SATHYABAMA

INSTITUTE OF SCIENCE ANDTECHNOLOGY

(Deemed to be university U/S 3 of UGC Act 1956)

Accredited with Grade "A++" by NAAC | 12B Status by UGC | Approved by AICTE

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119

SYLLABUS

SCHOOL OF COMPUTING

BACHELOR OF ENGINEERING IN COMPUTER SCIENCE AND ENGINEERING

(WITH SPECIALIZATION IN DATA SCIENCE)

(8 SEMESTERS)

REGULATIONS 2023

SHSB1101	TECHNICAL ENGLISH	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand specialized subject areas and skills included for their study.
- To comprehend and react in oral and written forms to the specialized texts.
- To respond to listening, reading and writing tasks by using digital tools.
- To enhance communication, collaboration and critical thinking skills.
- To explore creativity through blended learning contexts.

UNIT 1 **9 Hrs.**

Listening : Listening to choose the correct answer from the options given (MCQ).
Speaking : Self Introduction, Talking about likes and dislikes.
Reading : Comprehending a passage- Skimming, scanning, detailed reading.
Writing : Letter of Job Application, Resume, Letter to the Editor (problems and solutions).
Vocabulary : Kinds of Sentences, Affixes**,** Collocations, Sequence words, contextual guessing of words.
Language Focus : Parts of Speech, Tense and its types, Voice - Impersonal Passive
Language Lab work : Focus Digital literacy: students join zoom platform/ using online tools

UNIT 2 **9 Hrs.**

Listening : Listening to advertisements about a product, say true or false.
Speaking : JAM on current topics, mini presentations.
Reading : Identifying topic sentences by reading content.
Writing : Writing compare/ contrast paragraphs, process description, E-Mail Writing .
Vocabulary : Verbal phrases, Prepositions and Prepositional phrases, Concord, Discourse Markers.
Language Focus : Clauses, Conjunctions, Sentence Types - Simple, Compound & Complex.
Language Lab : Digital literacy: Responding to quiz using Kahoot application.

UNIT 3 **9 Hrs.**

Listening : Listening to summarize the information, debates / discussions.
Speaking : Group discussion on a given topic.
Reading : To find specific information and to prepare notes using the format.
Writing : Framing open ended questions- Survey Report- Arranging the sentences in the right order.
Vocabulary : Paired expressions, Adjectives/ adverbs, technical definitions, Compound Nouns .
Language Focus : Punctuation, Editing, Same words used as different parts of speech.
Language Lab : Digital literacy: Power point tools –Slide share to make presentation on the survey report.

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UNIT 4 **9 Hrs.**

Listening : Listening to differentiate instructions and recommendations.
Speaking : Debate on current issues.
Reading : Reading to understand and classify the information.
Writing : Instructions, Recommendations, Preparation of User Manual.
Vocabulary : Classification of words, Abbreviations, Acronyms.
Language Focus : Reported Speech, Causatives, Basic Sentence Patterns.
Language Lab : Digital literacy: Using online discussion forum.

UNIT 5 **9 Hrs.**

Listening and summarizing : Listening to identify the structure of sentences, small talks, TED talks.
Speaking **:** Giving impromptu talks, Speech Writing.
Reading **:** Read argumentative essays and paragraphs.
Writing **:** Essay writing, Checklist preparation, Note making.
Vocabulary **:** Homophones/Homonyms, Idioms and Phrases.
Language Focus **:** Negatives, Tag questions, Similes and Metaphors.
Language Lab **:** Digital literacy: Creating own Blogs and interactive exercises and quizzes online.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Classify technical words to use them in sentences framing, compose problem solving paragraphs.
CO2 - Categorize information based on the understanding of reading materials to prepare notes.
CO3 - Prepare and document to report, identify elements of editing.
CO4 - Interpret technical definitions related to the text and design a user manual using instructions.
CO5 - Summarize reading materials and outline an essay on any topic given.
CO6 - Demonstrate their language learning activities in the classroom/ online group environment.

TEXT / REFERENCE BOOKS

1. Technical English, Department of English, Sathyabama Institute of Science & Technology 2019.
2. Beer, David F., and David McMurrey. A Guide to Writing as an Engineer. 4th ed., Wiley, 2013
3. Alred, Gerald J., et al. Handbook of Technical Writing. 11th ed., Bedford/St. Martin's, 2019.
4. Pearsall, Thomas Edward. Technical Writing: A Practical Guide for Engineers, Scientists, and Nontechnical Professionals. McGraw- Hill Education, 2017.
5. Straus, Jane. The Blue Book of Grammar and Punctuation. John Wiley & Sons, 2014.
6. O'Conner, Patricia T. Woe is I: The Grammar phobe's Guide to Better English in Plain English. Riverhead Books, 2019.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SMTB1103	CALCULUS AND NUMERICAL METHODS	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVES

- To identify, reflect upon, evaluate and achieve conceptual understanding and knowledge of traditional Calculus to form independent judgments.
- To model the Engineering problems and obtain its solutions mathematically.
- To understand Science, Engineering and Computer Science analytically and improve logical thinking ability.

UNIT 1 DIFFERENTIAL CALCULUS 9 Hrs.

Definitions – Derivative of standard functions (Results only) - Differentiation of function of function – Logarithmic differentiation – Derivatives of implicit function – Partial derivatives (Simple Problems only)

UNIT 2 INTEGRAL CALCULUS 9 Hrs.

Integral of standard functions (Results only) – Integration by the method of substitution– Integration using partial fractions – Integration by parts– Generalization of integration by parts – Definite integral – Properties – Simple problems.

UNIT 3 DIFFERENTIAL EQUATIONS 9 Hrs.

Higher order linear differential equations with constant coefficients – Particular Integral for e^{ax}, sinax or cosax, x^n, $x^n e^{ax}$ – Method of Variation of Parameters – Homogeneous equation of Euler's – System of simultaneous linear differential equations with constant coefficients.

UNIT 4 NUMERICAL METHODS FOR SOLVING EQUATIONS 9 Hrs.

Solution of algebraic equation and transcendental equation: Regula Falsi Method, Newton Raphson Method – Solution of simultaneous linear algebraic equations: Gauss Elimination Method, Gauss Jacobi & Gauss Seidel Method.

UNIT 5 NUMERICAL INTERPOLATION, DIFFERENTATION AND INTEGRATION 9 Hrs.

Interpolation-Newton forward and backward interpolation formula, Lagrange's formula for unequal intervals – Numerical differentiation: Newton's forward and backward differences to compute first and second derivatives – Numerical integration: Trapezoidal rule, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Evaluate Definite Integrals and analyze properties of Beta and Gamma functions.
CO2 - Examine the maxima and minima of functions of several variables.
CO3 - Solve any higher order linear differential equations.
CO4 - Categorize and implement the numerical solutions of algebraic, transcendental, simultaneous linear equations.
CO5 - Appraise various numerical methods for Interpolation.
CO6 - Develop the solutions for Numerical differentiation and integration.

TEXT / REFERENCE BOOKS

1. Narayanan, S. and Manickavachagam Pillai, T.K., Calculus, Vol.I and Vol. II, S.Viswanathan Printers & Publishers, 2009.
2. P.R.Vittal., Calculus -Margham Publications, 2000.
3. Veerarajan T., Engineering Mathematics for First Year, II Edition, Tata McGraw Hill Publishers, New Delhi, 2008.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, Singapore, 2012.
5. Grewal B.S., Higher Engineering Mathematics, 41th Edition, Khanna Publications, New Delhi 2011.
6. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill Publishing Co., NewDelhi, 2003.
7. Kandasamy P., Thilagavathy K., and Gunavathy K., Applied Numerical Methods, S. Chand & Co., New Delhi, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SPHB1101	PHYSICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the concept of crystal structures and symmetry, the physics of scattering and diffraction theory, experimental diffraction from single crystals, instrumentation and powder diffraction.
- Students will be able to understand the Identify and describe properties of matter, including: flexibility, strength and transparency.
- The objective of this course is to develop a working knowledge of the laws and methods of thermodynamics and elementary statistical mechanics and to use this knowledge to explore various applications.
- Differentiate between various acoustic terms and understand how these apply to different materials and acoustic design solutions.
- To give knowledge about semiconductor physics and discus working and applications of basic devices, including p-n junctions, BJTs and FETs.

UNIT 1 QUANTUM MECHANICS 9 Hrs.

Introduction to Quantum Mechanics-Energy distribution function, Wave – particle duality-de Broglie matter waves – Concept of wave function and its physical significance – Heisenberg's Uncertainty Principle – Schrodinger's wave equation – Time independent and Time dependent equations – Particle in a one dimensional rigid box – tunnelling (Qualitative) – Scanning Tunnelling Microscope (STM).

UNIT 2 PROPERTIES OF MATTER 9 Hrs.

Introduction- Elasticity- Hooke's law - Torsional stress & deformations – Twisting couple – Torsion pendulum - theory and experiment–bending of beams - bending moment–cantilever:-Theory and experiment–uniform and non-uniform bending: theory and experiment- Magnetism - Basic definitions - Magnetic permeability, susceptibility, relation between permeability and susceptibility - Bohr magneton. Classification of magnetic materials-Hysteresis.

UNIT 3 CRYSTAL PHYSICS 9 Hrs.

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances – coordination number and packing factor for SC, BCC, FCC, HCP. – crystal imperfections: point defects, line defects –growth of single crystals: solution and melt growth techniques.

UNIT 4 SEMICONDUCTOR PHYSICS 9 Hrs.

Classification of materials-Theory of semiconductors: Intrinsic and extrinsic semiconductors, band structure of semiconductors - Fermi level in intrinsic and extrinsic semiconductors. Theory of p-n junctions – diode and transistor: p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, V-I characteristics, junction capacitance and voltage breakdown. Zener diode and its characterization- Avalanche breakdown- JEFT- I-V characteristics- amplifying and switching.

UNIT 5 LASER AND ITS APPLICATIONS 9 Hrs.

Absorption and Emission of Radiation by atoms, ions and molecules. Laser medium Phenomenon of population inversion. Laser cavity (fiber laser, and other cavities), generation of coherent beam, Q-switching, short pulse generation, power amplification. Basic Laser Principles: Theory of Laser, Properties of Laser, Fundamental Optical properties, Modified Optical properties, Laser output – its characteristics.

Max. 45 Hrs.

COURSE OUTCOMES

CO1 - Solve the time independent Schrodinger wave equation for a particle in a box to obtain the Eigen values and Eigen functions.
CO2 - Understand the dual nature of radiation and matter.
CO3 - Estimate the atomic packing factor for SC, BCC & FCC structures.
CO4 - Recognize sound level descriptors and how they are used in architectural acoustics and analyses acoustic properties of typically used materials for design consideration.
CO5 - Understanding the working, design considerations and applications of various semi conducting devices including p-n junctions, BJTs and FETs.
CO6 - Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.

TEXT / REFERENCE BOOKS

1. Pillai S.O., Solid state Physics, New age International Publishers, 7th Edition (2015).
2. Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill Publications (2022).
3. M.N.Avadhanulu & P.G.Kshirasagar. A text book of Engineering Physics, S. Ch.Publishing (2020).
4. B. B.Laud,Lasers and nonlinear optics, New age International Publishers, II-Edition (2010).
5. R. Murugesan, Modern Physics, S. Chand Publishing, 15th Edition (2015).
6. D. S. Mathur, Elements of Properties of Matter, S. Chand Publishing (2014).
7. A. K. Bandyopadhyay, Nanomaterials, New age International Publishers (2007).
8. K. K. Chattopadhyay, Introduction to nano science and nano technology, PHI publisher (2009).
9. Sulabha Kulkarni, Introduction to Nanoscience and Nanotechnology 2nd Edition (2020).
10. David Griffiths, Introduction to electrodynamics, Addison-Wesley publishing 3rd Edition. (2000)

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SEEB1101	ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamental concepts of electrical wiring and its components.
- To analyze DC and AC circuit behavior.
- To impart Knowledge on electronic devices and their applications.
- To gain Knowledge on operation of UPS and SMPS power supplies.

UNIT 1 INTRODUCTION TO ELECTRICAL SYSTEMS 9 Hrs.

Basic Element Resistors, inductors and capacitors - Domestic Wiring - Wiring Materials and Accessories -Staircase Wiring - Fluorescent Tubes-Earthing-Types & Benefits.

UNIT 2 DC CIRCUITS 9 Hrs.

Electrical Quantities - Ohm's law - Kirchoff's laws -Resistance in series and parallel combinations - Current and Voltage division rules - Mesh analysis and Nodal analysis.

UNIT 3 AC CIRCUITS 9 Hrs.

Sinusoidal functions - R.M.S and Average values for Sinusoidal waveform - Phasor representation - Sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - RL, RC and RLC series circuits - power and power factor.

UNIT 4 SEMICONDUCTOR DEVICES 9 Hrs.

VI Characteristics of PN-junction diodes and Zener diodes, BJT and its configurations – input/output Characteristics, Junction Field Effect Transistor – Drain and Transfer Characteristics - Silicon Controlled Rectifiers.

UNIT 5 POWER SUPPLY 9 Hrs.

Introduction to Power Supplies- Regulated power supplies- Single and Dual regulated power supply- Design using regulator IC- Switched Mode Power Supply (SMPS) - Design used in Computer Systems- Introduction to Uninterrupted power supplies (UPS), online UPS, offline UPS, high frequency online UPS.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the fundamental electrical concepts.
CO2 - Analyze simple DC circuits using appropriate techniques.
CO3 - Apply phasor analysis techniques to solve AC circuits.
CO4 - Demonstrate the characteristics of various semi-conductor devices.
CO5 - Analyze characteristics of Switched Mode Power Supply.
CO6 - Design power supply unit using regulator IC.

TEXT/REFERENCE BOOKS

1. Dr. Ramana Pilla, Dr. M Surya Kalavathi & Dr. G T Chandra Sekhar, Basic Electrical Engineering, S.Chand & Co.,2022.
2. Dr.Sanjay Sharma ,Electronic Devices and Circuits,2nd edition, S.K.Kataria & Sons, 2012.
3. B.N.Mittle & Aravind Mittle, Basic Electrical Engineering,2nd edition, Tata McGraw Hill, 2011.
4. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering,2nd edition, PHI Learning Private Ltd, 2010.
5. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics,1st edition, S.Chand & Co.,2009.
6. G.K.Mithal, Basic Electronic Devices and circuits,2nd Edition, G.K.Publishers Pvt, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

S11BLH11	PROGRAMMING IN C	L	T	P	EL	Credits	Total Marks
		2	0	4	0	4	100

COURSE OBJECTIVES

- To understand the concepts of variables, operators, control structures and arrays.
- To gain knowledge on Functions, Structures and Union in C.
- To explore the concepts of pointers and files to create real world applications using C.

UNIT 1 BITS AND BYTES IN COMPUTING 12 Hrs.

Computers: Hardware – Software – Processor – Memory – I/O devices – Interface – Programming Languages – Evolution from COBOL, FORTRAN to C, Python – Need.

Algorithms: Role in problem solving – Analysis – Design – Flowcharts: Role in problem solving – Symbols – Design – Pseudocode: Role in problem solving – Design – Program: Role in problem solving – Design.

Practical:

1. Describe a simple real-world problem in your domain of interest and describe it in the form of problem statement, input, output and provide its solution in terms of algorithm, flowchart, pseudo code and program.

UNIT 2 C: MATH BEHIND CODING 12 Hrs.

C: Structure of program – Character set – Tokens – Keywords – Identifiers – Constants – Variables – Data types – Strings – Operators and its types – Functions – Header Files.

Algorithmic Strategies: Iteration and Recursion – Efficiency – Role of Time and Space consumption while building an algorithm – Complexities.

Practical:

1. Describe a simple real-world problem in your domain of interest and provide a computing and non-computing solution for the same. Calculate the time and space consumed in both solutions. Compare and contrast the pros and cons in both solutions.
2. Write an algorithm, flowchart, pseudo code followed by a simple C code to do find the Factorial and Fibonacci series using both iteration and recursion.
3. Get the number of days taken to cultivate both rice and wheat in turns in an agricultural land from the user. Write a C program to convert the days and display as years, months and days using simple operators.
4. You have a circular plot for building playground and a rectangular plot for building an apartment. Get the input from the user for both plots and write a C program to calculate the area and perimeter of both plots.

UNIT 3 C: MAGIC BEHIND INSTANT OUTPUTS 12 Hrs.

Advanced Coding Concepts: Decision Making using Branching Statements and its types – Decision Making using Looping Statements and its types – Switch Statements – Break – Continue – Goto – Jump Statements.

Case Study: Fun with Code -- Printing Alphabets / Flags of Countries / Flying Alphabet Screensaver

Practical:

1. Describe a problem statement in your domain of interest whose solution involves repetition of same steps and provide code as solution involving for, while and do while loops.
2. Describe a problem statement in your domain of interest whose solution involves decision making and provide code as solution involving if-else, nested if-else and ladder if-else.
3. Develop a simple scientific calculator using Switch case statement.
4. A Cartesian co-ordinate system has four quadrants. Write a C program to find the quadrant of the co-ordinate points given by the user using both if-else and nested if-else control structure.

5. Given a rose flower to you, dismantle the petals of the flower from inside, if you notice - it follows the sequence of Fibonacci. Now, try to arrange the word "PIZZA" in several ways without repeating and calculate number of ways it can be done using factorial concept. Write a C program to find both Fibonacci and factorial by getting the mentioned input.
6. Product of two large prime numbers is used as encryption key in encryption algorithms. Write a C program to display all the prime numbers between 1 to 100 and give the first two largest numbers as the output.

UNIT 4 STORING GROUP OF HOMOGENOUS ELEMENTS: ARRAYS 12 Hrs.

Diving into Arrays: Definition – Syntax – Types – Representation: Row & Colum Order – Dynamic Arrays.

Idea behind Functions: Declaration – Definition – Types – Calling – Arguments – Prototypes – Call by Value – Call by Reference – Pointers – Amalgamation of Pointers: with Arrays & Strings.

Case Study: Fun with Code – Simple Game Development using Arrays and Functions.

Practical:

1. Describe a problem statement in your domain of interest where you need to work with group of same type of data. Provide a solution in terms of C program to store and manage the data effectively.
2. You're playing UNO cards, suddenly a person is getting rev card. Write a C program to reverse the round by storing the number of players in array.
3. Write a C program for Vehicle Regulation System where odd number ending vehicles can use the road on odd days and even number ending vehicles can use the road on even days using two separate arrays to store and display the odd and even numbers.
4. Write a C program to do the following applications in array:
   (i). Get set of +ve and -ve integers from user, replace -ve integers by 0 in the array.
   (ii). Reverse the floating-point numbers stored in the array.
   (iii). Return the smallest value and largest value position in the array.
   (iv). Search the number '5' in array and replace it with '10'.
5. Write C program to do the following string handling applications.
   (i). Get favorite actor and actress name, concatenate it and display.
   (ii). Display your name in uppercase, lowercase and as fname and lname.
   (iii). Count the frequency of "the" in any sentence and delete it from sentence.
   (iv). Check whether the given string is a palindrome or not.
6. Write C program to do the following string handling applications.
   (i). Get favorite actor and actress name, concatenate it and display.
   (ii). Display your name in uppercase, lowercase and as fname and lname.
   (iii). Count the frequency of "the" in any sentence and delete it from sentence.
   (iv). Check whether the given string is a palindrome or not.
7. Write a C program for counting the total number of duplicate elements in an array, print all the unique elements in the same array as two different functions.
8. Write a C program to sort the elements in an array in both ascending and descending order using two different functions.
9. program to find the largest and smallest number in an array using recursion and to convert the output into a binary number.
10. Write a C program to swap two numbers using two functions, one using pointers and the other one without using pointers.

UNIT 5 STORING GROUP OF HETROGENOUS ELEMENTS: STRUCTURE 12 Hrs.

Outset of Structure and Union: Structure Definition & Declaration – Structures Fusion with: Arrays – Pointers – Functions – Union Initiation, Definition & Declaration – Memory Allocation: Static and Dynamic.

Working with Files: File Handling Functions – Read – Write – Other Operations – Different File Types

Case Study: Report on using File Functions to create Score Board for any game, importing it to program.

Practical:

1. Describe a problem statement in your domain of interest where you need to work with group of different type of data. Provide a solution in terms of C program to store and manage the data effectively.
2. Write a C program to get the details of the student (roll no, name, date of birth, state, 10th percentage and 12th percentage) using Structure. Calculate the age of the student and display the eligibility status for his admission.
   Eligibility criteria: more than 60 percent in 10th and 12th, age>=17, state==TN.
3. Write a menu driven C program for library management system with ten entries:
   (i). Add Book
   (ii). Add Author
   (iii). Add Category
   (iv). Book Cost
   (v). Display - Book by Author, Book by Category, Book under cost
4. Write a C program to create an employee Union with employee details (id, name, salary) Accept the details of 'n' employees, rearrange the data in ascending order of employee name, id and salary as three different functions and display it.

Complex Practical Problems:

1. Design a C program by creating your own header file for any function of your choice and display the output by calling the header file.
2. Create TIC-TAC-TOE game using C Language.
3. Given a situation, you are going to ATM to withdraw money. Write a C program, get the money requested from the user as input and display the number of possible bank notes for the requested money. Note: Give input as number ending in 0's or 5's.
4. Develop a C program for managing Car Rental process with various modules for registration as new user, login, get id proof, keep track of cars available and cars given for rental.
5. Create SUDOKU game using C Language.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Interpret the difference between components of problem solving such as algorithm, flowchart, pseudo code and source code.

CO2 - Build simple solution for any given problem statement using various components of problem solving techniques and measure its efficiency in terms of time and space.

CO3 - Infer and examine the roots and foundation of C programming's key concepts like Datatypes, Operators.

CO4 - Devise and correlate the use of different core concepts such as Arrays and Functions in C language.

CO5 - Formulate real time solutions through programs using Structure and Union in C language.

CO6 - Design and Develop various Application Oriented Program for solving real time societal problems.

TEXT / REFERENCE BOOKS

1. Yashavant Kanetkar, “Let us C”, BPB Publications, Fourteenth Edition (2020).
2. R.G.Dromey “How to solve it by computer”, Pearson Education, Low Price Edition (2000).
3. Balagurusamy, “Programming in ANSI C”, Mc GrawHill Publications, Eighth Edition (2019).
4. Greg Perry, Dean Miller ―C Programming Absolute Beginner‘s Guide‖, 3rd Edition, 2013.

SPHB2101	PHYSICS LAB	L	T	P	EL	Credits	Total Marks
		0	0	2	0	1	50

SUGGESTED LIST OF EXPERIMENTS

1. Determine the Rigidity modulus of a given wire by Torsional pendulum
2. To determine the angle of Minimum Deviation by I - D curve method.
3. Determine V-I characteristics of a photodiode
4. To determine the Numerical aperture of an optical fiber
5. To find the Energy gap of a semiconductor
6. Determination of Young's modulus- non-uniform bending
7. Determination of Young's modulus- Uniform bending
8. Determination of the wave length of the laser using grating- Laser.
9. Determination of thickness of a thin sheet/wire- Air wedge.
10. Determination of Numerical Aperture and acceptance angle- Optical fiber.
11. Photoelectric effect
12. Michelson Interferometer.
13. V-I characterization of solar cell
14. CRO- Functions

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Measure the rigidity modulus of a given wire by oscillations.

CO2 - Measure the angle of minimum deviation by spectrometer.

CO3 - Analyze the I-V characteristics of the given photo diode.

CO4 - Measure the band gap of the given semiconductor.

CO5 - Measure the young's modulus of bar by uniform bending method.

CO6 - Determine the wavelength of the given laser light source.

SMTB1203	DISCRETE STRUCTURES	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVES

- The Objective of this Course is to identify, reflect upon, evaluate and achieve conceptual understanding and knowledge of traditional Calculus to form independent judgements.
- The purpose of this course is for modeling the Engineering problems and obtaining its solutions mathematically.
- This helps in understanding Science, Engineering and Computer Science analytically and logical thinking is attained.

UNIT 1 LOGIC 9 Hrs.

Statements – Truth Tables – Connectives – Equivalent Propositions – Tautological Implication – Normal Forms – Inference Theory – Consistency and Inconsistency of Premises. Proportional Functions – Quantifiers – Universal and Existential – Inference Theory – Rules of Inference Theory.
- Problems

UNIT 2 ALGEBRAIC STRUCTURES 9 Hrs.

Algebraic system – Semigroups – Monoids (definitions and examples only) – Groups – Cyclic groups – Subgroups – Cosets – Lagrange's Theorem.

UNIT 3 COMBINATORICS 9 Hrs.

Mathematical Induction – Recurrence Relation – Solving Homogeneous and Non- Homogeneous Recurrence Relations – Generating Functions- Partial order relation – Hasse Diagram – Lattices – Properties of Lattices – Duality of Lattices – Special Lattices – Modular lattices – Complemented Lattices – Distributive Lattices.

UNIT 4 BOOLEAN ALGEBRA 9 Hrs.

Boolean Identities – Atomic Boolean Algebra – Boolean Functions – Simplification of Boolean Functions.

UNIT 5 GRAPH THEORY 9 Hrs.

Introduction to Graphs – Graph Terminology – Cycles – Paths – Complete and Bipartite Graphs – Matrix Representation of Graphs – Graph Isomorphism – Connectivity – Trees – Euler and Hamiltonian Graphs.

Max. 45 Hrs.

Course Outcomes

On completion of the course, student will be able to

CO1 - Apply logic and truth tables to solve problems on Inference theory for propositional calculus and predicate calculus. Distinguish PCNF and PDNF

CO2 - Understand the basics of group properties and cosets. Apply the above concepts to derive Lagrange's theorem.

CO3 - Appraise the solution of mathematical induction and pigeonhole principle. Develop the recurrence relation and generating functions

CO4 - Distinguish PCNF and PDNF. Analyze properties of functions and groups

CO5 - Develop Euler, Hamiltonian paths. Identify graph isomorphism.

