in seventh semester.

Project Phase II (70M) - Final internal evaluation shall be taken up during this phase. This includes presentation, project demonstration, report submission and details of technical paper publication.

The evaluation of the project phases – I & II shall be carried out by the evaluation committee comprising of project guide & other faculty members.

Course Title	INTERNSHIP (two weeks)		
Course Code	20IS803	L-T-P	(0-0-1)1

The students have to undergo internship in Private industries/R&D organizations/Centres of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get an exposure to the external world for a period of 4 weeks. The students have to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award marks. There is a CIE in which the student shall present his/her work before a panel of examiners constituted at department level during VIII semester. The performance shall be communicated to the COE office and the same will be reflect in the VIII semester grade card.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Demonstrate the application of Knowledge and Skill sets acquired	1,3	
2	Exhibit critical thinking and problem solving skills by analyzing underlying problems	2,4	
3	Exhibit professional ethics by displaying positive disposition during Internship	8	
4	Prepare a document and present effectively	10,12	

Internship Evaluation Rubrics (Panel Evaluation - 100 marks)

Performance Indicators	High	Medium	Low
Organization of Presentation (25)	Demonstrates proficiency in slides, logical sequence and visuals (use of colors/ fonts/ hyperlinks) 25 marks	Not enough logical sequence and visuals 16-20 marks	Poor organization of slides and visuals 10-15m
Knowledge/Q&A (25)	Answers all questions with explanations and elaborations 25 marks	Answers average number of questions 16-20 marks	Unable to clarify qu 10-15 m
Report Preparation (25)	Clear and effective writing and description of the work 25 marks	Moderate description of the work 16 -20marks	Poor description of the work 10- 15 m
Presentation Skills (25)	Clear and effective Communication 25 marks	Communication is clear 16-20 marks	Ineffe communica 10-14 m

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]													
COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2
C01	3		3											
C02		3		3										
C03								3						
C04										3		3		

Course Title	SOFTWARE TESTING		
Course Code	20IS804	(L-T-P)C	(3-0-0)3
Exam	3Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply effective testing techniques for developing quality software. Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the concepts of Software Testing & its documentation process	1	2
2	Apply various testing techniques in the process of software development	3	2
3	Apply different approaches of verifying and validating a software product.	3,5	-
4	Apply various project management activities	3	2
MODULE – 1			10Hrs.
A Perspective on Testing, Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, code based testing, fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem, The currency converter, Saturn windshield wiper, Garage Door Opener. Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing: Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, traditional Equivalence Class Testing Improved Equivalence Class Testing Equivalence test cases for the triangle problem, Next Date function, and the commission problem, Guidelines and observations. Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, cause effect graphing, Guidelines and observations.			
MODULE – 2			10Hrs.
Path Testing, Data Flow Testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations. Definition-Use testing, Slice-based testing, program Slicing Tools Guidelines and observations. Life cycle based testing, model based testing: Traditional waterfall testing ,testing in iterative life-cycle, agile testing, agile model-driven development , Testing Based on Models Appropriate Models, Commercial Tool Support for Model-Based Testing			
MODULE -3			10Hrs.
Integration Testing: Decomposition-based integration, call graph-based, Path-based integrations. System Testing: Threads, Basic concepts for requirements specification, Model-Based Threads, Use Case–Based Threads Long versus Short Use Cases, How Many Use Cases?, Coverage Metrics for System Testing, Supplemental Approaches to System Testing , Non functional System Testing Atomic System Function Testing Example.			

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Course Title	DATA SCIENCE		
Course Code	20IS851	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	5
SEE	50 Marks	Total Hours	40L
Course Objective: Students will be able to apply the data science process to real-time data. Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO	Mapping to PSOs
1.	Describe the Data Analytics life cycle.	2	1
0.	Perform data analytics using R tool.	3,5	1
0.	Understand advanced analytical theory and methods	2	1
0.	Apply various data analytics methods to solve a problem	3	1
MODULE-1			10 Hrs.
Introduction: What is Data Science? Big Data and Data Science hype - and getting past the hype, Why now? –Datafication, Current landscape of perspectives, Skill sets needed. Statistical Inference - Populations and samples, Statistical modelling, probability distributions, fitting a model.			
MODULE-2			10 Hrs.
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms - Linear Regression.			
MODULE-3			10 Hrs.
k-Nearest, Neighbors (k-NN), k-means. One More Machine Learning Algorithm and Usage in Applications -Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam Data Wrangling: APIs and other tools for scrapping the Web.			
MODULE-4			10 Hrs.
Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system. Data Visualization - Data Visualization History, What Is Data Science, Redux?, A Sample of Data Visualization Projects			
Text Books: 1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.			
Reference Books: 1. Jure Leskovek, Anand Rajaraman and Jeffery Ullman. Mining of Massive Datasets. V2.1, Cambridge University Press. 2004. 2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013. 3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.			

MOOC

1. Introduction to data Analytics nptel.ac.in/courses/110106064/**E-Books: a) An Introduction to Data Science. By J. Stanton, 2013.**

2. Data Science <https://drive.google.com/file/d/0B6iefdnF22XQeVZDSkxjZ0Z5VUE/edit>

Course Articulation Matrix

[illegible]

Course Title	Pattern Recognition		
Course Code	20IS852	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Ability to understand decision theory and statistical decision making	1, 2	-
2.	Knowledge of different techniques for estimation of error rates	1,2, 3	-
3.	Understand the concepts of clustering	1,2	-
4.	Learn about non parametric decision making	1,2	-
5.	Learn about adaptive decision boundaries techniques	1,2,3	-
MODULE-1			10 Hrs
Introduction: Applications, Statistical Decision Theory, Application of PR to Image Processing & Analysis, Introduction to Probability, Events, Random Variables. Joint Distribution and Densities, Moments of Random Variables, Estimation, Minimum Risk Estimators.			
MODULE-2			10 Hrs
Statistical Decision Making: Baye's Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries. Unequal Cost of Errors: Estimation of Errors Rates, leaving-One-Out Technique, Characteristic Curves, Estimating the Composition of Population			
MODULE-3			10 Hrs
Nonparametric Decision Making: Introduction, Histograms, Kernel 2 Window Estimators, Nearest Neighbor Classification Technique. Adaptive Decision Boundaries: Discriminant Functions, Minimum Squared Error Discriminant Function, choosing a Decision Making Technique.			
MODULE-4			10 Hrs
Clustering-I: Introduction, Hierarchical Clustering, Agglomerative, Single Linkage, Complete Linkage, Average Linkage, Word's Method Problems. Clustering-II: Introduction, Partitional Clustering, Forgy's Algorithm, K-Means			
Text Books:			
1. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, PHI-2012. 2. Richard O. Duda, Peter E. Hart, and David G.Stork, Pattern Classification, 2nd Edition, Wiley-Interscience, 2001			
MOOC:			
1. Pattern Recognition https://nptel.ac.in/courses/106/106/106106046/			

Course Title	SYSTEM MODELLING AND SIMULATION		
Course Code	20IS853	(L-T-P)C	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40hrs
Course Objective: course is to provide an understanding of methods, techniques and tools for modeling, simulation and performance analysis of complex systems such as communication and computer networks. Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping PSO's
1	Identify various simulation models and give practical examples for each category	1,2	
2	Understand and justify when simulation is important tool and when not.	1	
3	Construct a model for a given system and perform its discrete-event simulation	2	
4	Generate and test random number variates and apply them to develop simulation models	3	
5	Analyze output data produced by a model and test validity of the model	3	
MODULE – 1			10 Hrs.
Introduction: When Simulation is the Appropriate Tool and When it is Not Appropriate, Advantages and Disadvantages of Simulation, Areas of Application, Systems and System Environment, Components of a System, Discrete and Continuous Systems, Model of a System, Types of Models, Discrete-Event System Simulation, Steps in a Simulation Study. Simulation Examples: Simulation of Queuing Systems. General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual Simulation Using Event Scheduling, List Processing.			
MODULE – 2			10 Hrs.
Statistical Models in Simulation: Review of Terminology and Concepts, Useful Statistical Models, Discrete Distributions, Continuous Distributions, Poisson Process, Empirical Distributions. Queuing Models: Characteristics of Queuing Systems, Queuing Notation, Long-run Measures of Performance of Queuing Systems, Steady-state Behavior of M/G/1 Queue, Networks of Queues.			
MODULE -3			10 Hrs.
Random-Number Generation, Random- Variate Generation: Properties of Random Numbers, Generation of Pseudo-random Numbers, Techniques for Generating Random Numbers, Tests for Random Numbers. Random-Variate Generation: Inverse Transform Technique, Acceptance-Rejection Technique. Input Modeling: Data Collection, Identifying the Distribution with Data, Parameter Estimation, Goodness of Fit Tests, Fitting a Non-stationary Poisson Process.			