CO6 - Illustrate the generality of tree, binary tree and tree expression.

TEXT / REFERENCE BOOKS

1. Kenneth H. Rosen, Discrete Mathematics and its applications, 6thEdition, McGraw- Hill, 2007.
2. Veerarajan T., Discrete mathematics with Graph Theory and Combinatorics, Tata Mc graw Hill Publishing Co., New Delhi, 2006.
3. Narasingh Deo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India, 2010.
4. Steven C .Chapra, Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill Publishing Co., New Delhi, 2003.
5. Kandasamy P., Thilagavathy K., and Gunavathy K., Applied Numerical Methods, S.Chand & Co., New Delhi, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCYB1101	CHEMISTRY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of quantum chemistry from bonds to bands.
- To learn the principles and applications of energy levels in molecules.
- To know the importance of electrochemistry in batteries.
- To explore the concept of corrosion mechanism and design principles.
- To study the various synthetic approaches in nano chemistry.

UNIT 1 ATOMIC AND MOLECULAR STRUCTURE 9 Hrs.

Introduction to quantum chemistry – Motion of a quantum mechanical particle in one dimension (time-independent) – Physical meaning of wave function – Schrodinger equation for Hydrogen atom (No derivation. Only wave function). Angular and radial wave functions and probability densities – Quantum numbers – Principal, azimuthal, spin and magnetic quantum numbers – Wave functions and orbital shapes - s,p,d,f - LCAO-MO of H_2 – Band theory of solids: Conductors, semi-conductors– Role of As and Ga doping on band structures.

UNIT 2 MOLECULAR SPECTROSCOPY 9 Hrs.

Electromagnetic spectrum – Interaction of radiation with matter – Energy levels in molecules – Microwave spectroscopy – Principle – Classification of molecules based on moment of Inertia – Rotational energy expression (J levels) – Calculation of J for CO molecule – Vibrational spectroscopy – Normal modes of vibrations – Vibrations of polyatomic molecules (CO_2 and H_2O) – Determination of Force constant – Electronic transitions in organic molecules – Mathematical derivation of Beer- Lambert's law.

UNIT 3 ELECTROCHEMISTRY 9 Hrs.

Electrochemistry: Galvanic cell - Electrochemical cell representation - EMF series and its significance. Batteries: Terminology – Mechanism of Lead-acid accumulator - Mechanism of Nickel-cadmium batteries. Mechanism of Lithium batteries: Li/ $SOCl_2$ cell - Li/I_2 cell - Lithium-ion batteries. Mechanism of Fuel Cells: Hydrogen-oxygen fuel cells - Solid oxide fuel cell (SOFC).

UNIT 4 CORROSION SCIENCE 9 Hrs.

Introduction: Definition. Types: Dry corrosion: Mechanism - Pilling-Bedworth rule - Wet Corrosion: Mechanism. Types: Galvanic corrosion and differential aeration cell corrosion. Galvanic series and its significance. Factors influencing corrosion. Corrosion prevention: Material selection and design - Cathodic protection – Sacrificial anodic method and Impressed current method – Inhibitors – Anodic and Cathodic inhibitors.

UNIT 5 CHEMISTRY OF MATERIAL SCIENCES 9 Hrs.

Phase equilibria: Gibbs phase rule – Terms involved in Phase rule – Phase diagram of water system – Thermal method of analysis – Construction of simple eutectic system (Lead-Silver alloy system).

Fuels– Classification of fuels – Determination of calorific values of solid fuels by bomb calorimeter– Manufacture of synthetic petrol by Fischer- Tropsch method – Knocking in IC engines – Chemical structure – Octane and cetane rating of fuels.

Nanomaterials: Size dependent properties of nanomaterials – Synthesis of gold and silver nanoparticles by Chemical reduction method– Applications of nanoparticles in medicine.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Apply the principles of quantum chemistry for energy level quantization in molecules.
CO2 - Analyze the molecular transitions by interaction of EMR with matter
CO3 - Assess the reaction mechanism in electrochemical storage device
CO4 - Comprehend the corrosion mechanism for environmental sustainability. Examine the mechanism of corrosion for mitigation.
CO5 - Interpret the role of phase diagram/ fuels/ nanoparticles in chemical/ material science.
CO6 - Apply the concept of chemical science in real world applications.

TEXT / REFERENCE BOOKS

1. A.K.Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill, 4th edition, 2019.
2. Ira N. Levine, Physical chemistry, 6th Edition, 2018.
3. Ira N. Levine, Quantum chemistry, 7th Edition, 2013.
4. David W. Ball and Thomas Baer, Physical Chemistry, Wadsworth Cengage Learning, 2nd Edition, 2014.
5. Mars G Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw Hill, 2018.
6. Douglas A. Skoog and Donald M.West, Principles of Instrumental Analysis, Cengage, 6th Edition, 2014.
7. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publication, 2018.
8. David Linden, Thomas B Reddy, Handbook of Batteries, 4th Edition, McGraw-Hill, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1231	INTRODUCTION DATA SCIENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Learn how to process raw data into formats necessary for analysis.
- In-depth knowledge of fundamental data science concepts through motivating real-world case studies.
- Understand the methods of data handling and big data.

UNIT 1 DATA ACQUISITION 9 Hrs.

Data Acquisition–Sources of acquiring the data - Internal systems and External systems- Web APIs, Data preprocessing- Exploratory Data Analysis (EDA)- Basic tools (plots, graphs and summary statistics) of EDA -Open Data Sources, Data APIs,Web Scrapping -Relational Database access (queries) to process/access data.

UNIT 2 DATA PREPROCESSING AND PREPARATION 9 Hrs.

Data Munging, Wrangling - Data Visualization Basics -Plyr packages - Cast/Melt. Tableau: Creating Visualizations in Tableau-Data hierarchies, filters, groups, sets, calculated fields-Map based visualizations-Build interactive dashboards-Data Stories.

UNIT 3 DATA QUALITY AND TRANSFORMATION 9 Hrs.

Data imputation -Data Transformation (minmax, log transform, z-score transform etc.,). - Binning, Classing and Standardization. - Outlier/Noise& Anomalies.

UNIT 4 HANDLING TEXT DATA 9 Hrs.

Bag-of-words- Regular Expressions - Sentence Splitting and Tokenization - Punctuations and Stop words, Incorrect spellings -Properties of words and Word cloud - Lemmatization and Term-Document TxD computation -Sentiment Analysis (Case Study).

UNIT 5 PRINCIPLES OF BIG DATA 9 Hrs.

Introduction to Big Data - Challenges of processing Big Data (Volume, Velocity and Variety perspective) - Use Cases.

Max .45 Hrs.

COURSE OUTCOMES

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

CO1 - Explore the fundamental concepts of Data science.
CO2 - Identify and execute the basic data format.
CO3 - Understand basics of Data Preprocessing and Data Visualization
CO4 - Improve the Data quality through various transformations.
CO5 - Implement the methods of handling text data.
CO6 - Analyze and understand the basics of Big Data.

TEXT / REFERENCE BOOKS

1. Data Science at the Command Line, Jeroen Janssens, O'Reilly, ISBN 978-1-491-94785-2015.
2. Python for Data Analysis, Wes McKinney, O'Reilly, ISBN-13: 978-1-491-95766, 2018.
3. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
4. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science, 2020.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1232	EXPLORATORY DATA ANALYSIS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To focus on the significance of data and software tools.
- To emphasize the relationship between variables and gain knowledge about univariate data analysis.
- To explore multivariate data analysis and visualize the data.

UNIT 1 INTRODUCTION 9 Hrs.

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data - Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT 2 THE EXPLORATORY PERSPECTIVE 9 Hrs.

Introduction: Overview – Sources of Data – Process for Making Sense of Data - Describing Data: Observations and Variables – Types of Variables – Central Tendency – Distribution of the Data – Confidence Intervals – Hypothesis Tests - Distributions of Single Variables.

Displaying Data: The Stem and Leaf – Summarizing Data – Resistant Statistics and Number Summaries - The Box and Whisker -Understanding Data: Skewness – Outliers – Gaps and Multiple Peaks.

UNIT 3 RELATIONSHIPS BETWEEN VARIABLES 9 Hrs.

Preparing Data Tables: Cleaning - Displaying Relationships =The Scatter Plot –Summarizing Relationships – Fitting A Line – Smoothing the Data – Median and Hinge Traces –Examining Residuals – Understanding Relationships: Outliers – Nonlinear Monotonic Relationships.

UNIT 4 REEXPRESSION AND UNIVARIATE ANALYSIS 9 Hrs.

Choosing Re-expressions: Nonlinear Monotonic Functions – Nonmonotonic Functions. Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread -Scaling and Standardizing – Inequality - Univariate data: measures of center and spread, transformations.

UNIT 5 MULTIVARIATE ANALYSIS AND VISUALIZATION 9 Hrs.

Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond - Bivariate Analysis – Multivariate Analysis – Casual Analysis.

Basics of Matplotlib, Plotting with Pandas and Seaborn, Other Python Visualization Tools.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Understand about the significance of exploratory data analysis.
CO2 - Analyze the data statistically.
CO3 - Summarize data and understanding their relationship.
CO4 - Perform univariate data exploration and analysis.
CO5 - Apply multivariate data exploration and analysis.
CO6 - Perform data exploration and visualization techniques.

TEXT / REFERENCE BOOKS

1. Glenn J. Myatt, Wayne P. Johnson – Making Sense Of Data | A Practical Guide To Exploratory Data Analysis And Data Mining, Second Edition, 2014.
2. Frederick Hartwig, Brian E. Dearing , Exploratory Data Analysis, 1979.
3. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.
4. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”, First Edition, O Reilly, 2017.
5. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

S11BLH21	PROGRAMMING IN PYTHON	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To learn about data structures lists, tuples, and dictionaries in Python.
- To build packages with Python modules for reusability and handle user/custom exceptions.
- To create real world GUI applications, establish Database connectivity and Networking.

UNIT 1 INTRODUCTION TO PYTHON 12 Hrs.

History of Python- Introduction to the IDLE interpreter (shell) - Data Types - Built-in function – Conditional statements - Iterative statements- Input/output functions - Python Database Communication - data analysis and visualization using python.

Practical:

- Implement built-in functions and trace the type of data items.
- Implement concepts of Conditional and Iterative Statements.
- Use the built-in csv module to read and write from a CSV file in Python.
- Perform data analysis and visualization on a given dataset using Python libraries like pandas, NumPy, matplotlib and display charts, graphs, and plots.

UNIT 2 OBJECT ORIENTED CONCEPTS 12 Hrs.

Class – Objects – Constructors – Polymorphism – Encapsulation -Inheritance -Data Abstraction-Method Overloading-Method Overriding- Database Access-Data Hiding-Import Class.

Practical:

- Execute concepts on Polymorphism, Encapsulation.
- Implement Data Abstraction and Inheritance.
- Differentiate Method Overloading and Overriding.
- Create a class called "Person" with attributes "name" and "age." Make the "age" attribute private and implement a getter method to access it.
- Create a module called "math_operations.py" with a class called "Calculator." Import the "Calculator" class into another script and use its methods to perform mathematical operations.

UNIT 3 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES 12 Hrs.

File Operations –Iterators - Exception handling - Regular Expressions- Functions and Modules-Import Statement Introduction to PIP-Installing Packages via PIP-Using Python Packages.

Practical:

- Create a text file called "numbers.txt" and write the numbers from 1 to 10 in words, each on a separate line.
- Implement a custom iterator that generates a sequence of Fibonacci numbers and print the first 10 numbers.
- Create a try-except block to catch a File Not Found Error and print a message when a file is not found.
- Write a Python program that handles a Zero Division Error and prints a custom error message to the console.
- Create a module called "greetings.py" with a function called "hello" that prints "Hello, World!" Import the module into another script and use the "hello" function.
- Install the "NumPy" package using PIP. Import the package and create a NumPy array with random values.

UNIT 4 GUI PROGRAMMING 12 Hrs.

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colors - Canvas - Widgets (frame, label, button, check box, entry, list box, message, radio button, text, spin box).

Practical:

- Design a GUI form with a vertical box layout that includes labels and entry fields for user registration information.
- Create a GUI window with a grid layout that contains buttons representing a 3x3 game board.
- Create a canvas in your GUI program and draw simple shapes such as rectangles, circles, and lines.
- Create a GUI form program that includes various widgets and implement event handling Concepts also add Create a drop-down menu that allows users to select different font styles for text display.

UNIT 5 DATABASE AND NETWORK 12 Hrs.

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socket module - Client – Server –Email – URL Access.

Practical:

- Connect to the NoSQL database using a Python connector module, such as "pymongo" for MongoDB or "cassandra-driver" for Cassandra.
- Use a cursor to iterate over the records in a collection/table and print specific fields/attributes.
- Implement error handling for specific scenarios, such as duplicate key violation or record not found, in the NoSQL database.
- Implement either a TCP/IP or UDP client-server application using the socket module for sending and receiving messages.
- Write a program using the smtplib module to send an email from a specified email address to another recipient.

Max. 60 Hrs.

COURSE OUTCOMES

On Completion of the course the student will able to

CO1 - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
CO2 - Do the decision making and write functions in Python.
CO3 - Explain how to design GUI Applications in Python and evaluate different database operations.
CO4 - Design and develop Client Server network applications using Python.
CO5 - Ability to design real life situational problems and think creatively about solutions of them.
CO6 - Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT / REFERENCE BOOKS

1. R. Nageswara Rao , ―Core Python Programmingll, Dreamtech Press, 3rd Edition, 2021
2. Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson,2013.
3. Python Notes for Professionals by Stack Overflow Documentation (https://books.goalkicker.com/PythonBook/)
4. Dr. Charles R. Severance, “Python for Everybody- Exploring Data Using Python 3”, 2016.
5. Paul Gries, Jennifer Campbell, Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3”, Pragmatic Bookshelf, 2nd Edition,2014.

S731BLH22	DATA STRUCTURES AND ALGORITHMS	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- To impart the basic concepts of data structures and algorithms.
- To be familiar with writing recursive methods
- To implement operations on Linked List, Stack and Queues.
- To implement traversal operations of trees and graphs.
- To understand concepts about various algorithm design techniques, searching and sorting techniques.

UNIT 1 INTRODUCTION TO ALGORITHMS 12 Hrs.

Introduction to Data vs Information - Data Structures - Classification – Abstraction - Abstract data types (ADT) - Array - characteristics - Storage Representations. Array Order Reversal- Recursion- Array operations, Algorithm- complexity – Time and Space trade off.

Practical:

1. Python program to find the sum of all elements of an array
2. Python program to find a series in an array consisting of characters
3. Python program to find the occurrence of a particular number in an array
4. Python program to find the largest element in an array
5. Python program for array rotation

UNIT 2 LINKED LIST 12 Hrs.

Array Vs Linked List – Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list – Polynomial Manipulation using List - Advantages and disadvantages of singly linked list - Circular linked list - Doubly linked list - Circular Doubly Linked List.

Practical:

1. Program to implement operations on a Singly linked list.
2. Program to implement operations on a doubly linked list

UNIT 3 STACKS & QUEUES 12 Hrs.

Introduction – Array Representation of a Stack – Linked List Representation of a Stack - Stack Operations - Algorithm for Stack Operations - Stack Applications: Tower of Hanoi - Infix to postfix Transformation - Evaluating Arithmetic Expressions. Queue –Introduction – Array Representation of Queue – Linked List Representation of Queue - Queue Operations - Algorithm for Queue Operations -. Queue Applications: Priority Queue.

Practical:

1. Program to implement a Stack using an array and Linked list.
2. Program to implement Queue using an array and Linked list.
3. Program to implement Circular Queue.

UNIT 4 TREES AND GRAPHS 12 Hrs.

Preliminaries of Tree ADT - Binary Trees - The Search Tree ADT–Binary Search Trees - AVL Trees - Tree Traversals - B-Trees - Heap Tree – Preliminaries of Graph ADT - Representation of Graph – Graph Traversal - BFS – DFS – Applications of Graph – Shortest - Path Algorithms – Dijkstra's Algorithm Minimum Spanning Tree – Prims Algorithm

Practical:

1. Program to convert an infix expression to postfix expression.
2. Program to implement BFS and DFS
3. Program to implement N Queens problem.
4. Program to implement Binary Tree Traversal Program to implement Travelling Salesman Problem

UNIT 5 ALGORITHM DESIGN TECHNIQUES & SEARCHING AND SORTING TECHNIQUES 12 Hrs.

Divide and Conquer Strategy – Greedy Algorithm – Dynamic Programming – Backtracking Strategy - List Searches using Linear Search - Binary Search - Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort - Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques.

Practical:

1. Program to sort the elements using insertion sort.
2. Program to sort the elements using quick sort.
3. Program to sort the elements using merge sort.
4. Program to find an element using Linear and Binary Search.

Max. 60 Hrs.

COURSE OUTCOMES

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

CO1 - Understand the concept of recursive algorithms.
CO2 - Demonstrate the different types of data structures.
CO3 - Able to understand the operations on linear data structures.
CO4 - Summarize searching and sorting techniques.
CO5 - Choose appropriate data structure as applied to specified problem definition.
CO6 - Understand and implement the various algorithm design techniques.

TEXT/REFERENCE BOOKS

1. Jean-Paul Tremblay, Paul G. Sorenson,'An Introduction to Data Structures with Application', TMH, 2017.
2. Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2nd Edition,2004.
3. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Editin, 2004.
4. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

SCYB2101	CHEMISTRY LAB	L	T	P	EL	Credits	Total Marks
		0	0	2	0	1	50

COURSE OBJECTIVES

- To understand the basic principle involved in volumetric and instrumental analysis.
- To acquire practical knowledge in pHmetry, potentiometry and conductometry.
- To develop the skill in water analysis.

SUGGESTED LIST OF EXPERIMENTS

1. Estimation of mixture of acids by conductometry.
2. Estimation of ferrous ion by potentiometry.
3. Determination of pKa value of glycine by pHmetry.
4. Estimation of hardness of water by EDTA method.
5. Determination of alkalinity of water
6. Estimation of Iron by photocolorimetry.
7. Estimation of copper in brass
8. Determination of high molecular weight polymer using Ostwald viscometer.

COURSE OUTCOME

On completion of the course, student will be able to

CO1 - Estimate the ionic conductance of mixture of acids.
CO2 - Construct a redox cell for the emf measurement.
CO3 - Interpret the concept of Zwitter ion in amino acids
CO4 - Predict the quality of water sample for domestic and industrial applications.
CO5 - Demonstrate the validity of Beer-Lambert's law.
CO6 - Apply Poiseuille's law for molar mass measurement.

TEXT / REFERENCE BOOKS

1. G,H. Jeffery, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition. Persons Education, 2004.
2. S. S. Dara, Experiments and Calculations in Engineering Chemistry, S. Chand and Co. 2010.

SMTB1304	MATRICES AND LINEAR ALGEBRA	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVES

- To identify, reflect upon, evaluate and achieve conceptual understanding and knowledge of traditional Calculus to form independent judgments.
- To model the Engineering problems and obtain its solutions mathematically.
- To understand Science, Engineering and Computer Science analytically and attain logical thinking.

UNIT 1 MATRICES 9 Hrs.

Characteristic equation of a square matrix – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigen Vectors-Cayley-Hamilton theorem (without proof) – verification, finding inverse and power of a matrix – Diagonalization of a matrix using orthogonal transformation – Quadratic forms – Nature of quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 VECTOR SPACES 9 Hrs.

Vector Spaces – Definition – Simple properties – Examples – Sub spaces and algebra of subspaces – Quotient spaces –Internal direct sum-External direct sum.

UNIT 3 LINEAR INDEPENDENCE AND DIMENSION 9 Hrs.

Linear combination of vectors, linear span, linear independence – basis and dimension, dimension of subspaces – Dimension of Quotient spaces.

UNIT 4 INNER PRODUCT SPACE 9 Hrs.

Inner product spaces – Definition – Examples – Applications – Orthogonal complement of a sub space – Orthonormal Basis – Gram Schmidt Orthogonalization process.

UNIT 5 LINEAR TRANSFORMATION 9 Hrs.

Linear Transformation – The Algebra of linear transformations – null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation – Characteristic roots – Canonical forms – Triangular forms.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, the students will be able to

CO1 - Define Eigen values and Eigen vectors.
CO2 - Use the Internal direct sum and External direct sum.\
CO3 - Analyze the Linear combination of vectors, linear span, linear independence
CO4 - Apply Orthogonal complement of a sub space – Orthonormal & Orthonormal Basis
CO5 - Develop the Algebra of linear transformations
CO6 - Create equations of spheres with various properties

TEXT/REFERENCE BOOKS

1. I.N.Herstein, Topics in Algebra, 2nd Edition, John Wiely, NewYork, 2013.
2. Stephen H.Friedberg, Arnold J.Insel, Lawrence E.Spence, Linear Algebra, 4thEd., Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. A.R. Vasistha, A first course in Modern Algebra, Krishna Prakasan, Meerut, 2019.
4. S. Lang, Introduction to Linear Algebra, 2nd Edition, Springer, 2005

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1301	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on understand ALU and its operations, types of memory organizations.
- To understand the types of memory organizations, interface and communication in I/O devices.
- To analyze about the characteristics, structure, communication and synchronization of multiprocessors.

UNIT 1 GENERAL REGISTERS **9 Hrs.**

Introduction - General Register Organization - Stack organization - Basic computer Organization - Instruction codes - Computer Registers - Computer Instructions - Instruction Cycle.

UNIT 2 ARITHMETIC LOGIC UNIT AND COMPUTER ARITHMETIC **10 Hrs.**

Introduction to ALU - Arithmetic – Logic - Shift Micro operations - Arithmetic Logic Shift unit - Example Architectures: MIPS – RISC – CISC- Addition - Subtraction - Multiplication and Division algorithms - Floating Point Arithmetic operations - Micro programmed Control- Design of Control unit

UNIT 3 MEMORY ORGANIZATION **8 Hrs.**

Memory Hierarchy - Main memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual memory

UNIT 4 INPUT - OUTPUT ORGANIZATION **9 Hrs.**

Peripheral Devices - I/O Interface - Modes of transfer - Priority Interrupt - DMA - IOP - Serial Communication.

UNIT 5 CHARACTERISTICS OF MULTIPROCESSORS **9 Hrs.**

Interconnection Structures - Interprocessor Arbitration - Interprocessor Communication and Synchronization - Cache coherence.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Classify the various types of registers, microinstructions and addressing modes.
CO2 - Explain Arithmetic Logic Unit and computer arithmetic operations.
CO3 - Infer the usage of Memory Organization.
CO4 - Describe about the I/O devices and organization.
CO5 - Explain the interconnection structures and interprocessor communication
CO6 - Describe the characteristics and synchronization of multiprocessors.

TEXT / REFERENCE BOOKS

1. M.Morris Mano, “Computer system Architecture”, 3rd Edition, Prentice-Hall Publishers, 2017.
2. Mark Burrell, “Fundamentals of Computer Architecture”, Mcmillan Higher Education, 2003.
3. John D. Carpinelli, “Computer Systems Organization and Architecture”, Pearson Education, 2001.
4. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5th Edition, McGraw-Hill, 2002.

5. William Stallings, "Computer Organization and Architecture - Designing for Performance", 9th Edition, Prentice Hall, 2012.
6. John P Hayes, Computer Architecture Organization, McGraw Hill Edition 4, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SISB4301	UNIVERSAL HUMAN VALUES	L	T	P	EL	Credits	Total Marks
		2	0	0	3	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- To understand (or developing clarity) the harmony in the human being, family, society and nature / existence.
- To Strengthen Self-reflection, develop commitment and courage to act.

MODULE 1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION 9 Hrs.

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as
3. the process for self- exploration
4. Continuous Happiness and Prosperity- A look at basic Human Aspirations
5. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of
6. aspirations of every human being with their correct priority
7. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
8. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE 2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF! 9 Hrs.

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'.
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.

Practice sessions to discuss the role others have played in making material goods available tome. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE 3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY – HARMONYIN HUMAN- HUMAN RELATIONSHIP 9 Hrs.

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the

other salient values in relationship

4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

MODULE 4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE 9 Hrs.

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and value in nature
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence.
5. Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE 5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 9 Hrs.

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations Sum up.
   Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions at the conduct as an engineer or scientist etc.

Total: 28 Lectures and 14 Practice Sessions

COURSE OUTCOMES

On completion of the course, the student will be able

CO1 - To become more aware of themselves, and their surroundings (family, society, nature)

CO2 - They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind

CO3 - To have better critical ability

CO4 - To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

CO5 - To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT BOOKS / REFERENCE BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj – PanditSunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT

Assessment by faculty mentor	: 10 Marks
Self-assessment	: 10 Marks
Assessment by peers	: 10 Marks
Socially relevant project/Group Activities/Assignments	: 20 Marks
End Semester Examination	: 50 Marks

SCSB1303	THEORY OF COMPUTATION	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

COURSE OBJECTIVES

- To introduce automata theory, regular languages, context free languages and recognizers for different languages.
- To design Turing machines for various languages.
- To gain knowledge on unsolvable problems.

UNIT 1 FINITE AUTOMATA AND REGULAR LANGUAGES 9 Hrs.

Finite automata and regular languages - Regular languages and regular expressions - Finite automata - Non-determinism and Kleene's theorem - Non-deterministic finite automata and NFA with null transition.

UNIT 2 CONTEXT-FREE LANGUAGES AND NORMAL FORMS 9 Hrs.

Context-free grammars - Definition - More examples - Union, concatenations, and *'s of CFLs - Derivation trees and ambiguity - Unambiguous CFG for algebraic expressions - Normal Forms - CNF – GNF.

UNIT 3 PUSH DOWN AUTOMATA 9 Hrs.

Pushdown automata - Introduction - Definition - Deterministic pushdown automata - PDA corresponding to a given context-free grammar – Context-free Grammar corresponding to PDA. Pumping Lemma for CFG.