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Course Title	Parallel Computing		
Course Code	20IS854	(L-T-P)C	(3-0-0)3
Exam	3 Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective:			
Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe fundamentals of parallel computing	1	
2.	Analyse the performance and design the parallel platforms	2	2
3.	Develop parallel application using PThreads /OpenMP/MPI	3	2
4.	Analyse the given problem, identify the hotspot and parallelize the given application	2	
MODULE – 1			10 Hrs.
Introduction: Motivating Parallelism, Scope of Parallel Computing. Parallel Programming Platforms : Implicit Parallelism, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms, Interconnection Networks.			
MODULE – 2			10 Hrs.
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. Basic Communication Operations: One-to-All Broadcast, All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce, Scatter and Gather, Analytical Modelling: Sources of Overhead in Parallel Computing			
MODULE -3			10 Hrs.
Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, building blocks, MPI, Topologies and Embedding, Overlapping Communication with Computation, collective Communication and Computation Operations, Groups and Communicator			
MODULE -4			10 Hrs.
Programming Shared Address Space Platforms Thread Basics, WhyThreads? The POSIX Thread API, Creation &Termination, OpenMP: Specifying concurrent tasks, "for" directive, Assigning iterations to threads, "section" directive, merging directives, Nesting directives, Synchronization constructs in OpenMP, Data Handling in OpenMP, OpenMP library functions.			
Text Books:			
1. Anantha Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Addison Wesley, 2003.			
Reference Books:			
3. Michael J. Quinn ,Parallel computing : Theory and Practice, McGraw-Hill, 2nd ed, 2002			
			MOOC Course:
3. https://nptel.ac.in/courses/106102163			

Course Articulation Matrix

[illegible]

Course Title	Internet Engineering		
Course Code	20IS855	L-T-P	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Identify different Network protocols and architecture	1	-
2.	Test network performance using networking tools	2	-
3.	Identify network thread and vulnerabilities	1	-
MODULE-1			10 Hrs
INTRODUCTION: Communication model, Communication software, and communication protocol: Representation, Development methods, Protocol engineering process. NETWORK REFERENCE MODEL: Layered architecture, Network services and interfaces, protocol functions, OSI model, TCP/IP protocol suite, Application protocols. PROTOCOL SPECIFICATION: Communication service specification, Protocol entity specification, Interface specifications, Interactions, Multimedia protocol specifications, Internet protocol specifications.			
MODULE-2			10 Hrs
SPECIFICATION AND DESCRIPTION LANGUAGE (SDL): A protocol specification language: SDL. Examples of SDL based protocol specifications, Other protocol specification languages. Protocol Verification And Validation, Protocol verification, Verification of a protocol using finite state machines. Protocol validation: Protocol validation, Protocol design errors, and protocol validation approaches, SDL based protocol verification, SDL based protocol validation.			
MODULE-3			10 Hrs
PROTOCOL CONFORMANCE TESTING: Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distribute architecture by local methods, Conformance testing with TTCN, Conformance testing of RIP, Multimedia applications testing, SDL based tools for conformance testing.			
MODULE-4			10 Hrs
PROTOCOL PERFORMANCE TESTING: SDL based performance testing of TCP, OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using bridge, Scalability testing. PROTOCOL SYNTHESIS: Synthesis methods, interactive synthesis algorithms, automatic synthesis algorithm, automatic synthesis of SDL from MSC protocol re synthesis.			