UNIT 4 TURING MACHINES 9 Hrs.

Turing machines - Models of computation and the Turing thesis - Definition of TM and TM as language acceptor - Non-deterministic TM and Deterministic TM – Universal TM.

UNIT 5 RECURSIVE LANGUAGES AND UNDECIDABILITY 9 Hrs.

Recursively enumerable and recursive languages – Properties of Recursively enumerable and recursive languages - Enumerating a language. Introduction to Undecidability- Halting problem- Undecidability of Post correspondence problem (PCP)-Modified PCP -Rice Theorem.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1 - Build solutions for acceptance, rejections problems using Finite State Machine.
CO2 - Perform operations on Context free Languages using context free grammars.
CO3 - Solve problems on Context Free Languages using Push Down Automata.
CO4 - Design a solution for given problems using Turing Machine.
CO5 - Distinguish Recursively Enumerable Languages and Recursive languages.
CO6 - Hypothesize solutions to unsolvable problems.

TEXT /REFERENCE BOOKS

1. John. C. Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw-Hill, 4th Edition, 2010.
2. Hopcroft, Motwani and Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Publishers, Third Edition, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each - No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

S731BLH32	MACHINE LEARNING ESSENTIALS	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- To build a comprehensive understanding of the principles, techniques, and applications of machine learning.
- To analyze classification and clustering techniques.
- To interpret the need for ensembling models and its techniques.
- To apply reinforcement learning techniques.

UNIT 1 INTRODUCTION TO MACHINE LEARNING 12 Hrs.

What is machine learning – Examples of Machine Learning Applications -Types of Machine Learning Techniques – Learning a class from Examples – Vapnik - Chervonenkis Dimension - Probably Approximately Correct Learning – Gradient Descent – Bias and Variance- Overfitting- Underfitting- Confusion Matrix.

Practical: Install necessary Library Files, Load Datasets, Load text file or CSV file and convert into Data Frame, Data Preprocessing- Handle missing values-separate dataset into features (X) and labels (y) - Split the dataset into training set and testing set using the train_test_split function from scikit-learn - Implement functions, Input confusion matrix, calculates sensitivity, specificity, and accuracy of various class -understanding Variance and Bias Difference.

UNIT 2 SUPERVISED LEARNING 12 Hrs.

Linear regression-with one variable-with multiple variables--Multiple Linear Regression-Nonlinear Regression-Regression Analysis-Prediction Classification Models-KNN Classification- Naïve Bayes Classification- Decision Tree Classification-Support vector Machine-Random Forest- Classification vs Regression.

Practical: Build Linear Regression Model-Logistic Regression Model-Train Classification Models KNN, Naïve Bayes-Decision tree algorithm to classify a set of data point according to given depth of the tree-Train SVM Model with different Kernel Functions- Train Random Forest with different hyperparameters like the number of trees, maximum depth, minimum samples per leaf.

UNIT 3 UNSUPERVISED LEARNING 12 Hrs.

Clustering-Supervised Learning after Clustering-Density Based Clustering Methods-Hierarchical Based clustering methods- Partitioning methods- Grid based methods. Dimensionality Reduction: Linear Discriminant Analysis -Principal Component Analysis.

Practical: K-Means Clustering to determine optimal number of clusters using techniques like the elbow method or silhouette score-Dendrogram Generation via implementing hierarchical clustering agglomerative or divisive on the dataset- Density-based clustering algorithms DBSCAN, OPTICS-Apply dimensionality reduction techniques LDA, PCA to visualize high-dimensional data.

UNIT 4 ENSEMBLING MODELS 12 Hrs.

Need of Ensembling- Applications of Ensembling – Types of Ensembling: Basic Ensemble Techniques-Advanced Ensemble Techniques: Bagging, Boosting, Stacking, Blending - Techniques of Ensembling - AdaBoost.

Practical: Explore about ensemble learning methods **–** Different ensembling models for classification tasks– Bagging with Random Forest, Boosting with AdaBoost, Stacking and Blending with Logistic regression and KNN-Experiment with different hyperparameters and with different datasets.

UNIT 5 REINFORCEMENT LEARNING 12 Hrs.

Introduction- RL Framework- Temporal Difference Learning -Active Reinforcement Learning- Markov Decision Process Model – Learning Expectations-Learning Algorithms-Q learning Algorithm-Case Study: Implementation of Q learning in automotive games.

Practical: Case Study using Q learning in Automotive Games- Machine learning approaches to develop self-driving cars capable of navigating complex traffic scenarios and ensuring passenger safety-Machine learning model to analyze and classify sentiments in social media data providing valuable insights for businesses regarding customer opinions and preferences.

Max. 60 Hrs.

COURSE OUTCOMES

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

CO1 - Reduce the dimension of the dataset with machine learning techniques
CO2 - Implement the predictive analytics for any real-world scenario
CO3 - Implement applications with clustering and classification techniques
CO4 - Implement the ensembling models.
CO5 - Learn and apply reinforcement techniques.
CO6 - Apply machine learning models to solve real-world problems, evaluate their performance and make informed decisions about selecting appropriate algorithms.

TEXT / REFERENCE BOOKS

1. Andreas C. Müller, Sarah Introduction to Machine Learning with Python: A Guide for Data Scientists Guido,First Edition, O'Reilly Media, Inc, 2020.
2. Zhi-Hua Zhou, "Ensemble Methods: Foundations and Algorithms", CRC Press, 2012.
3. Aurélien Géron, Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow, Second Edition, O'Reilly Media, Inc, 2019.
4. Shai Shalev-Shwartz, and Shai Ben-David, Understanding machine learning: From theory to Algorithms, Cambridge University Press, Published, 2014.
5. https://machinelearningmastery.com/stacking-ensemble-machine-learning-with-python.
6. https://sebastianraschka.com/blog/2018/model-evaluation-selection-part4.html.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

S12BLH31	PROGRAMMING IN JAVA	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To introduce object-oriented concepts, packages, interfaces and multithreading in Java.
- To understand input and output operations, GUI programming and database connectivity.
- To impart knowledge on the concepts of server-side programs.

UNIT 1 JAVA BASICS 12 Hrs.

Features of Java Language - JVM - Bytecode –Data Types-Java Tokens-Access Modifiers-Operators-Arrays one dimensional and multi-dimensional - Control Structures- String Handling – String class – String buffer class.

Practical: Implementation of Matrix Operations using Arrays, String Operations, Looping Control Statements, Conditional Control Statements.

UNIT 2 OBJECT ORIENTED PROGRAMMING 12 Hrs.

Object Oriented Concepts-Classes and Objects –Constructors –. Method Overloading-Inheritance – Types – Using Super – Method Overriding – Abstract Classes – Using final with inheritance- Garbage Collection.

Practical: Implementation of Constructors, Inheritance, Static and dynamic Polymorphism, Abstract Class

UNIT 3 PACKAGES, INTERFACES AND THREADS 12 Hrs.

Introduction to Packages – User Defined Packages - Importing packages – Access protection – Interfaces – Exception Handling – Using try, catch, throw, throws and finally –Java Thread Model – Main thread – Multithreading – Thread priorities – Synchronization.

Practical: Creating custom Packages, Interfaces. Handling predefined and User Defined Exceptions, Implementation Single and Multi-Threading.

UNIT 4 FILE STREAMS AND COLLECTIONS FRAMEWORK 12 Hrs.

IO Package - Introduction – Input Stream and Output Stream classes - Data Output Stream and Data Input Stream classes –File Input Stream – File Output Stream. - Reader and Writer Classes – File Reader and File Writer-Collections Framework-List, Set, Map.

Practical: Reading Contents From file and Writing Contents to File, Implementation of Collections Frameworks.

UNIT 5 GUI PROGRAMMING, DATA BASE CONNECTIVITY, SERVER-SIDE PROGRAMMING 12 Hrs.

GUI Programming using Java FX-Explore Events-Accessing Database using JDBC-Introduction to servlet - Servlet life cycle - Developing and Deploying Servlets – JSP TAGS-Expressions-Applications using Servlet and JSP.

Practical: Creation of Graphical user Interface for different Applications. Creation of Server-side Programs using Servlet and JSP.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop applications using java object oriented concepts.
CO2 - Create User defined Packages and Interfaces..
CO3 - Build Software using the concepts of Files and Collection Framework
CO4 - Design GUI using Java FX.
CO5 Implement Java Applications web using Data base Connectivity
CO6 - Design Web Applications using Servlet and JSP

TEXT / REFERENCE BOOKS

1. Herbert Schildt," The Complete Reference JAVA2", Fifth Edition, Tata McGraw Hill, 2017.
2. Bruce Eckel," Thinking in Java", Pearson Education, Fourth Edition 2006.
3. Core Java Volume-I Fundamentals, 9th Edition, Cay Horstman and Grazy Cornell, Prentice Hall, 2013.
4. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015.
5. https://docs.oracle.com/javase/tutorial/.
6. https://www.tutorialspoint.com/java/.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice	**20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks	**80 Marks**

SMTB1402	PROBABILITY AND STATISTICS	L	T	P	EL	Credits	Total Marks
		3	1	0	0	3	100

OBJECTIVE OF THE COURSE

- To identify, reflect upon, evaluate and achieve conceptual understanding and knowledge of traditional Calculus to form independent judgments.
- To model the Engineering problems and obtaining its solutions mathematically.
- To understand Science, Engineering and Computer Science analytically and logical thinking is attained.

UNIT 1 BASIC CONCEPTS OF PROBABILITY 9 Hrs.

Probability Space – Events – Axiomatic approach to Probability – Conditional Probability – Independent Events – Baye's Theorem. - Random Variables–Functions of Random Variables and their Probability Distribution.

UNIT 2 PROBABILITY DISTRIBUTION 9 Hrs.

Discrete Distributions: Binomial, Poisson and Geometric – Continuous Distributions: Uniform, Exponential and Normal – Applications only (no derivation).

UNIT 3 TWO DIMENSIONAL RANDOM VARIABLES 9 Hrs.

Joint Probability distributions– Marginal and Conditional Distributions–Transformation of Random Variables.

UNIT 4 CORRELATION AND REGRESSION 9 Hrs.

Correlation–Linear regression–Multiple and Partial Correlation–Curve Fitting–Method of Least Squares– Fitting of the Curve of the form $y = a+bx$, $y = a+bx+cx^2$, $z = ax+by+c$.

UNIT 5 ANALYSIS OF VARIANCE AND STATISTICAL QUALITY CONTROL 9 Hrs.

Review of F-test– Design of experiments: Completely Randomized Design, Randomized Block Design and Latin Square Design– Statistical Quality Control: Mean, Range, p, np, c–charts.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand probability concepts and Baye's theorem problems. Explain functions of random variables and their probability distributions.
CO2 - Analyze discrete and continuous probability distributions.
CO3 - Estimate the distributions and transformations of two dimensional random variables
CO4 - Distinguish correlation and regression. Construct curve fitting by the method of least squares.
CO5 - Evaluate problems on design of experiments using analysis of variances.
CO6 - Sketch the control charts and point out the results based on the charts

TEXT / REFERENCE BOOKS

1. Hong R.V, Tanis E.A and Zimmerman D L, Probability and Statistical Inference, Pearson Education Limited, Ninth Edition, 2015.
2. Miller I.and Freund J.E, Probability and Statistics for Engineers, Pearson Publishers, Ninth Edition, 2017.
3. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Tenth Edition, 2002.
4. VeerarajanT., Probability, Statistics and Random Processes, Tata McGraw-Hill, New Delhi, Fourth Edition, 2014.
5. Sivaramakrishna Das P., VijayaKumari C., Probability and Random Processes, Pearson Education, Sixth Edition, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1401	OPERATING SYSTEMS AND UNIX	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To have an overview of different types of operating systems and process management.
- To understand the concepts of storage management, I/O and file systems.
- To learn the basics of Unix Programming.

UNIT 1 INTRODUCTION **8 Hrs.**

Introduction - Operating system structures - System components - OS services - System calls - System structure - Resources Processes - Threads - Objects - Device management - Different approaches - Buffering device drivers.

UNIT 2 PROCESS MANAGEMENT **9 Hrs.**

Processes - Process concepts - Process scheduling - Operations on processes - Cooperating processes - CPU scheduling - Basic concepts - Scheduling criteria - Scheduling algorithms - Preemptive strategies - Non-preemptive strategies.

UNIT 3 SYNCHRONIZATION AND DEADLOCKS **9 Hrs.**

The critical section problem - Semaphores - Classic problems of synchronization - Critical regions - Monitors-Dead locks - Deadlock characterization - Prevention - Avoidance - Detection - Recovery.

UNIT 4 MEMORY MANAGEMENT AND I/O MANAGEMENT **10 Hrs.**

Storage Management Strategies - Contiguous Vs. Non-Contiguous Storage Allocation - Fixed and Variable Partition Multiprogramming - Paging - Segmentation - Paging/Segmentation Systems - Page Replacement Strategies - Demand & Anticipatory Paging, File Management: Access Methods - Directory Structure, Allocation Methods, Disk Management: Disk Structure- Disk Scheduling.

UNIT 5 UNIX **9 Hrs.**

Unix Components, Internal and External commands, File and directory related commands, File permission and manipulation, Standard I/O, configuring vi environment, Regular expression, Process related commands, Shell programming- Branching control structures- if, case etc., Loop control structures– while, until, for, etc., Jumping control structures – break, continue, exit, etc., Integer and Real arithmetic in shell programs.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Understand the fundamental components of a computer operating system and how computing resources are managed by the operating system.
CO2 - Apply the concepts of CPU scheduling in process management.
CO3 - Analyze synchronization and deadlocks in real computing problems.
CO4 - Demonstrate the different memory and I/O management techniques used in Operating Systems.
CO5 - Have practical exposure in disk scheduling.
CO6 - Write shell scripts in vi environment.

TEXT / REFERENCE BOOKS

1. Abraham Silberschatz, Peter Galvin and Gagne, “Operating System Concepts”, 10th Edition, Addison Wesley, 2018.
2. Harvey M.Deitel, ”Operating System”, 3rd Edition, Addison Wesley, 2004.
3. Gary Nutt,” Operating System, A modern perspective”, 3rd Edition, Addison Wesley, 2004.
4. Andrew S. Tanenbaum, “Modern Operating Systems”.4th edition 2015.
5. Eric S. Raymond, Art of UNIX Programming, The 1st Edition, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

S11BLH41	DATABASE MANAGEMENT SYSTEMS	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To understand the concept of DBMS and ER Modeling.
- To familiarize with normalization, Query optimization and relational algebra.
- To apply concurrency control, recovery, security and indexing for the real time data.

UNIT 1 DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE 12 Hrs.

History and motivation for database systems - characteristics of database approach - Actors on the scene - Workers behind the scene - Advantages of using DBMS approach - Data Models, Schema, and Instances - Three-Schema Architecture and Data Independence - The Database System Environment - Centralized and Client/Server Architectures for DBMS - Classification of DBMS.

Practical: Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.

UNIT 2 DATA MODELING 12 Hrs.

Entity Relationship Model: Types of Attributes, Relationship, Structural Constraints - Relational Model, Relational model Constraints - Mapping ER model to a relational schema - Integrity Constraints

Practical: Create a set of tables, add foreign key constraints and incorporate referential integrity.

UNIT 3 SCHEMA REFINEMENT 12 Hrs.

Guidelines for Relational Schema - Functional dependency - Normalization, Boyce Codd Normal Form, Multi-valued dependency and Fourth Normal form - Join dependency and Fifth Normal form.

Practical: Query the database tables using different 'where' clause conditions and also implement aggregate functions. Query the database tables and explore sub queries and simple join operations.

UNIT 4 QUERY PROCESSING AND TRANSACTION PROCESSING 12 Hrs.

SQL fundamentals -Translating SQL Queries into Relational Algebra - heuristic query optimization - Introduction to Transaction Processing - Transaction and System concepts - Desirable properties of Transactions - Characterizing schedules based on recoverability - Characterizing schedules based on serializability.

Practical: Execute complex transactions and realize DCL and TCL commands.

UNIT 5 CONCURRENCY CONTROL, RECOVERY TECHNIQUES & NOSQL DBMS 12 Hrs.

Two-Phase Locking Techniques for Concurrency Control - Concurrency Control based on timestamp - Recovery Concepts - Recovery based on deferred update - Recovery techniques based on immediate update -Shadow Paging - Introduction, Need of NoSQL - different NoSQL data models: Key-value stores - Column families - Document databases - Graph databases.

Practical: Create Document, column and graph-based data using NOSQL database tools.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Demonstrate the basic concept and role of DBMS in an organization.
CO2 - Illustrate the design principles for database design, ER model.
CO3 - Discuss normalization techniques with simple examples.
CO4 - Demonstrate the basics of query evaluation and heuristic query optimization techniques.
CO5 - Apply Concurrency control and recovery mechanisms for the desirable database problem.
CO6 - Design the database system with the fundamental concepts of DBMS.

TEXT / REFERENCE BOOKS

1. Silberschatz, A., Korth, H. F., and Sudarshan, S. Database System Concepts, McGraw-Hill, 7th Edition. 2019.
2. Elmasri, R., & Navathe, S. B. Fundamentals of database systems, 4th Edition, Addison Wesley Publishing Edition, 2017.
3. Majumdar, A. K., and Bhattacharyya, P. Database Management Systems. McGraw-Hill, 2017.
4. Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of
5. Polyglot persistence, Addison Wesley, 2012.
6. Shashank Tiwari, Professional NoSql, Wiley, 2011.

SCSB1431	DATA MINING AND DATA WAREHOUSING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand various Tools of Data Mining and their Techniques to solve the real time problems.
- To learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply.
- To assess the Pros and Cons of various algorithms and analyze their behavior on real datasets.

UNIT 1 DATA MINING 9 Hrs.

Introduction – Steps in KDD – System Architecture – Types of data -Data mining functionalities – Classification of data mining systems – Integration of a data mining system with a data warehouse – Issues – Data Preprocessing – Data Mining Application.

UNIT 2 DATA WAREHOUSING 9 Hrs.

Data warehousing components – Building a data warehouse – Multi Dimensional Data Model – OLAP Operation in the Multi- Dimensional Model – Three Tier Data Warehouse Architecture – Schemas for Multi- dimensional data Model – Online Analytical Processing (OLAP) – OLAP Vs OLTP Integrated OLAM and OLAP Architecture.

UNIT 3 ASSOCIATION RULE MINING 9 Hrs.

Mining frequent patterns – Associations and correlations – Mining methods – Finding Frequent itemset using Candidate Generation – Generating Association Rules from Frequent Item sets – Mining Frequent Item set without Candidate Generation – Mining various kinds of association rules – Mining Multi-Level Association Rule-Mining Multidimensional Association Rule- Mining Correlation analysis – Constraint based association mining.

UNIT 4 CLASSIFICATION AND PREDICTION 9 Hrs.

Classification and prediction – Issues Regarding Classification and Prediction – Classification by Decision Tree Induction -Bayesian classification – Baye's Theorem – Naïve Bayesian Classification – Bayesian Belief Network – Rule based classification – Classification by Back propagation – Support vector machines – Prediction – Linear Regression.

UNIT 5 CLUSTERING, APPLICATIONS AND TRENDS IN DATA MINING 9 Hrs.

Cluster analysis – Types of data in Cluster Analysis – Categorization of major clustering methods - Partitioning methods – Hierarchical methods – Density-based methods – Grid-based methods – Model based clustering methods -Constraint Based cluster analysis – Outlier analysis – Social Impacts of Data Mining- Case Studies: Mining WWW- Mining Text Database- Mining Spatial Databases.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Assess Raw Input Data and process it to provide suitable input for a range of data mining algorithm.
CO2 - Design and Modelling of Data Warehouse.
CO3 - Discover interesting pattern from large amount of data.
CO4 - Design and Deploy appropriate Classification Techniques.
CO5 - Able to cluster high dimensional Data.
CO6 - Apply suitable data mining techniques for various real time applications

TEXT / REFERENCE BOOKS

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, 2007.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw Hill, 2007.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction To Data Mining", Person Education, 2007.
4. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India,2006.
5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
6. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSBDPROJ	DESIGN THINKING AND INNOVATIONS	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To apply knowledge in Real time problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to Engineering /Non-Engineering problems.

Activity 1:
Design thinking introduction:

- Phases of design thinking- a study approach.
- Group Discussion on Ideation- Users perspective Formation of team – Thinking skills- Brain storming.

Activity 2:
Problem identification (phase I)

- Selecting user requirements.
- Survey on various user's applications.
- Specific Problem selection to proceed with the work – Team presentation on identified problems and various possible solutions.

Activity 3:
Problem identification (Phase II)

- Study of an application and its importance to end user.
- Various models of an applications.
- Finalize the identified problem.

Activity 4:
Design ideation and various stages

- Sketch design diagram.
- Architecture or full diagrammatic study.

Activity 5:
Review and upgradation

- Review of the ideation (one to one interaction).
- Feedback.
- Upgradation plan.

Activity 6:
Implementation (Phase I)

- Build the prototype using available resources.
- Record Module diagrams.

Activity 7:
Implementation (Phase II)

- Display and review of the prototype.
- Record its functionality and its Usage-Technical manual.

Activity 8:
Testing
- To test the product design with real time environment.
- Record Process-user manual.

Activity 9:
IPR-Activity I
- To study various IPR activities.
- To prepare for IPR Process.
- To file an IPR.

Activity 10:
Start-ups Formation
- To exhibit the product to public: feedback approach.
- To prepare full documentation.
- Start-ups registration/apply patent/publish paper/submit model/prototype/Apply for seed/submit as research proposal.

Course Outcomes [COs]
On completion of the course, student will be able to
CO1 - Solve real world problems by applying knowledge across domains.
CO2 - Develop various design products, processes or technologies for sustainable and socially relevant applications.
CO3 - Demonstrate knowledge of resource utilization/budgets to Implement appropriate methodologies.
CO4 - Execute tasks by application of engineering standards/ requirements/ design criteria, within timelines.
CO5 - Conduct extended investigation that results in the translation of idea to product / production of a research thesis/ developing a proof of concept.
CO6 - Communicate well organized technical and scientific findings effectively in written and oral forms, following ethical and professional norms.

TEXT / REFERENCE BOOKS
1. Mueller-Roterberg, Christian. "Handbook of Design Thinking." Hochschule Ruhr West (2018).
2. Design Kit by IDEO.org. "The field guide to human centered design." (2015), ISBN: 978-0-9914063-1-9.
3. https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy
4. https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype.
5. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximize-learning.
6. https://uxplanet.org/what-are-insights-aa1f2d1b3b9c.
7. https://labs.sogeti.com/using-design-thinking-to-design-business-models/.
8. https://www.northeastern.edu/graduate/blog/implementing-business-model-innovation/.

COURSE ASSESSMENT METHODS

Direct Methods	Design innovation Reviews Report Submission IPR Registration
Indirect Methods	Course Exit Survey

ASSESSMENT METHOD	RUBRICS	MARKS ALLOTTED	ASSESSMENT TYPE
Review 1	1	30	CAE
Internal Guide	2	10	CAE
IPR Process and Registration	5	10	ESE
Total – Internal		**50**	
Final Review	3	30	ESE
Report Submission	4	20	ESE
Total –External		**50**	

SCSB1501	DATA COMMUNICATION AND COMPUTER NETWORKS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To classify different network architectures, transmission methods and switching techniques.
- To evaluate network errors, examine methods to detect and remove them.
- To articulate the functioning behind the data transfer through different transmission mode in a network.

UNIT 1 INTRODUCTION 9 Hrs.

Data communication process - Components of communication media – Modes of Communication – IEEE protocol and Standards – Network Classifications – Rudiments of Networks topologies – Client Server and Peer to Peer Network Architecture.

UNIT 2 TRANSMISSION MEDIA & SWITCHING 9 Hrs.

Communication Media – Guided transmission, Unguided and Line of Sight (LOS) – Network Connecting Devices - Multiplexing Techniques – Switching Techniques – Packet Switching Techniques – Analog and digital signals – Encoding and modulation – Parallel and serial transmission.

UNIT 3 ERROR DETECTION, CORRECTION & COMMUNICATION 9 Hrs.

Types of Network Errors – Error Detection – Error Correction Methods – Flow control – Error control – IEEE 802.3 – IEEE 802.5 – IEEE 802.11– IEEE 802.15.1 (Piconet and Scatternet).

UNIT 4 ISDN & ATM 9 Hrs.

Access to ISDN – ISDN layers – Broadband ISDN – Packet layer protocol – ATM – ATM architecture – ATM layers – Congestion control – Leaky bucket algorithm.

UNIT 5 REFERENCE MODELS & PROTOCOLS 9 Hrs.

OSI Reference models – Routing algorithms – TCP/IP Layered Architecture – Transport and application layers of TCP/IP – Network Protocols DHCP – NAT – DNS – SMTP – HTTP – WWW.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Infer and interpret the foundations of communication, network and transmission along with its devices, types, topologies & protocols.

CO2 - Compare and construct different network architectures, transmission methods and switching techniques.

CO3 - Classify various types of network errors, examine methods to detect them and evaluate various correction algorithms to remove it.

CO4 - Apprehend and perceive the working of advanced switching network, its protocol and architecture.

CO5 - Deduce and master the functioning behind the data transfer through different transmission mode in a network.

CO6 - Categorize the classification of layers built in a network and discern the data flow between the layers through diverse range of algorithms.

TEXT / REFERENCE BOOKS

1. Behrouz and Forouzan, “Data Communications and Networking”, 2nd Edition, Tata McGraw Hill, 2007.
2. Andrew.S. Tenenbaum,” Computer Networks”, 4th Edition, Prentice Hall of India, 2008.
3. William Stallings,” Data and Computer Communication “, 6th Edition, Pearson Education, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1551	DATA MODELING AND PREDICTIVE ANALYTICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of advanced data modeling techniques.
- To study diverse data types and visualization techniques.
- To learn predictive analytics and build predictive data models.

UNIT 1 DATA MODELING: BASIC 9 Hrs.

Importance – Features – Performance – Data Model: Conceptual, Logical and Physical Data Models – Three Schema Architecture – Organizing the Data Modeling task – Roles – Responsibilities – Maintenance – Distributed Data: Replication – Partitioning – Transaction – Case Study: Advanced Normalization forms.

UNIT 2 DATA MODELING: ADVANCED 9 Hrs.

Conceptual Data Modeling – Design – Learning – Usage of patterns and Generic model – Types: Bottom-Up Modeling – Top Down Modeling – Hierarchy – Network – Chain – Evaluation, Comparison and Testing of Model – Modeling for Data Warehouse and Data Mart – Case Study: Enterprise Data Model Development.

UNIT 3 PREDICTIVE ANALYTICS: ALL ABOUT DATA 9 Hrs.

Data: Structured, Unstructured, Static, streamed – Attitudinal, Behavioral, Demographic data – Data-Driven and User-Driven Analytics – 4 V's in data – Keyword-based and Semantic-based Search – Visualization of raw data – Online marketing retail implementation – Content and Text Analysis – Case Study: PA in Fight, Fraud and Crime.

UNIT 4 PREDICTIVE ANALYTICS: APPLYING DATA MODELS 9 Hrs.

Model, Simulation and Categorization of data – Raw data to matrix conversion – Associating similar data – Birds flocking and Ant colony approaches – Preprocessing, structuring data – Building Predictive model – Developing and Testing model – Case Study: Google Search queries as Epidemic Predictors.

UNIT 5 PREDICTIVE ANALYTICS: BUILDING PREDICTIVE DATA MODELS 9 Hrs.

Visualization: Benefits – Complexity reduction – Evaluation – Visualizing: Hidden Groupings, Data Classification Results, Outliers in data, Decision Tree and Predictions – Ten reasons to implement Predictive Analytics – Ten steps to build Predictive Analytics model – Case Study: Birds Flocking behavior Data Visualization.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - List out different types of data models along with its roles and responsibilities.
CO2 - Implement conceptual data modeling design and types of modeling.
CO3 - List out the types of data and techniques to analyze the data.
CO4 - Apply different data models for predictive data analysis.
CO5 - Design and build predictive analytics model and list out ten reasons to implement the same.
CO6 - Apply predictive data model on real world data.

TEXT / REFERENCE BOOKS

1. Graeme C. Simsion and Graham C. Witt, “Data Modeling Essentials” Third Edition,2004.
2. Martin Kleppmann, “Designing Data-Intensive Applications: The big ideas behind reliable, scalable and maintainable systems”, 2021.
3. A. Wiley Brand, “Predictive Analytics for Dummies”2016.
4. Eric Siegel, “Predictive Analytics: The power to predict who will click, buy, lie or die”, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1531	TIME SERIES ANALYSIS AND FORECASTING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To equip various forecasting techniques and familiarize on modern statistical methods for analyzing time-series data.
- To amalgamate the intellectual facts of the time series data to implement in the field projects scientifically.
- To link time-dependent analytical tools and building the models by extracting real-time data.

UNIT 1 INTRODUCTION TO TIME SERIES 9 Hrs.

Characteristics of Time Series: Nature of Time Series Data, Time Series Statistical Models (White Noise, Moving signal in Noise); Measures of Dependence: Auto-correlation and Cross-Correlation, Stationary Time Series, Estimation of Correlation, Vector-Valued and Multidimensional Series.

UNIT 2 REGRESSION AND ARMA MODELS 9 Hrs.

Classical Regression in the Time Series Context, Exploratory Data Analysis, Smoothing in the Time Series Context, Auto-regressive Moving Average Models (Auto-regressive Models, Moving Average Models, ARMA Model), Difference Equations (ACF of an AR(2) Process, Sample Path of an AR(2)), Auto-correlation and Partial Autocorrelation Functions, Forecasting – Prediction for an AR(2), PACF of an AR(2), The Innovations Algorithm, Prediction for an MA(1), Forecasting ARMA Processes, Back casting an ARMA(1; 1).

UNIT 3 ARIMA AND GARCH MODELS 9 Hrs.

Integrated Models for Non stationary Data, Building ARIMA Models, Multiplicative Seasonal ARIMA Models, GARCH model.

UNIT 4 SPECTURAL ANALYSIS AND FILTERING 9 Hrs.

Cyclical Behavior and Periodicity, The Spectral Density, Periodogram and Discrete Fourier Transform, Parametric & Non-parametric Spectral Estimation, Linear Filters.

UNIT 5 STATE SPACE MODELS 9 Hrs.

Introduction, Filtering, Smoothing, and Forecasting, Maximum Likelihood Estimation; Structural Models: Signal Extraction and Forecasting, Dynamic Linear Models.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - understand the fundamental advantages and apply essential of forecasting techniques.
CO2 - apply an appropriate forecasting method in any given situation.
CO3 - apply non-stationary methods in real-time problems.
CO4 - forecast with better statistical models based on statistical data analysis.
CO5 - learn and apply variance transformation techniques.
CO6 - understand the application of frequency-domain time series analysis.

TEXT / REFERENCE BOOKS

1. T1. R. H. Shumway and D. S. Stoffer, Time Series Analysis and Its Applications with R Examples, 4th Edition, Springer Verlag, 2017.
2. J. D. Hamilton, Time Series Analysis, Princeton University Press, 2012.
3. R. S. Tsay, Analysis of Financial Time Series, 3rd Edition, Wiley Publications, 2010.
4. Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci, Introduction to Time Series Analysis and Forecasting, Second Ed., Wiley, 2016.
5. Brockwell, P. J., & Davis, R. A., Introduction to time series and forecasting, Third Ed., Springer, 2016.
6. Terence C. Mills, Applied Time Series Analysis: A Practical Guide to Modeling and Forecasting, Academic Press, 2019.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

S733BLH51	R PROGRAMMING	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- understand R for statistical programming, computation, graphics, and modeling.
- Analyze and fit some basic types of statistical models.
- Implement the required type of data analytics and data visualization tools for real world applications.

UNIT 1 INTRODUCTION TO R 12 Hrs.

History and fundamentals of R, Installation and use of R / R Studio / R Shiny, Installing R packages, R – Nuts and Bolts -Getting Data In and Out –Objects in R -Arrays, DataFrame and List -Control Structures and Functions- Loop Functions-Data Manipulation- String Operations- Matrix Operations.

Practical:

1. Implement the built-in functions in R
2. Using vectors and matrices
3. Using data frames
4. Using lists
5. Using looping constructs

UNIT 2 R DATA INTERFACES 12 Hrs.

R Data interfaces - CSV Files, XSL files, XML files, Web Data- Data Preprocessing: Missing Values, Outliers, Principle Component Analysis - Data Visualization – Charts & Graphs-Pie Chart, Bar Chart, Box plot, Histogram, Line graph, Scatter Plot.

Practical:

1. Creating custom functions.
2. Plotting Data (Dot plots, Histogram, Box plots, 3D plots, Scatter plots)

UNIT 3 STATISTICAL MODELING IN R 12 Hrs.

Statistical Modeling in R - Descriptive statistics-R Packages: Regression (MASS package) - Distribution (STATS package) - ANOVA - Time Series Analysis.

Practical:

1. Fit Statistical Models using R.

UNIT 4 MACHINE LEARNING IN R 12 Hrs.

Machine Learning in R - Classification: Decision Trees, Random Forest, SVM – Clustering: K-Means, Fuzzy - Association Rule Mining - Outlier Detection.

Practical:

1. Implementing machine learning algorithms in R.

UNIT 5 BUILDING R SHINY APPLICATION 12 Hrs.

Building R shiny Application: User Interface, Control Widgets, Dynamic Output - R Hadoop: Installation of R Hadoop - RHDFS – RMR2 - Data Analysis with R Hadoop - Case Study.

Practical:

1. Building R shiny applications

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - List motivation for learning R programming language.
CO2 - Access online resources for R and import new function packages into the R workspace.
CO3 - Import, review, manipulate and summarize data-sets in R.
CO4 - Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
CO5 - Perform appropriate statistical tests using R.
CO6 - Create and edit visualizations with R.

TEXT / REFERENCE BOOKS

1. Garrett Grolemund Hands-On Programming with R: Write Your Own Functions and Simulations, O'Reilly Media, Inc., 2014.
2. Hadley Wickham, Garrett Grolemund, R for Data Science, "O'Reilly Media, Inc.2016.
3. Christian Heumann, Michael Schomaker and Shalabh Introduction to Statistics and Data Analysis - With Exercises, Solutions and Applications in R, Springer, 2016.
4. Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet the R Software-Fundamentals of Programming and Statistical Analysis -, Springer 2013.
5. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, A Beginner's Guide to R (Use R), Springer 2009.

SCSB1631	STATISTICAL LEARNING MODELS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the principles and Concepts of statistical learning like learning model, model fitting, evaluation and Selection.
- To interpret and communicate the results of statistical Learning model effectively.
- To develop the problem-solving skills by applying the statistical Learning models to various data science tasks.

UNIT 1 INTRODUCTION TO STATISTICAL LEARNING 9 Hrs.

Fundamental concepts of Learning model - Types of data – Prediction – Inference – Bias – Variance - Trade off and Model Complexity - Model Selection: Cross Validation and its techniques - Applications and its uses.

UNIT 2 LINEAR REGRESSION 9 Hrs.

Simple Linear Regression and Multiple Linear Regression - Model Fitting - Interpretation of Coefficients - Hypothesis testing - Residual Analysis – Diagnostics - Model Evaluation - Extensions: Polynomial Regression – interactions – Transformation - Regularization Techniques: Ridge and Lasso regression.

UNIT 3 LOGISTIC REGRESSION 9 Hrs.

Binary Logistic regression - Multinomial Logistics Regression - Model Fitting - Interpretation of Coefficients - Odds Ratio - Model Evaluation: Confusion Matrix - ROC Curve - AUC Curve - Techniques for handling class imbalance and regularization.

UNIT 4 SUPPORT VECTOR MACHINE AND NAIVE BAYES 9 Hrs.

Linear SVM for classification and Regression - Non-Linear SVM using Kerner Functions - Tuning Hyper parameter and Model evaluation - Support Vector Regression (SVR) - Naïve Bayes: Bayes Theorem - Naïve Bayes Assumptions and its application in Classification - Multinominal Naïve Bayes - Gaussian Naïve Bayes - Text Classification and Spam Filtering using Naïve Bayes.

UNIT 5 MODEL EVALUATION AND INTERPRETATION 9 Hrs.

Performance Metrics: Accuracy – Precision – Recall - F1- Score – RMSE - Feature Selection Technique: Filter Methods - Wrapper Methods and Embedded Methods. Interpreting and Model Predictions: Feature importance - partial dependence plots - SHAP values.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - apply statistical learning techniques to analyze and interpret data in various Domains.
CO2 - interpret the results and insights gained from the models.
CO3 - Evaluate the performance of statistical Learning Models.
CO4 - select the appropriate evaluation metrics and compare models to make informed decisions.
CO5 - solve real world data science problems.
CO6 - identify the appropriate models, preprocess data and interpret the results to provide the practical solutions.

TEXT / REFERENCE BOOKS

1. T. Hastie, R. Tibshirani and J. Friedman ,The Elements of Statistical Learning, 2nd Edition. Springer-Verlag. 2009.
2. Fan, J., Li, R., Zhang, C.-H., and Zou, H., Statistical Foundations of Data Science. CRC Press,2020.
3. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J, An Introduction to Statistical Learning with Applications in R . Springer, New York, 2013.
4. Buehlmann, P. and van de Geer, S., Statistics for High-Dimensional Data: Methods, Theory and Applications. Springer, New York, 2011.
5. Hastie, T., Tibshirani, R., and Wainwright, M., Statistical learning with sparsity. CRC press, New York, 2015.
6. Wainwright, M. J., High-dimensional statistics: A non-asymptotic viewpoint. Cambridge University Press, 2019.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1451	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the foundational concepts of neural networks and deep learning.
- To explore various activation functions and loss functions.
- To investigate applications of CNNs and RNNs.

UNIT 1 NEURAL NETWORKS 9 Hrs.

Introduction – Artificial Neurons- Neuron structure and functionality - Types of neural networks, Hebbian Learning-Perceptron's-Limitations of Linear nets and perceptron's-Activation Functions-Error Function-Loss Function-Neural Network Architectures – Single Layer-Multi Layer-Deep Networks.

UNIT 2 SUPERVISED AND UNSUPERVISED NETWORKS 9 Hrs.

Supervised Learning Networks - Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

Unsupervised Learning Network - Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Adaptive Resonance Theory Networks.

UNIT 3 CNN and RNN 9 Hrs.

CNN: Introduction-Convolution and Pooling Layers-CNN Architectures (LeNet, AlexNet, VGG, ResNet)-Object Detection and Localization with CNNs-Image Classification and Transfer Learning-Case Studies: Image Recognition and Analysis

RNN: Introduction- Vanishing and Exploding Gradients - LSTM (Long Short-Term Memory) Networks-GRU (Gated Recurrent Unit) Networks-Applications of RNNs: Sequence Prediction, Language Modeling, and Text Generation-Time Series Analysis and Forecasting.

UNIT 4 DEEP LEARNING 9 Hrs.

Introduction to Deep Learning, Historical Trends in Deep learning- Autoencoders and Dimensionality Reduction- Generative Adversarial Networks (GANs)-Reinforcement Learning and Deep Q-Networks (DQN)-Attention Mechanisms and Transformer Networks-Transfer Learning.

UNIT 5 CASE STUDY 9 Hrs.

Implementing Neural Networks and Deep Learning Models using Frameworks like TensorFlow or PyTorch, Case Studies: Image Recognition and Analysis- Object Recognition in Video Streams-Sequence Prediction- Sentiment Analysis- Text Classification - Named Entity Recognition (using NLTK Library).

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1 - To understand the concepts of Neural Networks
CO2 - To differentiate supervised and unsupervised learning networks.
CO3 - To implement SOM and ART Algorithms.
CO4 - To differentiate various types of neural networks, feedforward, convolutional, recurrent, and deep networks
CO5 - To implement neural networks and deep learning models using various frameworks
CO6 - To choose appropriate neural network architectures and techniques for specific applications.

TEXT / REFERENCE BOOKS

1. Deep Learning: An MIT Press Book by Ian Goodfellow and Yoshua Bengio and Aaron Courville, Publisher-Alanna Maldonado, 2016.
2. Neural Networks and Deep Learning: A Textbook by Charu Aggarwal, Springer International Publishing,2023.
3. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall,2009.
4. Deep Learning for Computer Vision, Expert Techniques to Train Advanced Neural Networks using TensorFlow and Keras by Rajalingappaa Shanmugamani, Packt Publishing, 2018.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration:3 Hrs.**

PART A :	10 questions of 2 marks each; No choice	**20 Marks**
PART B :	2 questions from each unit of internal choice; each carrying 16 marks	**80 Marks**

S731BLH61	NATURAL LANGUAGE PROCESSING	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- To understand Language Modeling.
- To analyze word level and syntactic analysis and represent semantics and pragmatics.
- To gain knowledge of the linguistics concerned with the interactions and implement real world applications.

UNIT 1 OVERVIEW AND LANGUAGE MODELLING 12 Hrs.

.Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages- NLP Applications Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model, The role of Machine Learning in NLP.

Practical:

1. Create BoW preprocessing function and identify the importance of words in the BoW Model using the following three Techniques:
    - Count Vector Model.
    - Term Frequency Vector Model.
    - Term Frequency-Inverse Document Frequency (TF-IDF) Model.

UNIT 2 WORD LEVEL ANALYSIS 12 Hrs.

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

Practical :

1. Implement the following steps to generate words using Python.
    - Importing dependencies.
    - Loading and mapping data into Python.
    - Analyzing text.
    - NLP modelling and text generation.

2. Implement Decision Tree Classifier to classify ` whether a customer can be given bank loan or not based on the following classification features.
    - Age.
    - Credit balance.
    - Applicant job status.
    - Owning House or not.

UNIT 3 SYNTACTIC ANALYSIS 12 Hrs.

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

Practical :

1. Identify the given product review is fake or Genuine by applying the following classification algorithms.
    - Naïve Bayes Classifier
    - SVM classifier

UNIT 4 SEMANTICS AND PRAGMATICS 12 Hrs.

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

Practical:

1. Implement POS tagging using the following steps.
    a. Tokenize text (word tokenize).
    b. apply pos_tag to above step that is nltk.pos_tag (tokenize text).

UNIT 5 DISCOURSE ANALYSIS AND LEXICAL RESOURCES 12 Hrs.

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

Practical:

1. Building Chunker

Max. 60 Hrs.

COURSE OUTCOMES

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

CO1 - Understand NLP problems and survey the literature about that problem.
CO2 - Understand language modeling.
CO3 - Describe automated natural language generation and machine translation.
CO4 - Learn the natural language generation.
CO5 - Analyze the logic and semantics of world knowledge.
CO6 - Analyze and compare the use of different statistical approaches for different types of NLP applications.

TEXT / REFERENCE BOOKS

1. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015
2. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
3. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

S733BLH61	DATA VISULAIZATIONS	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- To develop skills for data visualization and analysis.
- To learn the various clustering techniques and predictive modeling techniques for visualization.
- To understand the concepts of visualization of volumetric data.

UNIT 1 INTRODUCTION TO DATA VISUALIZATION 12 Hrs.

Data Visualization: Basic Concepts- Data preparation- Stages in data mining - Principles of Perception, Color, Design, And Evaluation, Text Data Visualization, Interactivity and Animation, Temporal Data Visualization-Exploratory Data Analysis.

Practical:

Load the data set (excel and .csv) into the software and find the central tendency of the different columns. Study various charts and usages. Prepare the report for the same.

UNIT 2 DATA VISUALIZATION METHODS 12 Hrs.

Univariate Data Visualization: Bar Chart, Histograms, Frequency Polygram, Box Plots, Dot Plots - Bivariate Data Visualization - Multivariate Data Visualization: Histogram Matrix, Scatter plots Matrix, Multiple Box Plot and Trellis Plot -Visualizing Groups - Dynamic Techniques-Text and narrative Visualization.

Practical:

Create univariate plots Create Multivariate plots.

UNIT 3 CLUSTERING AND PREDICTIVE MODELING 12 Hrs.

Distance Measures - Agglomerative Hierarchical Clustering - Partition Based Clustering - Fuzzy Clustering. Predictive Modeling- Scatter Plots - ROC Charts - Lift Harts.

Practical:

Create scatter plots Create ROC Charts.

UNIT 4 VISUALIZATION OF VOLUMETRIC DATA 12 Hrs.

Vector Fields – Processes and Simulations – Visualizations of Maps – Geographic Information –GIS Systems – Collaborative Visualizations – Evaluating Visualizations.

Practical:

Create maps Prepare, analyze and present geographic data.

UNIT 5 VISUALIZATION TOOLS AND APPLICATIONS 12 Hrs.

Visualization Tools: Google Chart, Google Map API, MS Excel, Power Bi and D3 (Data Driven Documents)- Designing Information Dashboards-Applications: Science, Medicine and Bioinformatics.

Practical:

Create an interactive dashboard for the given data set Create the dashboard and collate the different sheets Create story board and collate the dashboards.

Max. 60 Hrs.

COURSE OUTCOMES

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

CO1 - Explain the data visualization concepts.
CO2 - Plot various data visualization graphs.
CO3 - Apply the appropriate clustering technique to the given data.
CO4 - Apply visualization techniques for various data analysis tasks.
CO5 - Use the different tools for effective data visualization.
CO6 - Designing information dashboards.

TEXT / REFERENCE BOOKS

1. Glenn J Myatt, Wayne P. Johnson, “Making sense of Data - A practical guide to data visualization, advanced mining methods and applications”, 1st Edition, Wiley, 2009.
2. Tom Soukup and Ian Davidson, “Visual Data Mining: Techniques and Tools for Data Visualization and Mining”, 1st Edition, John Wiley & Sons, 2002.
3. George and Roger L. Berger (2002), Statistical Inference, 2nd edition. Interactive Data Visualization for the Web, Scott Murray, O’Reilly (2013)
4. Hadley Wickham (Author), Garrett Grolemund (Author)R for Data Science: Visualize, Model, Transform, Tidy, and Import Data O'Reilly Media; 1 edition, 2016.
5. Michael J. Crawley, The R Book, 2nd Edition 2012.
6. Julie Steele, Noah Iliinsky, Beautiful Visualization By Publisher: O'Reilly Media, 2010.
7. Gabriel Svennerberg., Beginning Google Maps API 3, 2010.

SCSB1712	COMPUTER VISION	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Understand the basic principles of image formation and image processing algorithms.
- Emphasizes the core vision tasks of scene understanding and recognition.
- Discuss on Applications to 3D modeling, video analysis, and video surveillance, object recognition and vision-based control.

UNIT 1 INTRODUCTION 9 Hrs.

Image Processing, Computer Vision and Computer Graphics, what is Computer Vision - Low-level, Mid-level, High-level, Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

UNIT 2 IMAGE FORMATION MODELS 9 Hrs.

Monocular imaging system, Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection, • Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Photometric Stereo, Depth from Defocus, Construction of 3D model from images.

UNIT 3 IMAGE PROCESSING AND MOTION ESTIMATION 9 Hrs.

Image preprocessing, Image representations (continuous and discrete), Edge detection. Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

UNIT 4 SHAPE REPRESENTATION AND SEGMENTATION 9 Hrs.

Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, and Multiresolution analysis.

UNIT 5 OBJECT RECOGNITION AND IMAGE UNDERSTANDING 9 Hrs.

Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component Analysis, Shape priors for recognition, Pattern recognition methods, HMM, GMM and EM, Application: Surveillance – foreground background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Implement fundamental image processing techniques required for computer vision.
CO2 - Understand Image formation process.
CO3 - Extract features form images and do analysis of images.
CO4 - Generate 3D model from images.
CO5 - Understand video processing, motion computation and 3D vision and geometry.
CO6 - Develop applications using computer vision techniques.

TEXT / REFERENCE BOOKS

1. David A. Forsyth, Jean Ponce. "Computer Vision: A Modern Approach", 2nd Edition Pearson Education Limited, 2015.
2. E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision", Prentice Hall, 1998.
3. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2012.
4. E. R. Davies, Computer & Machine Vision, 4th Edition, Academic Press, 2012.
5. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010.
6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

S733BLH71	BIG DATA ANALYTICS	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- To study the tools required to manage and analyze big data.
- To explore the concept of knowledge representation and planning strategies.
- To study the learning techniques and logistic regression.

UNIT 1 INTRODUCTION TO BIG DATA 12 Hrs.

Introduction - Challenges of Conventional Systems, what is Business Analytics, Business Analytics lifecycle, Why Big Data Analytics, Defining Big data, Characteristics of Big Data (V's), Business Analytics phases: Data Acquisition- Data Cleaning - Data Manipulation - Data Analysis (Statistical and Analytical methods) to make sense of data - Data Visualization.

Practical:

1. Data Pre-Processing: Building Good Training Sets.
2. Manipulate the Twitter Data Set.

UNIT 2 HADOOP MAPREDUCE 12 Hrs.

Introduction to HADOOP - Hadoop ecosystem components and uses, Hadoop Storage: HDFS, Concept of Hadoop Distributed file system, Design of HDFS, Configuration of HDFS. Hadoop Data Types, large-scale deep belief nets with MapReduce - Functional Concept of Mappers, Functional-Concept of Reducers, MapReduce Execution Framework, Partitioners and Combiners, Hadoop Clusters component: Name Node, Secondary Name Node, and Data Node, Data flow (Anatomy of File Write and Read) - detecting malicious domain using deep Learning at scale.

Practical:

1. Hadoop – Map Reduce Programs / Commands / Job Scheduling
2. HDFS
3. YARN
4. Working with Pig and Hive

UNIT 3 KNOWLEDGE REPRESENTATION 12 Hrs.

Issues, predicate logic, resolution, representing knowledge using rules, forward versus backward reasoning, matching, control knowledge, weak slot and filler structure-semantic nets, frames, strong slot - learning curve analysis by logistic regression.

Practical:

1. Evaluating the results of machine learning algorithms
2. Implement Regression and Correlation Techniques

UNIT 4 GAME PLAYING 12 Hrs.

Mini-max search, alpha-beta cutoffs, planning system, goal stack planning, hierarchical planning, understanding as constraint satisfaction, waltz algorithm, natural language processing, syntactic processing - scalable multi-dimensional prediction model.

Practical:

1. Implement Classification Algorithms
2. Implement Naïve Bayes Classifier

UNIT 5 LEARNING 12 Hrs.

Rote learning, learning by taking advice, learning in problem solving, learning from examples, Winston's learning program, decision trees, perception, vision, speech recognition, navigation, manipulation, robot architecture - data analytics using scalable logistic regression - sentimental classification of big data using logistic regression.

Practical:

1. No SQL (using Cassandra/MongoDB/Spark)
2. Visualization (using Tableau)

Max. 60 Hrs.

COURSE OUTCOMES

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

CO1 - Understand the key issues in big data management.
CO2 - Acquire various analyzing techniques, software tools in big data analytics.
CO3 - Analyze various AI approaches to solve problems..
CO4 - Learn various classification techniques in big data analytics.
CO5 - Design models for real world scenarios.
CO6 - Design a case study and r:etrieve the patterns from large data to solve complex tasks.

TEXT / REFERENCE BOOKS

1. Stefano Ceri, Giuseppe Pelagatti Distributed Databases: Principles and Systems Paperback – Jul 2017, McGraw Hill Education, ISBN-10: 0070265119, ISBN-13: 978-0070265110, 2017.
2. Tom White “Hadoop: The Definitive Guide” Fourth Edition, O"reilly Media, 2015.
3. Prajapati, V. Big data analytics with R and Hadoop. Packt Publishing Ltd, 2011.
4. E.Rich K.Knight, and B. Nair, Artificial Intelligence, 3rdEdition, TMH, 1 July 2017.
5. RusselNorvig, Artificial Intelligence a Modern Approach, 3rd Edition, Pearson Education,2010.