Course Title	Block Chain Technology		
Course Code	20IS861	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Define and Explain the fundamentals of Blockcha	-	-
2	Illustrate the technologies of blockchain	2	1
3	Describe the models of blockchain	1	-
4	Analyze and demonstrate the Ethereum	1	1
MODULE-1			10 Hrs
Introduction: Basic Cryptographic primitives used in Blockchain – Secure, Collision- resistanthash functions, digital signature, public key cryptosystems, zero-knowledge proof systems. Needfor Distributed Record Keeping, Modelling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Why Nakamoto Came up with Blockchain based cryptocurrency?			
MODULE-2			10 Hrs
Technologies Borrowed in Blockchain – hash pointers, Consensus, Byzantine Models of fault tolerance, digital cash etc. Bitcoin blockchain - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Bitcoin, the challenges, and solutions			
MODULE-3			10 Hrs
Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS)based Chains - Hybrid models (PoW + PoS).Bitcoin scripting language and their use.			
MODULE-4			10 Hrs
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity – Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. Some attacks on smart contracts.			
Text Books: 1. Blockchain Technology: Cryptocurrency and Applications, S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press, 2019.			
Reference Books: 1. Green Computing: Tools and Techniques for Saving Energy, Money, and Resources Bud E. Smith CRC Press 2. Green Communications: Principles, Concepts and Practice- Samdanis et al, J. Wiley			

Course Title	Object Oriented Modelling and Design		
Course Code	20IS862	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Describe the concepts of object-oriented and basic class modelling problems.	-	-
2	Draw class diagrams, sequence diagrams and interaction diagrams to solve	2	1
3	Choose and apply a befitting design pattern for the given problem.	1	-
MODULE-1			10 Hrs
Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transitions and Conditions, State Diagrams, State diagram behaviour.			
MODULE-2			10 Hrs
Use Case Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.			
MODULE-3			10 Hrs
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.			
MODULE-4			10 Hrs
Use case Realization : The Design Discipline within up iterations: Object Oriented Design The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams Structuring the Major Components; Implementation Issues for Three-Layer Design.			
Text Books : 1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005 2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005. 3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns –Elements of Reusable Object-Oriented Software, Pearson Education,2007.			

Reference Books:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons. 2007.
3. Booch, Jacobson, Rumbaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, Pearson, Reprint 2013

Course Title	Information Retrieval Methods		
Course Code	20IS863	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Build an Information Retrieval system using the available tools	2	-
2	Identify and design the various components of an Information Retrieval system	2	
3	Analyze the Web content structure	2	
4	Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval	2	1
5	Design an efficient search engine	3	-
MODULE-1			10 Hrs
Introduction: Motivation, Basic concepts, Past, present, and future, The retrieval process. Modeling: Introduction, A taxonomy of information retrieval models, Retrieval: Adhoc and filtering, A formal characterization of IR models, Classic information retrieval, Alternative set theoretic models, Alternative algebraic models, Alternative probabilistic models, Structured text retrieval models, Models for browsing.			
MODULE-2			10 Hrs
Retrieval Evaluation: Introduction, Retrieval performance evaluation, Reference collections. Query Languages: Introduction, keyword-based querying, Pattern matching, Structural queries, Query protocols. Query Operations: Introduction, User relevance feedback, Automatic local analysis, Automatic global analysis.			
MODULE-3			10 Hrs
Text and Multimedia Languages and Properties: Introduction, Metadata, Text, Markup languages, Multimedia. Text Operations: Introduction, Document preprocessing, Document clustering, Text compression, Comparing text compression techniques.			
MODULE-4			10 Hrs
User Interfaces and Visualization: Introduction, Human-Computer interaction, The information access process, Starting points, Query specification, Context, Using relevance judgments, Interface support for the search process. Searching the Web: Introduction, Challenges, Characterizing the web, Search engines, Browsing, Meta searchers, Finding the needle in the haystack, Searching using hyperlinks.			
Text Books: 1. Modern Information Retrieval, Ricardo Baeza Yates, Berthier Ribeiro Neto, Pearson 1999.			
Reference Books: Information Retrieval Algorithms and Heuristics, David A. Grossman, Ophir Frieder Springer 2nd Edition 2004.			