SCSB2752	COMPUTER VISION LAB	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To introduce techniques of computer vision and pattern recognition.
- To understand the design issues of computer vision and object recognition systems.
- To provide the programming experience from implementing computer vision and object recognition applications.

SUGGESTED LIST OF EXPERIMENTS

1. Basic Image Handling and Processing video using OpenCV
2. Creating a 3D Model From 2D Images
3. Basic motion detection and tracking
4. Image captioning
5. Build your own Vehicle Detection Model
6. Contour based Segmentation
7. Region based Segmentation
8. Developing Social Distancing application
9. Implementation of Shape Detection using Hough Transform
10. Perform Face Detection on Your Family Photos
11. Scene Text Detection
12. Road Lane Detection in Autonomous Vehicles
13. Emotion Recognition through Facial Expressions
14. Build a People Counting Solution
15. Count Vehicles in Images and Video
16. Build a QR Code Scanner

COURSE OUTCOMES

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

CO1 - Recognize and describe both the theoretical and practical aspects of computing with images.
CO2 - Describe the foundation of image formation and image analysis. Understand the basics of 2D and 3D Computer Vision.
CO3 - Become familiar with the major technical approaches involved in computer vision.
CO4 - Gain exposures to advanced concepts leading to object categorization and segmentation in images.
CO5 - Build computer vision applications.
CO6 - Apply 3D modeling techniques to real time applications

SCSB3004	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To explore the various key distribution and management schemes.
- To learn various mechanisms for network security to protect against the threats in the networks.

UNIT 1 INTRODUCTION 9 Hrs.

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography) - Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT 2 SYMMETRIC CRYPTOGRAPHY 9 Hrs.

Mathematics of symmetric key cryptography: Algebraic structures - Modular arithmetic-Euclid‘s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- symmetric key ciphers: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

UNIT 3 PUBLIC KEY CRYPTOGRAPHY 9 Hrs.

Mathematics of asymmetric key cryptography: Primes – Primality Testing – Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm - asymmetric key ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT 4 MESSAGE AUTHENTICATION AND INTEGRITY 9 Hrs.

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNIT 5 SECURITY PRACTICE AND SYSTEM SECURITY 9 Hrs.

Electronic Mail security – PGP, S/MIME – IP security – Web Security - system security: Intruders – Malicious software – viruses – Firewalls.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2 - Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3 - Apply the different cryptographic operations of public key cryptography
CO4 - Apply the various Authentication schemes to simulate different applications.
CO5 - Understand various Security practices and System security standards
CO6 - Apply Various Techniques and approaches to build network protection.

TEXT / REFERENCE BOOKS

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.
2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd, 2018.
3. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13- 046019-2, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3526	WEB SECURITY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand and implement web technology.
- To design authentication in web applications.
- To address Web Vulnerability and cryptographic protocols.

UNIT 1 INTRODUCTION 9 Hrs.

Web Functionality Encoding Schemes Mapping the Application - Enumerating the Content and Functionality Analyzing the Application Bypassing Client-Side Controls: Transmitting Data Via the Client Capturing User Data Handling Client-Side Data Securely - Input Validation, Blacklist Validation - Whitelist Validation - The Defense-in-Depth Approach - Attack Surface Reduction Rules of Thumb.

UNIT 2 WEB APPLICATION AUTHENTICATION 9 Hrs.

Authentication Fundamentals- Two Factor and Three Factor Authentication - Password Based, Built-in HTTP, Single Sign-on Custom Authentication- Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity- Design Flaws in Authentication Mechanisms - Implementation Flaws in Authentication Mechanisms - Securing Authentication.

UNIT 3 SESSION MANAGEMENT &WEB SECURITY PRINCIPLES 9 Hrs.

Need for Session Management Weaknesses in Session Token Generation Weaknesses in Session Token Handling Securing Session Management; Access Control: Access Control Overview, Common Vulnerabilities Attacking Access Controls Securing Access Control. Origin Policy, Exceptions Cross Site Scripting, Cross Site Forgery Scripting; File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals- Classifying and Prioritizing Threats Origin Policy.

UNIT 4 WEB APPLICATION VULNERABILITY 9 Hrs.

Understanding Vulnerabilities in Traditional Client Server Application and Web Applications, Client State Manipulation, Cookie based Attacks, SQL Injection, Cross Domain Attack (XSS/ XSRF/ XSSI), HTTP Header Injection, SSL Vulnerabilities and Testing - Proper Encryption use in Web Application - Session Vulnerabilities and Testing - Cross-Site Request Forgery.

UNIT 5 CRYPTOGRAPHIC PROTOCOLS 9 Hrs.

Path Traversal - Finding and Exploiting Path Traversal Vulnerability Preventing Path Traversal Vulnerability Information Disclosure - Exploiting Error Messages Securing Compiled Applications Buffer Overflow Vulnerability Integer Vulnerability Format String Vulnerability. Path Traversal - Finding and Exploiting Path Traversal Vulnerability Preventing Path Traversal Vulnerability Information Disclosure - Exploiting Error Messages Securing Compiled Applications Buffer Overflow Vulnerability Integer Vulnerability Format String Vulnerability.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Students will be able to understand web security.
CO2 - Students would be able authenticate for different application.
CO3 - Students would be able to implement sessions and security principles.
CO4 - By Analyzing the logic of any algorithm, students would be able know various threat.
CO5 - Understand the detailed vulnerability in cryptography.
CO6 - Apply the path traversal for real time application.

TEXT / REFERENCE BOOKS

1. B. Sullivan, V. Liu, and M. Howard, “Web Application Security”, A B Guide. New York: McGraw-Hill Education, 2011.
2. D. Stuttard and M. Pinto,”2nd ed. Indianapolis”, IN: Wiley, John Sons, 2011.
3. Hanqing and L. Zhao, Web Security: A Whitehat Perspective. United Kingdom: Auerbach Publishers, 2015.
4. M. Shema and J. B. Alcover,” Hacking Web Apps: Detecting and Preventing Web Application, 2014.
5. Washington, Security Problems.”, DC, United States: Syngress Publishing, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3522	SOFTWARE DEFINED NETWORKS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming and various applications of SDN.
- To discuss and develop SDN Framework.

UNIT 1 INTRODUCTION 9 Hrs.

How SDN Works – History and Evolution of Software Defined Networking (SDN)-Separation of Control Plane and Data Plane, IETF Forces, Active Networking.

UNIT 2 OPEN FLOW AND SDN CONTROLLERS 9 Hrs.

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, and SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

UNIT 3 DATA CENTERS 9 Hrs.

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE. Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework (VMWare and others), and Mininet based examples.

UNIT 4 SDN PROGRAMMING 9 Hrs.

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT 5 SDN 9 Hrs.

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Centre Orchestration.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Analyze the evolution of software defined networks
CO2 - Express the various components of SDN and their uses
CO3 - Explain the use of SDN in the current networking scenario
CO4 - Design and develop various applications of SDN
CO5 - Understand and explain SDN Programming
CO6 - An Ability to understand the SDN Framework

TEXT / REFERENCE BOOKS

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.
3. Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013.
4. Vivek Tiwari, ―SDN and Open Flow for Beginnersǁ, Amazon Digital Services, Inc., 2013.
5. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice	**20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks	**80 Marks**

SCSB1502	DESIGN ANALYSIS AND ALGORITHM	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To analyze the performance of algorithms under various scenarios.
- To learn mathematical background for algorithm analysis & solving the recurrence equations.
- To apply the design strategies to real world problems.

UNIT 1 INTRODUCTION 9 Hrs.

Fundamentals of Algorithmic Problem Solving - Time Complexity - Space complexity with examples - Growth of Functions - Asymptotic Notations and its properties - Complexity Analysis Examples - Performance measurement - Instance Size, Test Data, Experimental setup.

UNIT 2 MATHEMATICAL FOUNDATION 9 Hrs.

Solving Recurrence Equations - Substitution Method - Recursion Tree Method - Master Method - Sorting in Linear Time - Lower bounds for Sorting: - Counting Sort - Radix Sort - Bucket Sort.

UNIT 3 BRUTE FORCE AND DIVIDE-AND-CONQUER 9 Hrs.

Brute Force: Travelling Salesman Problem - Knapsack Problem - Assignment Problem - Closest Pair and Convex Hull Problems - Divide and Conquer Approach: Binary Search - Quick Sort - Merge Sort - Strassen's Matrix Multiplication.

UNIT 4 GREEDY APPROACH AND DYNAMIC PROGRAMMING 9 Hrs.

Greedy Approach: Optimal Merge Patterns- Huffman Code - Job Sequencing problem- Tree Vertex Splitting, Dynamic Programming: – Dice Throw- Optimal Binary Search Algorithms.

UNIT 5 BACKTRACKING AND BRANCH AND BOUND 9 Hrs.

Backtracking: 8 Queens - Hamiltonian Circuit Problem - Branch and Bound - Assignment Problem - Knapsack Problem: Travelling Salesman Problem - NP Complete Problems - Clique Problem - Vertex Cover Problem.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the efficiency of an algorithm based on time and space complexity.
CO2 - Apply mathematical principles for recursive analysis.
CO3 - Construct algorithms based on brute force and divide and conquer techniques and its real time applications.
CO4 - Design Solutions using dynamic and greedy approaches for real world problems.
CO5 - Design a solution by using Branch and Bound and backtracking techniques.
CO6 - Develop a solution for any given problem by choosing appropriate algorithm.

TEXT / REFERENCE BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms David E. Goldberg, "Genetic Algorithm In Search Optimization And Machine Learning" Pearson Education India, 2013.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.

4. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3424	APPLIED STATISTICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments.
- Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 STATISTICAL DESCRIPTION, MEASURES OF CENTRAL TENDENCY AND DISPERSION 9 Hrs.

Statistical Representation of Data, Representation of data-Frequency Distribution-Graphical representation of Frequency Distribution-Histogram- Frequency Polygon-Ogive-Pie Chart-Measures of Central tendency and Dispersion-Coefficient of Variation-Coefficient of Quartile Deviation.

UNIT 2 ESTIMATION THEORY 9 Hrs.

Point Estimation – Interval Estimation – Properties of estimators – Consistency and Efficiency of an estimator. Sufficiency and completeness – Methods of Estimation: Method of Moments, Method of Maximum Likelihood estimator – Simple Problems.

UNIT 3 PARAMETRIC TEST 9 Hrs.

Basic sampling concepts-Z test for single mean, two sample means single proportions, two sample proportions-Student's t test for single mean, two sample mean-Paired t test - F test.

UNIT 4 NON PARAMETRIC TEST 9 Hrs.

Chi-square test–Goodness of fit–Independence of Attributes–Non-parametric test-Sign test-One sample run test, Kruskal Wallis H test-Mann Whitney U test-Kolmogorov Smirnov (K-S) test.

UNIT 5 MULTIVARIATE ANALYSIS 9 Hrs.

Multivariate analysis (Theory only)-Partial and Multiple Correlations-Elementary concepts of Factor analysis-Multiple Regression analysis- Discriminant analysis-Cluster analysis – Principle Component Analysis

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, the student will be able

CO1 - Formulate the statistical representation of data, data-frequency distribution.
CO2 - Evaluate consistency and efficiency of an estimator using various methods.
CO3 - Analyze the Tests based on t, Z and F distributions for mean, variance and proportion.
CO4 - Apply the various non-parametric tests.
CO5 - Develop the multiple and partial correlation methods.
CO 6 - Create models using various multivariate analysis.

TEXT / REFERENCE BOOKS

1. Hong R.V and Tanis E.A, Probability and Statistical Inference, Macmillan, (1989).
2. Ritchard A. Johnson ,Probability and Statistics for Engineers. Miller I. and Frund J.E, (2011).
3. Kossack.C.F. and Henschkee, C.I. Introduction to Statistics and Computer Programming, (2012).
4. Hogg and Craig, Introduction to Mathematical Statistics, Macmillan publication, (2007).
5. Veerarajan. T., Probability, Statistics and Random Processes, Tata McGraw-Hill, New Delhi, (2003).
6. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 9th Edition 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3713	BAYESIAN STATISTICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To Understand the principles of Bayesian Inference.
- To Specify and interpret Priori distribution, model selection and uncertainty quantification.
- To apply in real world problems and make decision based on Bayesian analytics.

UNIT 1 INTRODUCTION TO BAYESIAN STATISTICS AND INFERENCE 9 Hrs.

Bayesian Inference, Comparison with Frequency Statistics, Bayesian Probability. Bayesian Inference: Prior, likelihood, and posterior distributions, Updating Beliefs using Bayes Theorem, Maximum a posteriori estimation (MAP), Markov chain Monte Carlo (MCMC) methods- hasting and Gibbs Sampling.

UNIT 2 BAYESIAN MODELS AND ITS COMPUTATIONAL METHODS 9 Hrs.

Bayesian Linear Regression, Bayesian Logistic Regression, Hierarchical Models, Monte Carlo Methods, Importance Sampling, Sequential Monte Carlo, Variance Inference.

UNIT 3 BAYESIAN MACHINE LEARNING 9 Hrs.

Bayesian Classification Models: Naïve Bayes, Methods for Unsupervised Learning: Bayesian Non parametric Model, Gaussian Process and Dirichlet process, Bayesian Optimization, Bayesian Latent Variable, Autoencoders, Variational Autoencoders.

UNIT 4 BAYESIAN DEEP LEARNING 9 Hrs.

Bayesian Neural Network (BNN), Interpretation of Weights and Activation in BNN, Prior and Posterior Specification in BNN, Uncertainty Estimation in BNN, Model Selection in BNN, Variance Inference in DL, Monte Carlo drop out in DL.

UNIT 5 REAL WORLD APPLICATIONS AND CASE STUDIES 9 Hrs.

Real World Applications: Fraud detection, NLP, Image and Object Recognition. Case Studies: Credit Score in Finance, Disease Diagnosis in Healthcare, Demand Forecasting, Recommender System.

Max.45 Hrs.

COURSE OUTCOMES

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

CO1 - Perform Bayesian inference in both analytical and computational methods.
CO2 - apply in model section technique to choose appropriate model.
CO3 - select the appropriate prior distribution, expert opinion and data driven considerations.
CO4 - interpret and communicate the uncertainty.
CO5 - apply real world problem in various domains such as finance, Healthcare etc.,
CO6 - update on current research and advancement in Bayesian statistics.

TEXT / REFERENCE BOOKS

1. Andrew Gelman, John B.Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, and Donald B. Rubin, Bayesian Data Analysis 2001.
2. Bradley P. Carlin and Thomas A. Louis, Bayesian Methods for Data Analysis", 2010.
3. Peter M. Lee, Bayesian Statistics: An Introduction", 2000.
4. Jeff Gil, Bayesian Methods: A Social and Behavioral Sciences Approach" ,2021.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3524	GREEN COMPUTING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To analyze the Green Computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

UNIT 1 GREEN COMPUTING FUNDAMENTALS 9 Hrs.

Information Technology and Environment - Green Enterprise Characteristics- Green Vision-Green Value-Green IT Opportunity-Environmental Intelligence- Envisioning the Green Future.

UNIT 2 GREEN IT STRATEGIES AND ASSETS 9 Hrs.

Introducing Green IT Strategies-Green IT Drivers-Green IT Business Dimensions-Green IT Metrics and Measurements - Green IT Readiness and CMM-Green Assets– Buildings-Green IT Hardware- Green Data Centers- Networking and Communication Infrastructure-Managing Devices for Central Green Services.

UNIT 3 SOCIO CULTURAL A SPECTS OF GREEN IT 9 Hrs.

Green IT's Social Impact – Green Social stakeholders – Role based view of Green IT - Green User practices – Green IT Ethics and Code Conduct – Privacy and security of green Information - Green IT project - Green Virtual Communities.

UNIT 4 EMERGENT CARBON ISSUES – TECHNOLOGIES AND FUTURE 9 Hrs.

Future Carbon Landscape - Green ICT and Technology Trends - Nanotechnologies- Quantum Computing–Eco-design–New Renewable Energies-Green ICT- Business and Economic Trends.

UNIT 5 CASE STUDIES 9 Hrs.

Applying Green IT Strategies and Application to a Hospital -Packing Industry and Industrial Sector.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2 - Enhance the skill in energy saving practices in their use of hardware.
CO3 - Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4 - Understand the ways to minimize equipment disposal requirements.
CO5 - Satisfy societal requirements
CO6 - Apply green computing concepts in real time

TEXT / REFERENCE BOOKS

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies, August 2012.
3. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011.

4. John Lamb, ―The Greening of IT, Pearson Education, 2009.
5. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008.
6. Carl speshocky, ―Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
7. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency, CRC Press, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3621	DISTRIBUTED DATABASE AND INFORMATION SYSTEMS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the techniques used for data fragmentation, replication and allocation during the distributed database design process.
- To discuss the issues involved in resource management and process.
- To perceive the building blocks and design of information systems on business operations.

UNIT 1 INTRODUCTORY CONCEPTS AND DESIGN OF (DDBMS) 9 Hrs.

Data Fragmentation - Replication and allocation techniques for DDBMS - Methods for designing and implementing DDBMS - designing a distributed relational database - Architectures for DDBMS - Cluster federated - parallel databases and client server architecture - Overview of query processing.

UNIT 2 DISTRIBUTED SECURITY & DISTRIBUTED DATABASE APPLICATION TECHNOLOGIES 9 Hrs.

Overview of security techniques - Cryptographic algorithms - Digital signatures - Distributed Concurrency Control - Serializability theory - Taxonomy of concurrency control mechanisms - Distributed deadlocks – Distributed Database Recovery - Distributed Data Security - Web data management - Database Interoperability.

UNIT 3 ADVANCED IN DISTRIBUTED SYSTEMS 9 Hrs.

Authentication in distributed systems - Protocols based on symmetric cryptosystems - Protocols based on asymmetric cryptosystems - Password-based authentication - Unstructured overlays - Chord distributed hash table - Content addressable networks (CAN) - Tapestry - Some other challenges in P2P system design - Tradeoffs between table storage and route lengths - Graph structures of complex networks - Internet graphs - Generalized random graph networks.

UNIT 4 FUNDAMENTALAS OF INFORMATION SYSTEMS 9 Hrs.

Defining information – Classification of information – Presentation of information systems – Basics of Information systems – Functions of information systems – Components of Information systems- Limitations of Information systems – Information System Design.

UNIT 5 ENTERPRISE COLLOBRATION SYSTEMS 9 Hrs.

Groupware – Types of groupware – Enterprise Communication tools – Enterprise Conferencing tools – Collaborative work management tools – Information System for Business operations – transaction processing systems – functional Information Systems – Decision Support systems – Executive Information systems – Online Analytical processing.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Identify the introductory distributed database concepts and its structures.
CO2 - Produce the transaction management and query processing techniques in DDBMS..
CO3 - To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
CO4 - Critiques on each type of databases.
CO5 - Analyze, Design and present the information systems.
CO6 - Designing of decision support system and tools for Business operations.

TEXT / REFERENCE BOOKS

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education Asia, 2012.
2. Ajay D. Kshemkalyani, MukeshSinghal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2008.
3. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 2006.
4. Ralph Stair and George Reynolds, “Principles of Information Systems” Course Technology, Inc.,2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3616	SOFT COMPUTING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the knowledge about Genetic Algorithms.
- To design various types of neural networks and concepts of neuro fuzzy.
- To implement searching techniques with AI enabled Applications.

UNIT 1 NEURAL NETWORKS 9 Hrs.

Introduction to ANS - Adaline - Back propagation network - Hopfield network - Boltzman machine - Self organizing maps- Support Vector Machines-Spike Neuron Models.

UNIT 2 FUZZY LOGIC 9 Hrs.

Fuzzy sets - Fuzzy rules and fuzzy reasoning –Defuzzification- Fuzzy inference system - Mamdani fuzzy model - Sugenofuzzy model - Tsukamoto fuzzy model.

UNIT 3 NEURO FUZZY 9 Hrs.

Adaptive Neuro Fuzzy Inference System - Coactive neuro-fuzzy modelling - Classification and regression trees - Data Clustering Algorithm - Rule based structure - Neuro - Fuzzy control I - Neuro - Fuzzy control II - Fuzzy decision making.

UNIT 4 GENETIC ALGORITHM 9 Hrs.

Introduction - Implementation of GA - Reproduction - Crossover - Mutation - Coding - Fitness scaling - Application of GA.

UNIT 5 ARTIFICIAL INTELLIGENCE 9 Hrs.

Introduction - Searching techniques - First order Logic - Forward reasoning - Backward reasoning - Semantic – Frames.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Describe human intelligence and how intelligent system works.
CO2 - Apply basics of Fuzzy logic and neural networks.
CO3 - Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
CO4 - Discuss about Neuro Fuzzy concepts.
CO5 - Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self- learning situations.
CO6 - Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

TEXT / REFERENCE BOOKS

1. James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
2. S.R.Jang, C.T. Sun And E.Mizutani, “Neuro-Fuzzy And Soft Computing”, PHI / Pearson Education 2004.
3. David E. Goldberg, “Genetic Algorithm In Search Optimization And Machine Learning” Pearson Education India, 2013.

4. Stuart J. Russel, Peter Norvig, “Artificial Intelligence A Modern Approach”, 2nd Edition, Pearson Education, 2003.
5. S.N.Sivanandam , S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2nd Edition, 2011.
6. S.Rajasekaran, G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications “, PHI Learning Pvt. Ltd., 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3818	PERFORMANCE EVALUATION OF COMPUTERS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of performance Evaluation of Computers.
- To discuss appropriate evaluation techniques, performance metrics and workloads for a system field.

UNIT 1 INTRODUCTION AND BASIC CONCEPTS 9 Hrs.

Background, Performance Evaluation Viewpoints and Concepts, Goals of Performance Evaluation, Applications of Performance Evaluation, Techniques, Metrics of Performance, Workload characterization, Benchmarking.

UNIT 2 PROBABILITY THEORY REVIEW 9 Hrs.

Basic Concepts on Probability Theory, Sample Space and Events, Conditional Probability and Independence, Mean and Median use, Geometric, and Harmonic Mean, Variance, and Standard Deviation, Random Variables, Expectation and Variance, Density and Distribution Functions, Comparing Systems Using Sample Data, Regression Models.

UNIT 3 MEASUREMENT/TESTING TECHNIQUES 9 Hrs.

Event and Measurement Strategies, Event Tracing, Hardware Monitor, Software Monitors. Hybrid Monitors, Traffic Issues and Solutions, Accounting Logs. Benchmarking and Capacity Planning-Types of Benchmark Programs, Common Mistakes in Benchmarking, Example Benchmark Programs, Procedures of Capacity planning, Problems in Capacity Planning.

UNIT 4 DATA REPRESENTATION AND GAME RATIO 9 Hrs.

Guidelines for Preparing Plots, Charts Used for Data Presentation, Program Profiling, Common Mistakes in Charts Construction, Errors in Experimental Measurements.

UNIT 5 BASICS OF QUEUEING THEORY AND QUEUEING NETWORKS 9 Hrs.

Introduction, Queueing Modeling Notations, Rules for all Queues, Single-Queue, Single (M/M/ 1) System, Single-Queue, Multiple Server (M/M/c) System, Other Queues, Little's Law. Queueing Networks- Definitions, Open Queueing Networks, Closed Queueing Networks, Product-Form Queueing Networks, Case Studies.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop both analytical and simulation modelling of computer systems.
CO2 - Compute probabilities.
CO3 - Infer properties of samples and associate confidence measures to sampled statistics.
CO4 - Extract the salient features from a sample and to present them.
CO5 - Follow a scientific approach to understanding.
CO6 - Recognize why the performance of a system varies with some fact.

TEXT / REFERENCE BOOKS

1. Raj Jain, The Art of Computer System Performance Analysis: Techniques for Experimental Design Measurements Simulation and Modelling, Wiley, (2015).
2. Mor Harchol-Balter, Performance Modelling and Design of Computer Systems, Cambridge, (2013).
3. Peter G. Harrison, Naresh M. Patel, Performance Modelling of Communication Networks and Computer Architectures, Addison- Wesley Longman, (1993).
4. K. S. Trivedi, Probability and Statistics with Reliability Queueing and Computer Science Applications, Wiley, (2001).

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3027	DATA SCIENCE AND SOCIETY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the mathematical foundations required for data science.
- To provide solutions to societal challenges and gain knowledge on legal and ethical issues related to data science.
- To learn machine tools and techniques and interpret data using visualization libraries in Python.

UNIT 1 DESCRIBING RELATIONSHIPS 9 Hrs.

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression – regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean**.**

UNIT 2 INTRODUCTION TO DATA SCIENCE 9 Hrs.

Data Science: Importance, Benefits, uses and applications- Scope of Data Science- Data Science with other fields - facets of data - Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores-Data Science Process: Overview - Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.

UNIT 3 DATA SCIENCE AND SOCIETY 9 Hrs.

Data Science for Social Good**,** Importance and Benefits of Data Science in Society, Business value of Data Science, Data Types Used to Improve Public Health and Welfare, Solutions for societal challenges, Private Law and data science, Legal and ethical issues related to data science. Intellectual Property Rights, Data Science: Privacy, Security, and Protection.

UNIT 4 MACHINE LEARNING TOOLS, TECHNIQUES AND APPLICATIONS 9 Hrs.

Supervised Learning, Unsupervised Learning, Reinforcement Learning, Dimensionality Reduction, Principal Component Analysis, Classification and Regression models, Tree and Bayesian network models, Neural Networks, Testing, Evaluation and Validation of Models.

UNIT 5 DATA CLEANING, PREPARATION AND VISUALIZATION 9 Hrs.

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers-String Manipulation: Vectorized String Functions in pandas.

Data Visualization - Basic principles, ideas and tools for data visualization- Need for Visualization-Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots three-dimensional plotting - Geographic Data with Base map - Visualization with Seaborn- Examples of exciting projects- Case studies.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Explain the basic terms of Linear Algebra and Statistical Inference.
CO2 - Describe the Data Science process and how its components interact.
CO3 - Apply Machine Learning algorithms to solve real-world problems.
CO4 - Analyze the performance of parameters that can be achieved by applying different models.
CO5 - Apply visualization Libraries in Python to interpret and explore data
CO6 - Apply the python libraries used for data analysis.

TEXT / REFERENCE BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I).
2. Gilbert Strang, Wellesley, Introduction to Linear Algebra - -Cambridge Press, 5 th Edition.2016.
3. Douglas Montgomery, Applied Statistics and Probability for Engineers –.2016.
4. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
5. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V).
6. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.
7. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.
8. Anne Beaulieu, Sabina Leonelli , “Data and Society, A Critical Introduction”, Sage Publishing, 2021.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3037	COMPREHENSIVE LINUX	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Emphasize the significance of server management concepts of an Enterprise Linux Operating System.
- Comprehend the importance of GIT repositories and Security vulnerability in Linux Operating System.
- Explore the cloud level services offered by Linux Operating System.

UNIT 1 STARTING WITH LINUX 9 Hrs.

Understanding What Linux Is- Exploring Linux History- Understanding How Linux Differs from Other Operating Systems- Understanding How Linux Distributions Emerged- Creating the perfect Linux desktop- Lab: Ubuntu OS installation on Virtual machines- Starting with the Ubuntu Desktop Live image- Handling Ubuntu desktop- Using the Desktop- Understanding the importance of threads- Lab: Understanding Basic Desktop Application Management in Ubuntu- Adding an application launcher- Managing files and folders-- Installing and managing additional software- Lab: Knowing Advanced Desktop Application management in Ubuntu- Using tools- Lab: Configuring basic tools in Ubuntu OS- Working with shell in UBUNTU- Lab1: Getting aquatinted with different types of shell- LAB3: Basic Shell Management.

UNIT 2 GAINING ACCESS 9 Hrs.

Using the root User Account-Exploring Administrative Commands, Configuration Files, and Log Files- Using Other Administrative Accounts- Lab: Implementing privilege escalation- Using Shell Variables, expanding arithmetic expressions Expanding variables- Lab: Manipulating environmental/shell variable- Getting Information about Commands and help- Managing user accounts in UBUNTU- User Management- Lab: Managing Regular User Account-Group Management-Lab: Group Management- Moving around the file system UBUNTU- File Management- Lab: Working with basic file system- Permission Management- Lab: Working with file system permissions- Access Control Lists- Lab: Managing User and Group Permissions- Working with text files in UBUNTU.

UNIT 3 FILE MANIPULATIONS 9 Hrs.

Editing text files from shell prompt- Managing running processes- Process Management-Lab: Monitoring process activity- Writing simple shell scripts- Understanding Shell Scripts- Lab: Implementing basic shell programs- Understanding server managing in RHEL- Install the server RHEL- Lab: RHEL 8 Installation on Virtual Machine- Initial Server Configuration- Lab: Configuring and Verifying the Initial Server Settings-Remote Server Management- Lab: RHEL Remote Server management-Initial Server Configuration- Lab: Configuring and Verifying the Initial Server settings-Remote Server Management-

Lab: RHEL Remote Server management- File Transfer-Lab: Securely coping files between Servers-Log Management- Lab1: Monitoring system logs-Lab2: Recording and Managing Server Logs- Server Monitoring- Lab: Monitoring the Health of the server.

UNIT 4 MANAGING SOFTWARE IN RHEL 9 Hrs.

System software and package management- administering networking in RHEL- Lab: Examining and Configuring Network in Server- Starting and stopping services in RHEL- Lab: Managing Daemons and Services in RHEL- Configuring a web server in RHEL- Lab: Managing a Basic Webserver- Advance Webserver Management-Lab: Advance Webserver Management- Secure Webserver-Lab: Securing the Webserver Effectively- Managing disks and file systems- Lab: Making Simple Partitions- Logical Volume Management- Lab: Implementing Logical Volume Management (LVM)- Configuring Samba

server in RHEL- Lab: Deploy a samba share directory- Configuring an NFS file server in RHEL- Lab: Deploy a NFS Share export- Introducing container technology.

UNIT 5 INTRODUCTION TO GIT 9 Hrs.

Getting started with GIT and its architecture- Lab: Installing and Configuring GIT in RHEL- Remote Repositories - Lab: Exploring GIT Remote Repository- BRANCHING AND MERGING- Lab: Learning and Exploring Branches in GIT- Configuring databases in LINUX- Lab: MariaDB (MYSQL) installation and configuration in RHEL-MongoDB-Lab: MongoDB installation and configuration in RHEL-UNDERSTANDING LINUX SECURITY OS- Lab: Kali Linux Installation on Virtual Machine- Description about Different Security tools in Kali Linux-Hands-on Study on Nmap and Metasploit-Lab: Gathering information using NMAP-Metasploit-Lab: Vulnerability Management using Metasploit- Knowing LINUX as cloud workhorse- Amazon Web Service (AWS- Lab: Operating and Managing an EC2 Instance in AWS Cloud.

COURSE OUTCOMES

CO1 - Identify the need of a Linux Operating System.
CO2 - Know the process management functions of a Linux Operating System.
CO3 - Understand the need of users and group management in Linux Operating System.
CO4 - Find the significance of GIT repositories and databases.
CO5 - Recognize the essentials of file management part of a Linux Operating System.
CO6 - Gain an insight of the importance of cloud and security in Linux Operating System.

TEXT / REFERENCE BOOKS

1. "Comprehensive Linux for All ", Red Hat, 1st Edition, 2023.
2. Petersen, Richard, "Red Hat Enterprise Linux 8: Desktops and Administration, Surfing Turtle Press, 2019.
3. Colino, Miguel Perez, " Red Hat Enterprise Linux 8 Administration: Master Linux Administration Skills ", Packt Publishing, 2021.
4. Günther, Tobias, "Learn Version Control with Git: A Step-By-step Course for the Complete Beginner, Independently Published, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 Exam Duration: 3 Hrs.

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3812	STREAM ANALYTICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To optimize business decisions and create competitive advantage with Big Data analytics.
- To explore the fundamental concepts of stream data analytics.
- To analyze and implement various tools for real world applications.

UNIT 1 OVERVIEW 9 Hrs.

Static data analytics vs stream analytics –- Batch data processing architecture – Stream data processing architecture –stream Analytics Scenarios – How Stream Analytics work – Advantages of Stream Analytics – Disadvantages of Stream Analytics – Importance of Real time Analytics.

UNIT 2 STREAMING DATA SOURCES 9 Hrs.

Real-time or streaming data sources - Issues in Online Sources: Models and Issues in Data Stream Systems, Challenges, opportunities, and pitfalls in online social networks - Reliance on Online Data : Trust, credibility, and reputations - Online social Media and Policing: Behavior, Perceptions - Challenges Information Privacy: Information privacy disclosure, revelation and its effects in OSM and online social networks, Phishing in Online Social Media & Identifying fraudulent entities in online social networks.

UNIT 3 STREAM PROCESSING MODEL 9 Hrs.

Data stream -Data Stream processing model Algorithms for streams-Filtering Data Streams-Moment-The Alon-Matias-Szegedy (AMS) Algorithm for Second Moments-Counting item sets-Sliding Windows-The Datar-Gionis-Indyk Motwani Algorithm (DGIM)- Real Time application.

UNIT 4 LINEAR ALGEBRA 9 Hrs.

Matrix, Representation, Examples of matrix Data, Vectors, examples, Representation, Matrix Addition, Scalar Multiplication, Matrix Multiplication properties, Matrix Vector Multiplication, Matrix Multiplication, Inverse and Transpose, Applications of Matrix operations on Real Time Data, Parallel Matrix Multiplication, Dimensionality Reduction by Principal Component Analysis and Eigen Values, Eigen Vectors.

UNIT 5 STREAM PROCESSING TOOLS 9 Hrs.

Apache tools: Kafka, Spark, Storm, and Flink - Amazon tools: Kinesis Streams, Kinesis, and Firehose - Real-time analytical instruments: Azure Stream Analytics – Google Cloud Stream Analytics - Oracle Stream Analytics - real-world streaming analytics use cases: Uber: Chaperone auditing tool - Netflix: Keystone Streaming Platform and Mantis

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Have insights about stream data analytics and the importance of it.
CO2 - Understand the importance of privacy while using the Data.
CO3 - Exploit required algorithm needed for analytics.
CO4 - Understand the underlying mathematics which is essential for analytics.
CO5 - Analyze various tools and instruments for stream analytics.
CO6 - Apply stream processing models and tools to real life societal needs

TEXT / REFERENCE BOOKS

1. Anindita Basak, Krishna Venkataraman, Ryan Murphy, Manpreet Singh, Stream Analytics with Microsoft Azure, Packt Publishing Limited, 2017.
2. Andrew G. Psaltis, Streaming Data Understanding the real-time pipeline, Manning Publications, 2017.Life 3.0, Max Tegmark, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3616	SYSTEM MODELING AND SIMULATION	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To discuss about modeling, design, simulation, planning, verification and validation.
- To understand various mathematical models, validate and verify the simulated model.
- To implement case studies invoking simulation programming techniques.

UNIT 1 INTRODUCTION TO SIMULATION 9 Hrs.

Introduction – Simulation Terminologies - Application areas - Model Classification - Types of Simulation - Steps in a Simulation study - Concepts in Discrete Event Simulation - Simulation Examples.

UNIT 2 MATHEMATICAL MODELS 9 Hrs.

Statistical Models - Concepts – Discrete Distribution- Continuous Distribution - Poisson Process- Empirical Distributions - Queuing Models – Characteristics- Notation– Queuing Systems - Markovian Models - Generation of Pseudo Random numbers- Properties of random numbers - Techniques for generating random numbers - Testing random number generators - -Generating Random-Variates- Inverse Transform technique– Acceptance- Rejection technique - Composition & Convolution Method.

UNIT 3 ANALYSIS OF SIMULATION DATA 9 Hrs.

Input Modeling - Data collection – Assessing sample independence- -Hypothesizing distribution family with data –Parameter Estimation – Goodness-of-fit tests –Selecting input models in absence of data – Output analysis for a Single system – Terminating Simulations– Steady state simulations.

UNIT 4 VERIFICATION AND VALIDATION 9 Hrs.

Model Building – Verification of Simulation Models – Calibration and Validation of Models – Validation of Model Assumptions – Validating Input – Output Transformations

UNIT 5 SIMULATION OF COMPUTER SYSTEMS AND CASE STUDIES9 Hrs.

Simulation Tools – Model Input – High level computer system simulation – CPU Memory Simulation – Comparison of systems via simulation– Simulation Programming techniques – Development of Simulation models.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the components of continuous and discrete systems and simulate them.
CO2 - Explain the need for the development process to initiate the real problem.
CO3 - Simulate any discrete system using queuing systems.
CO4 - Implement numerical algorithm to meet simple requirements.
CO5 - Discuss the simulation methods and select the suitable technique on the problems
CO6 - Model any system from different fields.

TEXT / REFERENCE BOOKS

1. Jerry Banks and John Carson, “Discrete Event System Simulation”, Fourth Edition, PHI, 2005.
2. Geoffrey Gordon, “System Simulation”, Second Edition, PHI, 2006 .
3. Frank L. Severance, “System Modeling and Simulation”, Wiley, 2001.
4. Averill M. Law and W. David Kelton, “Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
5. Sheldon M. Ross: Introduction to Probability Models 7th Edition, Academic Press, 2002.

6. Donald E. Knuth: The Art of Computer Programming - Volume 2: Semi Numerical Algorithms, 2nd Edition, PEARSON Education, Reading MA, USA 2000.
7. Sheldon M. Ross: Simulation 3rd Edition, Academic Press, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3516	INTELLIGENT DATA ANALYTICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To acquire knowledge on Data science and its Foundations.
- To explore about the various data process and evaluation methods.
- To understand distinct analysis tools and practice ethical decision and actions.

UNIT 1 INTRODUCTION 9 Hrs.

Business Intelligence vs Data Science vs Big Data Analytics; Data warehouse; Data mining: Introduction, Knowledge discovery from data, Data pre-processing, Classification, Clustering, Prediction, Association, Recent applications of data mining methods; Decision support system (DSS) and its components; Business intelligence.

UNIT 2 PREDICTIVE ANALYTICS 9 Hrs.

Predictive Analytics- Simple linear regression- Multiple linear regressions - Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

UNIT 3 WEB ANALYTICS 9 Hrs.

Web Analytics – Basics – Traditional Ways – Expectations – Data Collection – Clickstream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing – Outcome's data – Competitive data – Search Engine Data.

UNIT 4 PRIVACY AND DATA SCIENCE 9 Hrs.

Significance of Privacy and Ethics in Application of Data Science; Reidentification of Anonymous People with Big Data, Privacy- preserving data mining algorithms, Data Partitioning and Privacy; Recent research in privacy-preserving data mining.

UNIT 5 ETHICS AND RECENT TRENDS 9 Hrs.

Data and Business Insights- Data Science Engineering: - Need of Data Science - Ethics – Doing good data science – Natural Language Processing – Machine Learning Model- Valuing Data privacy – Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1 - Analyze the key issues in data science and its associated applications in intelligent business and scientific computing.

CO2 - Comprehend and apply the methods of big data analytics.

CO3 - comprehend the fundamentals of privacy-preservation in data analytics.

CO4 - Analyze privacy issues on data science applications.

CO5 - Think through the ethics incorporating privacy, data sharing and decision-making.

CO6 - Build interactive dashboards for Business.

TEXT / REFERENCE BOOKS

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016.
2. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018.
3. Introduction to Machine Learning with Python-A Guide for Data Scientists, by Andreas C. Mueller, Sarah Guido, O'Reilly; 1st edition, October 2016.
4. Getting Started with Tableau 2019.2 (Second Edition), Tristan Guillevin, Packt Publishing; 2nd edition June, 2019.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A: 10 questions of 2 marks each –No choice **20 Marks**
PART B: 2 questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SCSB3028	MATHEMATICAL TOOL FOR DATA SCIENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the mathematical foundations required for data science.
- To provide a comprehensive calculus background required to solve standard Data Science problems.
- To identify and implement standard solutions to generic problems of optimization and integration encountered in Data Science.

UNIT 1 LINEAR ALGEBRA 9 Hrs.

Linear Algebra: Vector and matrices –vectors 2D, 3D and ND- matrices - Systems of Linear Equations- Null Space- Rank- Eigen values and Eigen Vectors, Singular Value Decomposition. Matrix operations: addition, multiplication, transpose, inverse - Principal component analysis (PCA).

UNIT 2 PROBABILITY AND STATISTICS 9 Hrs.

Basic probability- conditional probability- Bayes' rule - Application to web search algorithms: Link analysis and Page Rank- Descriptive Statistics- Covariance and Covariance matrix- Normal Distribution- Probability density function - Hypothesis Testing. Differentiation and integration - Optimization techniques (gradient descent, Newton's method) - Multivariable calculus - Partial derivatives - Probability and Statistics: - Probability theory and distributions - Bayesian statistics.

UNIT 3 FOUNDATIONS OF STATISTICAL LEARNING 9 Hrs.

Basics of statistical learning: models- regression- curse of dimensionality- overfitting- Optimization and convexity -Gradient descent - Newton's method.

UNIT 4 CLASSIFICATION & CLUSTERING 9 Hrs.

Linear discriminant analysis - Logistic Regression - Support vector machines (SVM)- Similarity and distances- Nearest neighbor methods - Decision tress and application of entropy- Clustering Algorithm.

UNIT 5 OPTIMIZATION & INFORMATION THEORY 9 Hrs.

Linear programming - Nonlinear programming - convex optimization - Entropy - Mutual information - Compression algorithms- Numerical Methods - Root finding algorithms - Interpolation and extrapolation - Numerical integration.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Explain the rationale behind second order conditions to optimize smooth multivariate functions in the constrained and unconstrained scenarios.
CO2 - Describe, choose and apply numerical methods to optimize smooth and rough functions.
CO3 - Apply essential calculus concepts relevant to Data Science.
CO4 - Apply and use both analytical and numerical methods for integration.
CO5 - Implement some of these techniques in one of the standard programming languages.
CO6 - Analyze and correlate the results to the solutions.

TEXT / REFERENCE BOOKS

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong "Mathematics for Machine Learning", 2020.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville "Deep Learning", 2017.
3. Christopher M. Bishop "Pattern Recognition and Machine Learning", 2008.
4. David C. Lay, Steven R. Lay, and Judi J. McDonald "Linear Algebra and Its Applications, 2018.
5. Joseph K. Blitzstein and Jessica Hwang "Introduction to Probability", 2019.
6. William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery "Numerical Recipes: The Art of Scientific Computing, 2007.
7. Stephen Boyd and Lieven Vandenberghe "Convex Optimization, 2014.
8. Gilbert Strang, Wellesley-Cambridge, Introduction to Linear Algebra - Press, 5 th Edition, 2016.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3812	DATA SCIENCE FOR IOT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Understand the Fundamentals of IoT concepts, principles and its architecture.
- Analyze and extract insights from IoT generated by interconnected devices.
- Gain awareness of the privacy and address security concerns in IoT devices

UNIT 1 INTRODUCTION TO IoT 9 Hrs.

Definition and Characteristics of IoT, Role of data science in IoT, Architecture and Components, Applications, Types of data generated by IoT devices, challenges in collecting and managing IoT data, Data Acquisition Techniques, Protocols used in IoT systems.

UNIT 2 DATA STORAGE AND MANAGEMENT 9 Hrs.

Processing and Filtering Techniques for IoT data, Data Storage options: Relational Database-ACID Properties, Non-Relational Database- MongoDB, Cloud based object Storage- Amazon S3, Edge Vs Fog computing data processing.

UNIT 3 IoT PLATFORMS 9 Hrs.

Introduction to IoT platforms- Role in IoT Deployments- AWS IoT, Microsoft Azure IoT, Google Cloud IoT, Comparison, Features IoT Platforms and Capabilities of IoT platforms.

UNIT 4 IoT DATA SECURITY AND PRIVACY 9 Hrs.

Security challenges in IoT, Data Privacy Techniques for IoT data, Anonymization techniques, Protecting IoT devices from cyber security threats, Secure Protocols: TLS, SSH, Encryption Algorithms: AES, RSA.

UNIT 5 IoT ETHICAL CONSIDERATIONS AND APPLICATIONS IN DATA SCIENCE 9 Hrs.

Ethical Implications of IoT data collection and usage, Privacy concerns and data governance in IoT applications, Smart Cities, Industrial IoT, Health care, Agriculture.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Apply data science methodologies to analyze and extract insights from IoT data generated by interconnected devices.
CO2 - Develop skills in handling and managing large volumes of IoT data.
CO3 - Understand the ethical considerations in data science and IoT.
CO4 - Apply edge analytics and real-time processing techniques in IoT systems.
CO5 - Implement applications in IoT platforms Azure, Google Cloud, AWS.
CO6 - Evaluate and select appropriate data science techniques and tools for specific IoT use cases and datasets.

TEXT / REFERENCE BOOKS

1. Ajaykumar Kannan, Yogesh Simmhan, and Naganand Yadati Data Science for IoT: Build . Smart IoT Solutions Using Machine Learning and Deep Learning Approaches, 2018.
2. Minerva Singh. IoT Analytics: Data Science, Data Engineering and Machine Learning for IoT", 2017.
3. Madhusudhanan B. Data Science and Internet of Things: Data Analytics and Insights", 2020.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3422	KNOWLEDGE MANAGEMENT SYSTEMS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand knowledge management system life cycle.
- To acquire the Knowledge Capturing Techniques and learn coding tools and procedures.
- To explore the faster decision making with knowledge transfer systems.

UNIT 1 KNOWLEDGE MANAGEMENT 9 Hrs.

KM Myths–KM Lifecycle–Understanding Knowledge–Knowledge, intelligence –Experience – Common Sense – Cognition and KM – Types of Knowledge – Expert Knowledge – Human Thinking and Learning.

UNIT 2 KNOWLEDGE MANAGEMENT SYSTEM LIFE CYCLE 9 Hrs.

Challenges in Building Systems– Conventional Vs. KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge Creation and Transformation. Knowledge Architecture.

UNIT 3 CAPTURING KNOWLEDGE 9 Hrs.

Evaluating the Expert – Developing a Relationship with Experts – Fuzzy Reasoning and the Quality of Knowledge – Knowledge Capturing Techniques, Brain Storming – Protocol Analysis – ConsensusDecisionMaking–RepertoryGrid-ConceptMapping–Blackboarding.

UNIT 4 KNOWLEDGE CODIFICATION 9 Hrs.

Modes of Knowledge Conversion – Codification Tools and Procedures –Knowledge Developer's Skill Sets – System Testing and Deployment – Knowledge Testing –Approaches to Logical Testing, User Acceptance Testing–KM System Deployment Issues – User Training–Post implementation.

UNIT 5 KNOWLEDGE TRANSFER AND SHARING 9 Hrs.

Transfer Methods – Role of the Internet – Knowledge Transfer in e-world – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Workers.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Understand the concept of knowledge and its types.
CO2 - Analyze the challenges in building Knowledge Management systems.
CO3 - Develop knowledge management capturing techniques.
CO4 - Test the coding tools for knowledge management systems.
CO5 - Understand the architecture and development of knowledge systems.
CO6 - Develop models with Knowledge management system tools.

TEXT / REFERENCE BOOKS

1. Elias. M. Award & Hassan M. Ghaziri “Knowledge Management” Pearson Education, 2000.
2. Guus Schreiber, Hans Akkermans, Anjo Anjewierden, RobertdeHoog, NigelShadbolt, Walter Vande Veldeand BobWielinga, “Knowledge Engineering and Management”, Universities Press, 2001.
3. C.W.Holsapple, “Hand books on Knowledge Management”, International Handbooks on Information Systems, Vol1 ,2003.
4. Becerra Fernandez,I., Sabherwal,R.: Knowledge Management: Systems and Processes. M.E.SharpeInc., 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3816	QUANTUM COMPUTING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand Quantum state transformation and classical computation versions.
- To know various Quantum Computation Algorithms and proficient on the concepts of robust computation and error correction.
- To have knowledge on Generalizations and advanced quantum computation algorithms.

UNIT 1 QUANTUM BUILDING BLOCKS-I 9 Hrs.

Introduction - Single Qubit Quantum Systems - Multiple Qubit Systems.

UNIT 2 QUANTUM BULDING BLOCKS-2 9 Hrs.

Measurement of multiple Qubit Systems-Quantum State Transformations-Quantum versions of Classical Computations.

UNIT 3 BASIC ALGEBRA FOR QUANTUM ALGORITHMS. 9 Hrs.

Introduction-Numbers and Strings-Basic linear algebra-Boolean Functions, Quantum, Bits and Feasibility, Special Matrices, Tricks.

UNIT 4 QUANTUM ALGORITHMS 9 Hrs.

Phil's algorithm, Deutsch's algorithm, Jozsa Algorithms, Simon's Algorithm, Shor's Algorithms, Grover's Algorithms.

UNIT 5 ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATIONS 9 Hrs.

Quantum subsystems and properties of entangled states-Quantum error correction-Fault tolerance and Robust.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - An ability to identify, analyze Quantum Building Blocks.
CO2 - Know Quantum state transformations.
CO3 - Identify the advantages and limitations of some Quantum Computation Algorithms.
CO4 - Apply advanced quantum computation algorithms.
CO5 - Proficiency on the concepts of robust computation and error correction.
CO6 - Analyze error correction mechanisms.

TEXT / REFERENCE BOOKS

1. Eleanor Rieffel and Wolfgang Polak, Quantum Computing A Gentle Introduction, The MIT Press Cambridge, Massachusetts London, 2011.
2. Richard J. Lipton, Kenneth W. Regan, Quantum Algorithms Via Linear Algebra, The MIT Press Cambridge, Massachusetts London, England, 2014.
3. Goong Chen, David A. Church, Berthold-Georg Englert, Carsten Henkel, Bernd Rohwedder, Marlan O. Scully, M. Suhail Zubairy, Hapman and Hall/CRC, Quantum Computing Devices: Principles, Designs and Analysis, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**

PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3825	PARALLEL SYSTEM PROGRAMMING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Parallel computing and Algorithm Design.
- To learn the two popular parallel programming paradigms (Message passing and Shared memory).
- To understand major performance issues for parallel systems and programs.

UNIT 1 INTRODUCTION TO PARALLEL COMPUTING 9 Hrs.

Motivating Parallelism- Scope of Parallel Computing- The von Neumann architecture- Modifications to the von Neumann Model- Parallel Hardware: SIMD systems- MIMD systems-Interconnection networks-Cache coherence – shared memory versus distributed memory. Parallel Software: Caveats-Coordinating the processes/threads- Shred- Distributed-memory -Programming hybrid systems.

UNIT 2 PRINCIPLES OF PARALLEL ALGORITHM DESIGN 9 Hrs.

Preliminaries - Decomposition techniques - Characteristics of tasks and interactions - Mapping techniques for load balancing - Methods for containing interaction overheads - Parallel algorithm models – Basic communication operations.

UNIT 3 PROGRAMMING USING MESSAGE PASSING 9 Hrs.

Principles of Message-Passing Programming - The Building Blocks: Send and Receive Operations-MPI: the Message Passing Interface - Topologies and Embedding Section - Overlapping Communication with Computation - Collective Communication and Computation Operations - Groups and Communicators.

UNIT 4 PROGRAMMING USING SHARED MEMORY 9 Hrs.

Shared Memory Programming with threads: Processes, Threads, and threads - Matrix-Vector Multiplication – Critical Sections- Producer- Consumer Synchronization and Semaphores- Barriers and Condition Variables-Read-Write Locks-Caches, Cache Coherence, and False Sharing.