Course Title	DEEP LEARNING		
Course Code	20IS864	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Introduce major deep learning algorithms and their applications to solve real world problems. Course Outcomes: At the end of the course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Comprehend the fundamentals of deep learning algorithms	1	-
2.	Apply specific deep learning algorithms to obtain solutions for appropriate problems.	3	2
0.	Identify and analyse deep learning techniques suitable for training the models using tensorflow and keras.	3,5	2
1.	Conduct various experiments to demonstrate techniques using Deep neural networks, Convolutional neural networks, Recurrent neural networks.	3,5	2
MODULE-1			10 Hrs
Introduction to Artificial Neural Networks with Keras- From Biological to Artificial Neurons, Biological Neurons, Logical Computations with Neurons, Architectures of Neural Network, Learning Process in ANN, The Perceptron, MultiLayer Perceptron (MLP) and Backpropagation, Types of Activation Functions, Regression MLps, Classification MLPs. Implementing MLP's with Keras, : Installing TensorFlow 2, Building an Image Classifier Using the Sequential API, Building a Regression MLP Using the Sequential API, Building Complex Models Using the Functional API, Saving and Restoring a Model, Using Callbacks, Visualization Using TensorBoard, Fine-Tuning Neural Network Hyperparameters			
MODULE-2			10 Hrs
Training Deep Neural Networks- Vanishing/Exploding Gradients, Glorot and He Initialization, Nonsaturating Activation Functions, Batch Normalization, Gradient Clipping, Reusing Pretrained Layers, Transfer Learning With Keras, Unsupervised Pretraining, Pretraining on an Auxiliary Task. Faster Optimizers, Momentum Optimization, Nesterov Accelerated Gradient, AdaGrad, RMSProp, Adam and Nadam Optimization, Learning Rate Scheduling. Avoiding Overfitting Through Regularization, ℓ_1 and ℓ_2 Regularization, Dropout, Monte-Carlo (MC) Dropout, Max-Norm Regularization.			
MODULE-3			10 Hrs

Course Title	Natural Language Processing		
Course Code	20IS865	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course objective: To introduce students the challenges of empirical methods for natural language processing (NLP) applications. Course Outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Understand the fundamental mathematical models and algorithms in the field of NLP	1	-
2	Understanding the principles of language resource annotation and its use in machine learning applications and apply the above principles in analysis of data and acquire intended information through the use of available tools.	1	-
3	Understanding the design and implementation issues in various NLP applications such as information retrieval and information extraction	1	1
4	Understanding the complexity of Natural Language Generation	1	1
MODULE-1			10 Hrs
Introduction to NLP: Definition, Knowledge in speech and language processing, Word Classes: Review of Regular Expressions, Morphology: Inflectional, derivational, parsing and parsing with FST, Combining FST lexicon and rules, human morphological processing.			
MODULE-2			10 Hrs
Phonology : Speech sounds, phonetic transcription, phoneme and phonological rules, optimality theory, machine learning of phonological rules, phonological aspects of prosody and speech synthesis. Pronunciation, Spelling and N-grams: Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora, simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.			
MODULE-3			10 Hrs
POS Tagging: Tag sets, concept of HMM tagger, rule based and stochastic POST, algorithm for HMM tagging, transformation based tagging, Sentence level construction & unification: Noun phrase, co-ordination, sub-categorization, concept of feature structure and unification.			
MODULE-4			10 Hrs
Lexical Semantics and Word Sense Disambiguation: Semantics: Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language, basics of FOPC, semantics of FIPC. Semantic Analysis: Syntax driven, attachment & integration, robustness. Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, internal structure of words, creativity and the lexicon: metaphor and metonymy and their computational approaches. Word Sense Disambiguation: Selectional restriction-based, machine learning based and dictionary based approaches			

Text Book:

D.Jurafsky, J H Martin Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, Pearson, Volume 1, 3rd edition, 2009.

Reference Books:

1. Barry Nance , Natural Language Processing A Pananian Perspective, Prentice Hall, Eastern Economy Edition. Eugene Cherniak.
2. Allen, James, Natural Language Understanding, Benjamin/ Cummings, 2nd ed. Bharathi, A Vineet Chaitanya and Rajeev Sangal. 1995