Shared Memory Programming with OpenMP: Compiling and running OpenMP programs-The Trapezoidal Rule-Scope of Variables-The Reduction Clause-The parallel for Directive-Scheduling Loops-Producers and Consumers.

UNIT 5 PROGRAMMING PARALLEL PROCESSORS 9 Hrs.

Introduction to CUDA – CUDA Threads – CUDA Memories – Performance and Floating-Point Considerations-Parallel Programming and Computational Thinking- Introduction to OPENCL.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Recognize various parallel computing requirement
CO2 - Describe the basic concepts of Shared Memory and Message Passing
CO3 - Design solutions for Parallel Processor based Architecture
CO4 - Analyze a problem, design a solution, and test their implementation
CO5 - Design and implement large scale machine as well as applications
CO6 - Implement parallel computing to a variety of applications in Mathematics and Engineering

TEXT / REFERENCE BOOKS

1. Ananth Grama and George Karypis, “Introduction to parallel computing”, Addison-Wesley 2009.
2. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
4. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3038	ADVANCED COMPUTER NETWORKS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To introduce topics related to computer networks and internet operating system.
- To gain knowledge on how to develop products networks.
- To introduce basics of Linux kernel architecture where the network devices based on and its interface with various products developed for these devices.

UNIT 1 LINUX KERNEL 9 Hrs.

Linux Kernel Programming Introduction, Static & Dynamic Linking of modules, User vs Kernel Space, Systems Calls, Make file for modules. Shell Programming.

Programming Assignments**:** Writing shell programs related to shell function, line count of several files and wait and sleep commands.

UNIT 2 NETWORK DRIVERS 9 Hrs.

Introduction to Network Device Drivers. Character Device Driver Development, Process Synchronization and Scheduling, Interrupt Handling, Kernel Debugging.

Programming Assignments: Writing a kernel program, compiling and inserting and removing a module in kernel.

UNIT 3 eBPF - NETWORKING AND SECURITY 9 Hrs.

Basics of eBPF, Packet Filters basics, Introduction to Kernel's Traffic Control Layer, Use of C for eBPF Programming Assignments: Writing a simple C program to interact with eBPF using syscall.

UNIT 4 NETWORK OPERATING SYSTEM PROGRAMMING MODULE 9 Hrs.

Introduction to Internet Operating System. Basics of Cisco IOS XR7, Cisco IOS and Open Network Linux. Socket basics, basics of Client-Server Architecture, Basics of Overlay Networking and Virtualization, Content Delivery Networks and Network Automation.

Programming Assignments: Writing a simple C program on SNULL (Simple Network Utility for Loading Localities). Writing a C program to capture network packets.

UNIT 5 NETWORK DRIVERS TESTING 9 Hrs.

Socket basics, Loopback Addressing, Structure of SNULL (Simple Network Utility for Loading Localities).

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the fundamentals of Linux Kernel architecture.
CO2 - Develop products related to advanced computer networks.
CO3 - Deep knowledge in structure of networks to the protocol content and usage level.
CO4 - Understand the internet operating systems running in routers and switches.
CO5 - Develop products run in these networks and network devices.
CO6 - Test and maintain the products run in the networks.

TEXT / REFERNCE BOOKS

1. Robert Love, Linux Kernel Development, 3 rd edition, Addison Wesley, ISBN: 8131758184, 2010.
2. Andrew S.Tanenbaum, David J.Wetherall, Computer Networks, 5th Edition, Pearson, ISBN-13: 978-0-13-212695-3, 2011.
3. M J Bach, The Design of the Unix Operating System, 1st edition, Pearson Education, ISBN: 9332549575, 2015.
4. J Cooperstein, Writing Linux Device Drivers - A Guide with Exercises, Createspace, ISBN: 1448672384, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3029	MACHINE LEARNING FOR DATA SCIENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To comprehend the concepts of pattern recognition.
- To study the various methodologies of object detection in pattern recognition.
- To implement classifiers with region and boundary analysis.

UNIT 1 OBJECT RECOGNITION 9 Hrs.

Introduction to pattern recognition, types of images, regular pattern, irregular pattern, fuzzy methods. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non-supervised learning methods.

UNIT 2 OBJECT DETECTION METHODOLOGIES 9 Hrs.

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

UNIT 3 FUZZY LOGIC IN PATTERN ANALYSIS 9 Hrs.

Explanation of how fuzzy approach can be applied to pattern recognition, classificatory analysis preprocessing, feature detection and primitive extraction, adaptive classification of fuzzy grammar. Algorithms for pattern recognition, neural network fundamentals, approaches for pattern recognition.

UNIT 4 IMAGE EXTRACTION CONCEPTS 9 Hrs.

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

UNIT 5 BOUNDARY ANALYSIS AND MATCHING 9 Hrs.

Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach, Ordered- structural matching, View class matching, Models database organization. Knowledge Based Vision: Knowledge representation, Control strategies, Information integration, Application.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Study the concepts of pattern recognition.
CO2 - Understand the various methodologies of object detection in pattern recognition.
CO3 - Acquire knowledge about pattern classifications.
CO4 - Study and compare the various classifiers like fuzzy and neural classifiers.
CO5 - Predict the concept of image extraction through computer vision and boundary analysis.
CO6 - Analyze different region and boundary and different matching techniques.

TEXT / REFERENCE BOOKS

1. Dude, Hart and Stock, "Pattern Classification", John Wiley and Sons, 2nd Edition, 2001.
2. Gose, Johnsonbaugh and Jost, "Pattern Recognition and Image Analysis", Prentice Hall, Har/Dsk Edition, 1996.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision", 2007.
4. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol.I, II, Addison-Wesley, 1993.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3034	PREDICITVE ANALYSIS AND SEGMENTATION	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To learn about fundamentals of data modelling techniques.
- To gain knowledge about regression and classification.
- To understand more about additive and boosting methods.

UNIT 1 INTRODUCTION TO PREDICTIVE ANALYTICS 9 Hrs.

Need for Analytics - Introduction to Tools and Environment - Application of Modeling in Business - Databases & Types of data and variables - Data Modeling Techniques - Missing imputations etc. Need for Business Modeling - Regression — Concepts -Blue Property-Assumptions-Least Square Estimation - Variable Rationalization - Model Building.

UNIT 2 REGRESSION AND CLASSIFICATION 9 Hrs.

Model Theory - Model fit Statistics - Model Conclusion - Analytics applications to various Business Domains etc. Regression Vs Segmentation-Supervised and Unsupervised Learning, Tree Building - Regression, Classification - Over fitting, Pruning and complexity -Multiple Decision Trees etc.

UNIT 3 MODEL ASSESSMENT AND SELECTION 9 Hrs.

Bias, Variance and model complexity - Bias-variance trade off - Optimism of the training error rate - Estimate of In-sample prediction error - Effective number of parameters - Bayesian approach and BIC - Cross- validation - Boot strap methods, conditional or expected test error.

UNIT 4 ADDITIVE MODELS AND TREES 9 Hrs.

Additive Models, Trees, and Related Methods: Generalized additive models – Tree Based Methods – PRIM: Bump Hunting - Multivariate Adaptive Regression Splines - Hierarchical Mixture of Experts - Boosting methods- Numerical Optimization via gradient boosting – Right-sized trees for Boosting - Regularization.

UNIT 5 SURVIVAL ANALYSIS 9 Hrs.

Survival Analysis: Survival Analysis Measurements - Kaplan Meier Analysis - Parametric Survival Analysis - Proportional Hazards Regression - Extensions of Survival Analysis Models - Evaluating Survival Analysis Models.

Max: 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the concept of data analytics and modeling.
CO2 - Analyze data and build models.
CO3 - Apply the models and predict error.
CO4 - Create additive models and Trees.
CO5 - Understand the usage of survival analysis.
CO6 - Apply the prediction model for decision making for a given set of problems.

TEXT / REFERENCE BOOKS

1. Gareth James Daniela Witten Trevor Hastie Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, 2021.
2. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020 2nd Edition.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.
4. Dean Abbott ,Applied Predictive Analytics: Principles and Techniques for The Professional Data Analyst, 2014.
5. Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics For Dummies, 2nd Edition, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3035	COGNITIVE SCIENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To learn basics and develop skills in Cognitive Science with focus on acquisition.
- To understand the mind and intelligence that connects psychology, artificial intelligence, neuroscience and linguistics.
- To gain knowledge about the methods and tools to solve real time issues.

UNIT 1 INTRODUCTION TO COGNITIVE SCIENCE 9 Hrs.

The Cognitive view –Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science.

UNIT 2 COGNITIVE PSYCHOLOGY 9 Hrs.

Cognitive Psychology: The Architecture of the Mind - The Nature of Cognitive Psychology- A Global View of the Cognitive Architecture- Propositional Representation- Schematic Representation- Cognitive Processes, Working Memory, and Attention- The Acquisition of Skill- The Connectionist Approach to Cognitive Architecture.

UNIT 3 LANGUAGE ACQUISITION, SEMANTICS AND PROCESSING MODEL 9 Hrs.

Milestones in Acquisition – Theoretical Perspectives- Semantics and Cognitive Science – Meaning and Entailment –Reference – Sense – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind- Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes.

UNIT 4 INTEGRATION CHALLENGE 9 Hrs.

Cognitive Science and Integration Challenge: Levels of explanation, Local integration, Tackling the Integration Challenge: Intertheoretical reduction, Marr's tri-level hypothesis, Models of mental architecture.

UNIT 5 NEURAL NETWORK MODELS OF COGNITIVE PROCESSES 9 Hrs.

Language learning, Neural network models of children's physical reasoning, Challenges and Applications, the massive modularity hypothesis, Hybrid architectures, Tools: Working with Concept Maps.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identify and describe the relationships between Cognitive Systems with different Cognitive Disciplines.

CO2 - Enumerate and Characterize various neuroscientific theories of cognitive systems.

CO3 - Analyze and describe the representation, and use of knowledge by individual minds, brains, and machines.

CO4 - Perform neuroscience and linguistics based real time experiments.

CO5 - Implement the knowledge of neuro science with its advanced techniques towards the cognitive field.

CO6 - Formulate hypothesis and computational models to draw conclusions that embeds cognitive psychology and neuroscience.

TEXT/REFERENCE BOOKS

1. Jose Luis Bermudez, “Cognitive Science: An Introduction to the Science of the Mind”, Cambridge University Press, New York, 2014.
2. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, Second Edition, MIT press, 1995.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3573	DATA PRIVACY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To learn about session management and configuration management.
- To understand the concept of Authentication and Authorization.
- To learn about the cryptography Techniques.

UNIT 1 DATA SECURITY THREATS, DATA SECURITY THREAT TECHNIQUES 9 Hrs.

Introduction, Data breach, Identity Theft, Bank fraud Physical or Digital theft (Stolen laptops, removable media, impersonation), Malware, SQL Injection, Dumpster diving, Phishing and Pre-Phishing, Denial of Service attack, Social Engineering.

UNIT 2 COUNTER MEASURES AND DATABASE ACTIVITY MONITORING TOOL 9 Hrs.

Introduction, Disk Encryption, Hardware based mechanisms for protecting data, Backups, Data masking, Data Erasure, and Database Activity Monitoring using IBM Infosphere Guardium.

UNIT 3 APPLICATION SECURITY, AUTHENTICATION AND AUTHORIZATION 9 Hrs.

Input Validation - Buffer overflow; cross-site scripting; SQL injection; canonicalization, Sensitive information Access sensitive data in storage; network eavesdropping; data tampering Network eavesdropping; Brute force attack; dictionary attacks; cookie replay; credential theft Elevation of privilege; disclosure of confidential data; data tampering; luring attacks; Phishing.

UNIT 4 CONFIGURATION MANAGEMENT AND SESSION MANAGEMENT 9 Hrs.

Unauthorized access to administration interfaces; unauthorized access to configuration stores; retrieval of clear text configuration data; lack of individual accountability; over privileged process and service accounts. Hijacking; session replay; man in the middle.

UNIT 5 CRYPTOGRAPHY AND ITS PARAMETER 9 Hrs.

Cryptography Poor key generation or key management; weak or custom encryption Parameter manipulation; Query string manipulation; form field manipulation; cookie manipulation; HTTP header manipulation, Exception management Information disclosure; denial of service Auditing and logging, User denies performing an operation; attacker exploits an application without trace; attacker covers his or her tracks, Countermeasures Introduction to code analysis using IBM Rational App_Scan.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Work on data security threats and it's techniques.
CO2 - Work on DB activity monitoring tools.
CO3 - Have an overview of code analysis.
CO4 - Demonstrate hijacking Techniques.
CO5 - Implement different cryptography key generation Techniques.
CO6 - Discuss the auditing and logging.

TEXT / REFERENCE BOOKS

1. T Data security & Application Security, IBM ICE Publication, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice	**20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks	**80 Marks**

SCSB3838	INFORMATION RETRIEVAL	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To evaluate the performance of IR system.
- To explore information sharing on semantic web.
- To implement various applications of Information Retrieval giving emphasis to multimedia and distributed IR - web search.

UNIT 1 INTRODUCTION TO INFORMATION RETRIEVAL 9 Hrs.

Basic Concepts of IR - Data Retrieval & Information Retrieval - IR system block diagram. Automatic Text Analysis: Luhn's ideas - Conflation Algorithm - Indexing and Index Term Weighing - Probabilistic Indexing - Automatic Classification. Measures of Association - Different Matching Coefficient - Classification Methods - Cluster Hypothesis - Clustering Algorithms - Single Pass Algorithm - Single Link Algorithm - Rocchio's Algorithm.

UNIT 2 STORAGE AND VECTOR MODEL SEARCHING STRATEGIES 9 Hrs.

Storage: Inverted file - Suffix trees & suffix arrays - Signature Files - Scatter storage or hash addressing - Clustered files.IR Models: Basic concepts - Boolean Model - Vector Model Searching strategies: Boolean Search - Serial search - cluster based retrieval - Query languages - Types of queries - Patterns matching - structural queries.

UNIT 3 ONTOLOGY 9 Hrs.

Performance evaluation: Precision and recall - alternative measures Ontology: Ontology based information sharing - Ontology languages for semantic web - Ontology creation.

UNIT 4 DISTRIBUTED AND MULTIMEDIA IR 9 Hrs.

Distributed IR: Introduction - Collection Partitioning - Source Selection - Query Processing - web issues. Multimedia IR: Introduction - Data Modeling - Query languages - Generic multimedia indexing approach - One dimensional time series - two-dimensional color images - Automatic feature extraction.

UNIT 5 WEB DATA MINING AND RECOMMENDATION 9 Hrs.

Searching the Web: Challenges - Characterizing the Web - Search Engines - Browsing - Meta-searchers - Web crawlers - Meta-crawler - Web data mining - Finding needle in the Haystack - Searching using Hyperlinks - Page ranking algorithms. Collaborative Filtering and Content Based Recommendation of Documents and Products - Information Extraction and Integration: Extracting Data from Text. Semantic Web - Collecting and Integrating Specialized Information on the web.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basic concepts and techniques in information retrieval.
CO2 - Appreciate the importance of data structures for efficient retrieval of information.
CO3 - Evaluate the performance of an IR system.
CO4 - Understand the issues involved in providing an IR service in a distributed system.
CO5 - Develop projects in frontier web search.
CO6 - Do research in web search and information extraction

TEXT / REFERENCE BOOKS

1. Yates & Neto - "Modern Information Retrieval" - Pearson Education - ISBN 81-297-0274-6, 2000.
2. C.J. Rijsbergen - "Information Retrieval" - (www.dcs.gla.ac.uk), 2004.
3. Heiner Stuckenschmidt - Frank van Harmelen - “Information Sharing on the Semantic Web” - Springer International, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3839	COMPUTATIONAL METHODS AND TECHNIQUES	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To know the scope of computational intelligence and the type of agents.
- To study the perceptron and learning techniques.
- To explore the concept of fuzzy rules, steps in genetic algorithm, ant colony and swarm optimization algorithm.

UNIT 1 ARTIFICIAL INTELLIGENCE 9 Hrs.

Introduction - Foundations of AI - History of AI - Intelligent agent - Types of agents - Structure - Problem solving agents - Uninformed and informed search strategies.

UNIT 2 ARTIFICIAL NEURAL NETWORKS 9 Hrs.

Basic concepts - Single layer Perceptron - Multilayer Perceptron - Supervised and Unsupervised learning -deep learning algorithms - Back propagation Networks - Performance Issues.

UNIT 3 FUZZY SYSTEMS 9 Hrs.

Introduction to fuzzy- Fuzzy sets and Fuzzy reasoning - Fuzzy matrices - Fuzzy Functions - Decomposition - Fuzzy rules and inferences - Fuzzy decision making - deep learning architecture for Fuzzy logic.

UNIT 4 GENETIC ALGORITHMS 9 Hrs.

Survival of the fittest - Fitness Computations - Cross over- Mutation - Reproduction - Rank method - Rank Space method.

UNIT 5 SWARM INTELLIGENCE 9 Hrs.

`Particle swarm optimization - Global PSO- Local PSO - Ant colony Optimization - Simple Ant Colony - Ant System - feature selection of logistic regression. - Max, Min Ant System.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Understand the search strategies in AI.
CO2 - Analyse the performance issues of learning techniques.
CO3 - Solve a problem with fuzzy logic and rule out the inferences.
CO4 - Optimize continuous and discrete functions and multi objective problems.
CO5 - Design models for real world scenarios.
CO6 - Design a case study and optimize the results.

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, " Artificial Intelligence A Modern Approach ", 3rd Edition, Pearson Education, 2010.
2. Elain Rich & Kevin Knight, Artificial Intelligence, Third edition, Tata McGraw Hill,2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 Exam Duration: 3 Hrs.

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3871	DATA SECURITY SERVICES	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To gain knowledge about corrupted systems.
- To develop an understanding of security policies and familiarize with cyber security landscapes.
- Analyze and evaluate the cyber security needs and address software vulnerabilities.

UNIT 1 DATA SECURITY CONTROLS 9 Hrs.

Factor Authentication, Adware, Botnet, Denial-of-Service Attack, Encryption, Exploit. Firewall, Hacker, Authentication, Access control, Backups & recovery, Encryption, Data masking, Tokenization, Deletions & erasure, data resiliency, data masking.

UNIT 2 DATA SECURITY STRATEGIES 9 Hrs.

Physical security of servers and user devices, Access management and controls, Application security and patching, Network and endpoint security monitoring and controls, Data security and BYOD, The insurance. Network security threats: spyware, search, denial of services, misrepresentation, playback and session hijacking, redirections, viruses, Trojan horses, and worms, defining a security policy.

UNIT 3 INFORMATION SYSTEM SECURITY AND PROTECTION OBJECTIVES 9 Hrs.

The development of the Internet and the role of the intranet and extranet. Control at the level of management: data control, data administration, security control, control at the management level, Software control.

UNIT 4 ACCESS CONTROL 9 Hrs.

Cryptography, identification numbers, digital signatures, security and credit card business. Input control, communication control, control of data processing, database control, output data control. Legal aspects of the security of information systems. Information systems security planning: security management information system, the reconstruction plan information system, ISO / IEC 17799: 2000.

UNIT 5 TOOLS FOR PROTECTING THE NETWORK AND OPERATING SYSTEM SERVICES. 9 Hrs.

Protecting DNS, NIS, Proxy, e-mail, WWW, FTP, NFS. Firewalls, NAT. Security services and procedures: one-time passwords, token cards / soft tokens, TACACS +, RADIUS, KERBEROS, VPN, IKE / IPsec. Secure data storage. Monitoring the performance of the system. Intrusion detection systems. Reestablishment of network systems. Top data security tools Vault, FortiGate-Generation Firewall, Egnyte, Incydr, Cloud guard SaaS, Google Apigee Sense, Xplenty and Data Security.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Gain the core companies in Data security.
CO2 - Analyze and resolve security issues in networks.
CO3 - Understand to secure an IT infrastructure.
CO4 - Design, develop, test and evaluate secure software.
CO5 - Develop policies and procedures to manage security risks.
CO6 - Design a Security system.

TEXT / REFERENCE BOOKS

1. Alan Calder,Steve Watkins ",IT Governance: An International Guide to Data Security and ISO27001/ISO27002", Sixth Edition, 2021.
2. Mostapha Zbakh, Mohammed Essaaidi, Pierre Manneback, Chunming Rong, "Cloud Computing and Big Data: Technologies, Applications and Security", 2019.
3. Sherri Davidoff, "Data Breaches: Crisis and Opportunity", Addison-Wesley Professional, 2020.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3840	DECISION SUPPORT SYSTEM	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamentals of Decision Support System.
- To explore various types of Decision Support Systems and learn about decision-making models and methods.
- To develop critical thinking and problem-solving skills.

UNIT 1 DECISION SUPPORT SYSTEM 9 Hrs.

Decision concept – Steps – Decision Support System – Components – Characteristics – Clarifications and applications.

UNIT 2 MODEL MANAGEMENT 9 Hrs.

Modeling process – types of models – optimization simulation – Heuristic Descriptive – Predictive model case – modeling languages – model directory – model.

UNIT 3 DATA MANAGEMENT SYSTEM 9 Hrs.

Data Base – Sources of Data – Data directory – Data Structure and Data Base Language – Query Facility Data Management System – DBMS as DSS development Tool.

UNIT 4 DIALOG MANAGEMENT 9 Hrs.

User Interface – Graphics – Multimedia – visual interactive modeling – natural language processing – speech recognition and understanding – Issues in user interface.

UNIT 5 DEVELOPMENT OF DECISION SUPPORT SYSTEM 9 Hrs.

Development process – software and hardware – data Acquisition – Model acquisition – dialog development – Integration – Testing and validation–Training and Implementation.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Understand the concept and components of Decision Support Systems.
CO2 - Identify decision-making problems and opportunities.
CO3 - Design and develop Decision support system solutions.
CO4 - Evaluate and assess Decision support system effectiveness.
CO5 - Analyze and solve real-world decision problems.
CO6 - Develop skills in data management and integration for decision support.

TEXT / REFERENCE BOOKS

1. Sharda, R., Delen, D., & Turban, E., Decision Support and Business Intelligence Systems. Pearson Education, 2020.
2. Power, D. J., & Sharda, R. Decision Support Systems: Concepts and Resources for Managers. Business Expert Press, 2018.
3. Turban, E., & Aronson, J. E., Decision Support Systems and Intelligent Systems. Pearson Education, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**

PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB1311	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of intelligent agents and learn search strategies.
- To learn the concepts of knowledge representation and reasoning in AI.
- To explore various applications of AI.

UNIT 1 INTRODUCTION AND PROBLEM SOLVING 9 Hrs.

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search – Bidirectional search – Searching with partial Information.

UNIT 2 INFORMED SEARCH AND GAME PLAYING 9 Hrs.

Informed search – Strategies – A* Heuristic function – Hill Climbing – Simulated Annealing – Constraint Specification problem – Local Search in continuous space – Genetic algorithm – Optimal decisions in games - Pruning - Imperfect decisions –Alpha-Beta pruning – Games that include an element of chance.

UNIT 3 KNOWLEDGE AND REASONING 9 Hrs.

Knowledge based agent – The Wumpus world environment – Propositional logic – Inference rules – First-order logic – Syntax and semantics – Situation calculus – Building a knowledge base – Electronic circuit domain – Ontological Engineering – Forward and backward chaining – Resolution – Truth maintenance system-Mental Events and Mental Objects.

UNIT 4 ACTING LOGICALLY 9 Hrs.

Planning – Representation of planning – Partial order planning –Planning and acting in real world – Acting under uncertainty – Bayes's rules – Semantics of Belief networks – Inference in Belief networks – Making simple decisions – Making complex decisions.

UNIT 5 APPLICATIONS 9 Hrs.

AI applications – Language Models – Information Retrieval- Information Extraction –Fields of Natural Language Processing, Chatbots and its types, Artificially Intelligent Chatbots, Introduction to Chatbot Applications (Retrieval based- Conversation based)-Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - An ability to identify, analyze the search algorithm for the AI problems.
CO2 - Represent a problem using first order logic.
CO3 - Provide the knowledge based agent to solve the problem.
CO4 - Understand the Informed search strategies.
CO5 - Apply the baye's rule to solve the problem for societal concern.
CO6 - Design user centric applications that use AI concepts

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rdEdition, Pearson Education, 2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.

3. M. Tim Jones, “Artificial Intelligence: A Systems Approach (Computer Science)”, Jones and Bartlett Publishers, Inc., First Edition, 2008.
4. Artificial Intelligence: Foundations of Computational Agents, 2nd Edition,David L. Poole and Alan K. Mackworth,2010.
5. Introduction to Artificial Intelligence, Ertel, Wolfgang, Ist Edition ,2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3841	BUSINESS INTELLIGENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To acquire knowledge on Business Intelligence and its Applications.
- To explore about the issues and challenges in Business Intelligence.
- To understand the various issues and challenges in Business Intelligence.

UNIT 1 BUSINESS INTELLEIGENCE INTRODUCTION 9 Hrs.

Introduction-Data, Information Vs Intelligence- Components of Business Intelligence Architecture-Business Query and Reporting-A Business view of the Data-Production Reporting-Online Analytical Processing (OLAP)-Microsoft Office-dashboards-Scorecards-Analytic Applications-Measures of BI Success -Emerging BI Modules.

UNIT 2 BUSINESS INTELLIGENCE LIFE CYCLE 9 Hrs.

Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC)Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Strategy, Objectives and Deliverables, Transformation Roadmap, Building a transformation roadmap, BI Development Stages and Steps, Parallel Development Tracks, BI Framework.

UNIT 3 BUSINESS INTELLIGENCE USER MODEL 9 Hrs.

Introduction, Evolution of Business Intelligence, Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques, OLAP Applications, Applying the OLAP to Data Warehousing, Benefits of using OLAP, Dashboard, Advanced/Emerging BI Technologies, Future of Business Intelligence.

UNIT 4 BUSINESS INTELLIGENCE ISSUES AND CHALLENGES 9 Hrs.

Critical Challenges for Business Intelligence success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, Availability of Skilled Team Members, Business Intelligence Application Development methodology, Planning the BI Projects, Business Analysis and Data Standardization, Affect of Dirty Data on Business profitability, Importance of Meta-Data, Silver Bullet Syndrome, Customer Pain Points, Creating Cost Effective Enterprise friendly BI solution.

UNIT 5 BUSINESS INTELLIGENCE STRATEGY AND ROAD MAP 9 Hrs.

Planning to implement a Business Intelligence Solution, Understand Limitations of Business Intelligence, Business Intelligence Usage, Best use of Business Intelligence, The Advantages of BI with Sales- BI used for the rescue, Organization Culture, Managing Total Cost of Ownership for Business Intelligence, Total Cost of Ownership and Business Intelligence, Managing the TCO of the Business Intelligence, Factors that Affect Total Cost of Ownership.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the foundations, definitions and capabilities of Data Analytics and Business Intelligence.

CO2 - Demonstrate stages and steps in the Life Cycle of Business Intelligence.

CO3 - Analyze the intelligent issues and critical challenges in Business Intelligence.

CO4 - Apply distinct methodologies to create Cost effective and Enterprise friendly Solutions on BI Projects.

CO5 - Design and Deploy BI solutions to real world problems.

CO6 - Compare and identify the factors that influence Total Cost of Ownership for Business Intelligence.

TEXT / REFERENCE BOOKS

1. Grossmann W, Rinderle-Ma," Fundamental of Business Intelligence", Springer, 2015.
2. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision support and Business Intelligence Systems", Pearson-9th Edition, 2011.
3. Cindi Howson, "Successful Business Intelligence", Tata McGraw-Hill Edition,2008.
4. Foster Provost and Tom Fawcett, "Data Science for Business: What you need to know about data mining and data-analytic thinking",2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**

PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3451	REINFORCEMENT AND ENSEMBLE LEARNING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts and techniques of reinforcement and ensemble learning.
- To explore the core challenges and opportunities in the field of deep reinforcement learning
- Implement different reinforcement learning algorithms and ensembling model techniques.

UNIT 1 INTRODUCTION 9 Hrs.

Introduction to Deep Reinforcement Learning – Approximate Solution Methods: On-policy Prediction with Approximation – On- policy Control with Approximation – Off-policy Methods with Approximation.

UNIT 2 NEURAL NETWORK: RECURRENT AND RECURSIVE 9 Hrs.

Tree Recursive Neural Networks and Constituency Parsing, Recurrent neural networks for language modeling Dynamic Neural Networks for Question Answering.

UNIT 3 NEURAL NETWORK: CNN 9 Hrs.

Convolutional neural networks, recurrent and recursive neural networks, backpropagation algorithms, regularization and optimization techniques for training such networks.

UNIT 4 REINFORCEMENT LEARNING ALGORITHMS 9 Hrs.

dynamic programming, Monte Carlo, and temporal difference, and function approximation reinforcement learning algorithms, and applications of deep and reinforcement learning – Value function methods, Deep RL with Q-learning – Multi agent RL - Eligibility Traces – Policy Gradient Methods – Applications and Case studies.

UNIT 5 ENSEMBLING MODELS 9 Hrs.

Ensemble models –Applications of Ensembling– Types and techniques of Ensembling–Graphical models –Evaluation measures–Hypothesis testing –Cross-validation and Hyperparameter optimization– Bootstrapping and Uncertainties.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - To understand the basics of deep reinforcement learning.
CO2 - To implement in code deep reinforcement learning algorithms.
CO3 - To explore the core challenges and opportunities in the field of deep reinforcement learning.
CO4 - Implement and apply Monte Carlo reinforcement learning algorithms.
CO5 - Implement and apply temporal-difference reinforcement learning algorithms.
CO6 - Understand the ensembling models and its techniques.

TEXT/REFERENCE BOOKS

1. Deb, K.: Optimization for Engineering Design, PHI, India, 2000.
2. Deb, K.: Multi-objective Optimization using Evolutionary Algorithms, Wiley, Uk, 2001.
3. Relf, Christopher G., "Image acquisition and processing with LabVIEW", CRC press,2003.
4. Aner ozdemi R, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley & Sons, 2021.
5. Chris Solomon, Toby Breckon,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley & Sons,2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice	**20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks	**80 Marks**

SCSB3036	MALWARE DATA SCIENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamental concepts and techniques of malware analysis and reverse engineering.
- To learn how to identify, classify, and analyze different types of malwares, including viruses, worms, Trojans, ransomware, and others.
- To observe the anatomy of malware, including how it spreads, hides, and communicates with command-and-control servers.

UNIT 1 INTRODUCTION AND STATIC ANALYSIS 9 Hrs.

Introduction: Malware Analysis – Why Malware Analysis - Types of Malware Analysis – Static Analysis: Determining the File Type – Fingerprinting the Malware-Extracting, Strings – Determining File Obfuscation – Comparing and Classifying the Malware.

UNIT 2 DYNAMIC ANALYSIS 9 Hrs.

Dynamic Analysis: System and Network monitoring – Dynamic analysis monitoring Tools-Dynamic Analysis Steps – Tools –Analyzing a Malware Executable – Dynamic Link Library (DLL) Analysis.

UNIT 3 MALWARE FUNCTIONALITIES AND PERSISTENCE 9 Hrs.

Functionalities – Downloader – Dropper – Keylogger – Malware Command Control – PowerShell-based Execution. Persistence Methods: Scheduled Tasks – Startup Folder – Winlogon Registry Entries – Image File Execution Options – COM hijacking – Service.

UNIT 4 NETWORK CONSTRUCTION AND ANALYSIS 9 Hrs.

Identifying Attack Campaigns using Malware Networks: Nodes and Edges, Bipartite Networks, Visualizing Malware Networks – Building Malware Networks and shared Image Relationship Network, Shared Code Analysis: Preparing Samples, Using the Jaccard Index and Using Similarity Matrices for Evaluation.

UNIT 5 DETECTION, EVALUATION AND VISUALIZATION 9 Hrs.

Understanding ML Based Malware Detectors: Steps for Building ML based Detector, Types of Machines Learning Algorithms, Evaluating Malware Detection Systems, Building ML Detectors: Decision Tree based Detector, Basic Visualization.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the concepts and techniques of Malwares for system security.
CO2 - Compare the techniques of Static and Dynamic methods to identify and classify Malwares.
CO3 - Analyze the functionalities of malware by applying persistence methods.
CO4 - Construct the network and Formulate the analysis test to detect malware for securing community applications.
CO5 - Simulate a detector system and evaluate to scale better along with visualization.
CO6 - Design a case study for any Network with a malware detector and compare the performance of the various classifiers and algorithms.

TEXT/ REFERENCE BOOKS

1. Monnappa K A, “Learning Malware Analysis”, Packet Publisher, 2018.
2. Joshua Saxe and Hillary Sanders, “Malware Data Science – Attack Detection and Attribution”, September 2018, ISBN-13: 978-1-59327-859-5.
3. Michael Ligh, Steven Stair. Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code”, Wiley Publishing Inc., 2011.
4. Alexey Kleymenov and Amr Thabet, “Mastering Malware Analysis: The complete malware analyst's guide to combating malicious software, APT, cybercrime, and IoT attacks”, Packt Publisher, 2019.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3842	REGRESSION ANALYSIS AND PREDICITVE MODELIING	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Develop an understanding of regression analysis and model building.
- Provide the ability to develop relationship between variables.
- Investigate possible diagnostics in regression techniques for real life problems.

UNIT 1 SIMPLE REGRESSION ANALYSIS 9 Hrs.

Introduction to a linear and nonlinear model. Ordinary Least Square methods. Simple linear regression model, using simple regression to describe a linear relationship. Fitting a linear trend to time series data, validating simple regression model using t, F and p test. Developing confidence interval. Precautions in interpreting regression results.

UNIT 2 MULTIPLE REGRESSION ANALYSIS 9 Hrs.

Concept of Multiple regression model to describe a linear relationship, Assessing the fit of the regression line, inferences from multiple regression analysis, problem of overfitting of a model, comparing two regression model, prediction with multiple regression equation.

UNIT 3 TRANSFORMATION TECHNIQUES 9 Hrs.

Introduction, variance stabilizing transformations variables, transformations to linearize the model, BoxCox methods, transformations on the repressors Generalized and weighted least squares, Some practical applications.

UNIT 4 MULTICOLLINEARITY 9 Hrs.

Introduction, sources of multicollinearity, effects of multicollinearity. Multicollinearity diagnostics: examination of correlation matrix, variance Inflation factors (VIF), Eigen system analysis of X1X. Methods of dealing with Multicollinearity: collecting additional data, model, re-specification, and ridge regression.

UNIT 5 MODEL BUILDING AND NONLINEAR REGRESSION 9 Hrs.

Variable selection, model building, model misspecification. Model validation techniques: Analysis of model coefficients, and predicted values, data splitting method. Nonlinear regression model, nonlinear least squares, transformation to linear model, parameter estimation in nonlinear system, statistical inference in nonlinear regression.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - develop in-depth understanding of the linear and nonlinear regression model.
CO2 - demonstrate the knowledge of regression modeling and model selection techniques.
CO3 - examine the relationships between dependent and independent variables.
CO4 - estimate the parameters and fit a model.
CO5 - investigate possible diagnostics in regression modeling and analysis.
CO6 - validate the model using hypothesis testing and confidence interval approach.

TEXT / REFERENCE BOOKS

1. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Introduction to Linear Regression Analysis, Third Ed., Wiley India Pvt. Ltd., 2016.
2. Norman R. Draper, Harry Smith; Applied Regression Analysis, WILEY India Pvt. Ltd. New Delhi; Third Edition, 2015.
3. Johnson, R A., Wichern, D. W., Applied Multivariate Statistical Analysis, Sixth Ed., PHI learning Pvt., Ltd., 2013.
4. Iain Pardoe, Applied Regression Modeling, John Wiley and Sons, Inc, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3711	ML TOOLS AND TECHNIQUES	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand input preprocessing and combining output from different methods.
- To provide data analytic skills by processing and visualization of data.
- To understand performance improvement techniques and develop engineering applications using tool.

UNIT 1 INTRODUCTION TO DATA MINING AND MACHINE LANGUAGE 9 Hrs.

Fielded Applications, The Data Mining Process, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics, Input: concepts, instances, attributes, Preparing the Input, output: Knowledge representation- Tables, Linear Models, Trees, Rules, Instance-Based Representation, Clusters.

UNIT 2 KNOWLEDGE REPRESENTATION 9 Hrs.

Tables, Linear Models, Trees, Rules, Instance-Based Representation, Clusters, and Algorithms: the basic Methods, Inferring Rudimentary Rules, Simple Probabilistic Modeling, Divide-and-Conquer: Constructing Decision Trees, Covering Algorithms: Constructing Rules, Mining Association Rules, Linear Models, Instance-Based Learning, Clustering, Multi-Instance Learning.

UNIT 3 CREDIBILITY 9 Hrs.

Training and Testing, Predicting Performance, Cross-Validation, Other Estimates, Hyperparameter Selection, Comparing Data Mining Schemes Predicting Probabilities, Counting the Cost, Evaluating Numeric Prediction, The Minimum Description Length Principle, Applying MDL to Clustering, using a Validation Set for Model Selection.

UNIT 4 TREES AND RULES 9 Hrs.

Decision Trees, Classification Rules, Association Rules, extending instance-based and linear models-Instance-Based Learning, Extending Linear Models, Numeric Prediction with Local Linear Models, WEKA Implementations. Data transformations- Attribute Selection, Discretizing Numeric Attributes, Projections, Sampling, Cleansing, Transforming Multiple Classes to Binary Ones, Calibrating Class Probabilities.

UNIT 5 MACHINE LEARNING TOOLS 9 Hrs.

Knime, Accord. net, Scikit- Learn, Tensor Flow, Pytorch, Rapid Miner, Google Cloud Auto ML, Jupyter Notebook, Apache Mahout, Azure Machine Learning studio, MLLIB, Orange3, IBM Watson, Pylearn2.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Able to represent the knowledge using tools.
CO2 - Compare different output models and their applications.
CO3 - analyze on how to improve the performance.
CO4 - To implement the models using WEKA tools.
CO5 - To work with learning workbench and links to algorithm implementations in the software.
CO6 - Design and implement applications-based Tools.

TEXT / REFERENCE BOOKS

1. Chris Pal, Ian Witten, Eibe Frank, Mark Hall, Data mining machine learning tools and techniques, 2011.
2. Peter, flach, Machine Learning the art of science and algorithms that make sense of data,2012.
3. Oliver Theobald, Machine Learning for Absolute Beginners,2021.
4. Christoph Molnar,Interpretable Machine Learning, ,2020.
5. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank, Mark A. Hall, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SCSB3843	CLOUD SERVICE MANAGEMENT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Introduce Cloud Service Management terminology, definition & concepts.
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud service to solve real world problems.

UNIT 1 CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9 Hrs.

Cloud Ecosystem –The Essential Characteristics – Basics of Information Technology Service Management and Cloud Service Management - Service Perspectives - Cloud Service Models – Cloud Service Deployment Models.

UNIT 2 CLOUD SERVICES STRATEGY 9 Hrs.

Cloud Strategy Fundamentals - Cloud Strategy Management Framework - Cloud Policy - Key Driver for Adoption - Risk Management - IT Capacity and Utilization - Demand and Capacity matching - Demand Queueing - Change Management - Cloud Service Architecture.

UNIT 3 CLOUD SERVICE MANAGEMENT 9 Hrs.

Cloud Service Reference Model - Cloud Service Lifecycle - Basics of Cloud Service Design – Dealing with Legacy Systems and Services - Benchmarking of Cloud Services - Cloud Service Capacity Planning - Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management.

UNIT 4 CLOUD SERVICE ECONOMICS 9 Hrs.

Pricing models for Cloud Services – Freemium - Pay Per Reservation - Pay per User –Subscription based Charging - Procurement of Cloud- based Services - Capex vs OpenX Shift - Cloud service Charging - Cloud Cost Models.

UNIT 5 CLOUD SERVICE GOVERNANCE & VALUE 9 Hrs.

IT Governance Definition –Cloud Governance Definition – Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
CO2 - Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.
CO3 - Select appropriate structures for designing, deploying and running cloud-based services in a business environment
CO4 - Analyse the benefits and drive the adoption of cloud based services.
CO5 - Perform cloud based governance and value services.
CO6 - Solve the real world problems using Cloud services and technologies.

TEXT / REFERENCE BOOKS

1. Enamul Haque, Cloud Service Management and Governance: Smart Service Management in Cloud Era, Enel Publications, 2020.
2. Thomas Erl, Ricardo Puttini, Zaigham Mohammad Cloud Computing: Concepts, Technology & Architecture by,2013.
3. Thomas Erl, Robert Cope, Amin Naserpour Patterns, Cloud Computing Design, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A : 10 questions of 2 marks each –No choice **20 Marks**
PART B : 2 questions from each unit of internal choice; each carrying16 marks **80 Marks**

SBAB4001	PRINCIPLES AND PRACTICES OF MANAGEMENT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To analyze how the field of Management has evolved and its significant contributions.
- To analyse and apply the critical role of managers in modern organizational settings.
- To illustrate and evaluate the importance of planning, organizing, directing and controlling in decision making.

UNIT 1 INTRODUCTION 9 Hrs.

Definition, Functions, Process, Scope and Significance of Management. Nature of Management, Managerial Roles, Managerial Skills and Activities, Difference between Management and Administration. Significance of Values and Ethics in Management.

UNIT 2 SCHOOLS OF MANAGEMENT 9 Hrs.

Evolution of Management Thought - Contributions of F.W. Taylor, Henry Fayol, Elton Mayo, Approaches of Management Thought (including MBO & MBE) Functions of Management. Concept of Leadership- Theories and Styles.

UNIT 3 PLANNING AND ORGANIZING 9 Hrs.

Nature, Scope, Objective and Significance of Planning, Elements and Steps of Planning, Decision Making Organizing Principles, Span of Control, Line and Staff Relationship, Authority, Delegation and Decentralization. Effective Organizing, Organizational Structures, Formal and Informal Organizations, Staffing.

UNIT 4 DIRECTING 9 Hrs.

Effective Directing, Supervision, Motivation: Different Theories of Motivation - Maslow, Herzberg, Mc Clelland, Vroom, Porter and Lawler, Job Satisfaction. Communication Process, Channels and Barriers, Effective Communication.

UNIT 5 CONTROLLING AND COORDINATING 9 Hrs.

Elements of Managerial Control, Control Systems, Management Control Techniques, Effective Control Systems. Coordination Concept, Importance, Principles and Techniques of Coordination, Concept of Managerial Effectiveness.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understanding of basic management concepts, principles, and practices.
CO2 - Develop planning and decision-making strategies in an organization.
CO3 - Summarize the concept and complete the process of organizing.
CO4 - Develop an understanding of staffing, leadership, directing and motivation in an organization.
CO5 - Predict the dynamics of controlling and its emerging issues in management.
CO6 - Assess managerial practices and choices relative to ethical principles and standards.

TEXT / REFERENCE BOOKS

1. Stephen P. Robbins, David A. Decenzo, Fundamentals of Management, Pearson Education, 9th Edition.
2. Harold Koontz, O'Donnell and Heinz Weihrich, Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill.
3. Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage.
4. Richard L. Daft, Principles of Management, Cengage Learning.
5. Prasad, L.M. Principles and Practice of Management, Sultan Chand.
6. Jhunjhunwala J Mohanty, Management Principles and Applications, Himalaya Publishing House.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A: 10 questions of 2 marks each –No choice **20 Marks**
PART B: 2 questions from each unit of internal choice; each carrying 16 marks **80 Marks**

S41BPB41	VENTURE CREATION	L	T	P	EL	Credits	Total Marks
		2	0	0	3	3	100

COURSE OBJECTIVES

- To develop an entrepreneurial mindset, understand the concept of entrepreneurship and identify personal strengths and weaknesses.
- To understand the design thinking process and apply design thinking to real-world problems.
- To identify problems and opportunities and develop ideas for new ventures by assessing market potential.
- To develop a value proposition, business model canvas, build MVP to create sustainable differentiation for the venture with a well-structured business plan, unit economics, go-to-market strategies and funding plan for managing business growth.
- To build an idea pitch and deliver it with confidence to potential stakeholders.

UNIT 1 INTRODUCTION TO ENTREPRENEURSHIP 9 Hrs.

Defining Entrepreneurship, evolution the concept and Emerging Trends in Entrepreneurship (Domain specific), Understanding the unique opportunities; Why be an Entrepreneur? Entrepreneurship in Indian Scenario & Its role in economic development; Success stories of Entrepreneur (Domain specific); Entrepreneurial style assessment tool; Developing the Entrepreneurial mindset- Attributes & skills, recognizing your sweet spot for starting up; Principles of Effectuation; Myths about Entrepreneurship; Types of Entrepreneurs; Entrepreneur vs Intrapreneur; Role of Entrepreneurial Teams.

UNIT 2 DESIGN THINKING AND OPPORTUNITY DISCOVERY 9 Hrs.

Introduction to Design Thinking for startups; Design Thinking principles & process; Define the problem using Design thinking principles and validate Problem; Generation of ideas, Idea generation techniques and evaluating creative ideas; Identify problem worth solving; Sharpen your Problem Pitch.

UNIT 3 CUSTOMER, MARKETS AND CREATING A SUSTAINABLE DIFFERENTIATION 9 Hrs.

Differentiate between a customer and a consumer; Who is your customer and what is your segment; Customer Job, Pains, and Gains using Value proposition Canvas; Build solution using Value Proposition Canvas; Market Estimation-TAM,SAM,SOM; Competitive analysis; Minimum viable product – what is MVP: Build - Measure - Learn, differentiate between solution Demo & MVP; How to validate MVP- Achieve a Product – Market fit.

UNIT 4 BUSINESS MODEL, BUSINESS PLANNING AND GO TO MARKET STRATEGIES 9 Hrs.

Introduction to Business model, Business plan ; Lean approach 9 block lean canvas model; Financial feasibility: Costs, revenue streams, Pricing, Financial Projections, Key Financial Metrics using financial template, Managing growth & targeting scale, Unit economics; Selecting the Right Channel; Introduction to Digital Marketing and tools; Branding strategy.

UNIT 5 FUNDING STRATEGY 9 Hrs.

Sources of funds: Debt & Equity; Map the Start-up Lifecycle to Funding Options; Build an Investor ready pitch deck.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - To define entrepreneurship and explain emerging trends in entrepreneurship.
CO2 - To identify and evaluate business opportunities and assess market potential.
CO3 - To conduct customer discovery, market research, build a lean canvas, develop a business plan and marketing strategies.
CO4 - To identify sources of funding and develop a funding strategy, understand basic legal requirement for starting and running a business.
CO5 - To build an idea pitch and deliver it with confidence to various stakeholders.
CO6 - To apply design thinking principles and processes to real-world problems, generate creative ideas and develop a problem pitch for potential solutions.

TEXT / REFERENCE BOOKS

1. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. Entrepreneurship (10th ed.). McGraw-Hill Education. (2017).
2. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business. (2011).
3. Blank, S. G., & Dorf, B. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch. (2012).
4. Roy, R. Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press. (2017).
5. Chandan, J. S., & Rana, S. S. Entrepreneurship Development and Management. New Delhi: McGraw Hill Education. (2019).
6. Sinek, S. Start with Why: How Great Leaders Inspire Everyone to Take Action. Portfolio. (2011).
7. Choudhary, R., & Mehta, N. From Zero to One: How to Build a Successful Startup in India. Notion Press. (2019).
8. Osterwalder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. (2010).
9. Mitra, P., & Banerjee, A. Startup Minds: The Entrepreneur's Journey from Idea to Success. SAGE Publications India. (2019).
10. Thiel, P. Zero to One: Notes on Startups, or How to Build the Future. Crown Business. (2014).
11. Zappos, T. Delivering Happiness: A Path to Profits, Passion, and Purpose. Business Plus. (2010).

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A: 10 questions of 2 marks each –No choice **20 Marks**
PART B: 2 questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SCSB4006	SOFTWARE PROJECT MANAGEMENT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamental principles of software project management.
- To have a good knowledge of responsibilities of project manager.
- To be familiar with the different methods and techniques used for project management.

UNIT 1 INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT 9 Hrs.

Introduction to Software Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Categorizing Software Projects, Project Evaluation and Programme Management, Project Portfolio Management, Evaluation of Individual Projects, Cost–benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programme Management, An Overview of Project Planning.

UNIT 2 SELECTION OF APPROPRIATE PROJECT APPROACH, EFFORT ESTIMATION 9 Hrs.

Selection of an Appropriate Project Approach, Choosing Methodologies and Technologies, Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, Software Effort Estimation, Problems with Over and Under-Estimates, Software Effort Estimation Techniques, Bottom-up Estimation, Top-down Approach and Parametric Models, Expert Judgment, estimating by Analogy, COCOMO Model, Cost Estimation, Staffing Pattern, Effect of Schedule Compression.

UNIT 3 ACTIVITY PLANNING AND RISK MANAGEMENT 9 Hrs.

Activity Planning, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Risk Management, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Boehm's Top 10 Risks and Counter Measures, Resource Allocation, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost.

UNIT 4 MONITORING AND CONTROL 9 Hrs.

Monitoring and Control, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management, Managing Contracts, Managing People in Software Environments, Understanding Behavior, Organizational behavior, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress Management.

UNIT 5 SOFTWARE QUALITY 9 Hrs.

Software Quality, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply project management concepts and techniques to an IT project.
CO2 - Identify issues that could lead to IT project success or failure.
CO3 - Explain project management in terms of the software development process.
CO4 - Describe the responsibilities of IT project managers.
CO5 - Apply project management concepts through working in a group as team leader
CO6 - Be an active team member on an IT project.

TEXT / REFERENCE BOOKS

1. Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management, TMH Edition 6, 2018.
2. Walker Royce, Software Project Management, Pearson Edition, 2005.
3. Stellman and Greene, Applied Software Project Management 1st Edition, Kindle Edition
4. Richard Thayer, Edward Yourdon, Software Engineering Project Management, WILEY
5. Jack Marchewka, Information Technology Project Management providing measurable organizational value, WILEY.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A: 10 questions of 2 marks each –No choice **20 Marks**
PART B: 2 questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SCSB1714	SMART PRODUCT DEVELOPMENT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To introduce basic working principles of sensor devices.
- To educate different interface medium for communication.
- To impart knowledge on different automation system.

UNIT 1 INTRODUCTION TO SENSOR DEVICES 9 Hrs.

Piezoresistive pressure sensor- Piezoresistive Accelerometer - Capacitive Sensing- Accelerometer and Microphone - Resonant Sensor and Vibratory Gyroscope - Low-Power, Low Voltage Sensors- Micro Electro Mechanical Systems Analysis and Design of MEMS Devices- Nano Sensors.

UNIT 2 INTERFACING SENSOR INFORMATION AND MCU 9 Hrs.

Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control MCUs for Sensor Interface Techniques and System Considerations- Sensor Integration.

UNIT 3 CONTROL TECHNIQUES AND STANDARDS 9 Hrs.

Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, Adaptive Control. Control Application using - CISC, RISC, DSP Control and IEEE 1451 Standards.

UNIT 4 COMMUNICATION FOR SMART SENSORS 9 Hrs.

Wireless Data Communications- RF Sensing- Telemetry- Automotive Protocols- Industrial Networks Home Automation- MCU Protocols.

UNIT 5 SMART CITY-CASE STUDY 9 Hrs.

Smart Adaptive advertising - Customized Digital experience, Disaster Prevention, Smart Agriculture, Smart Health, Smart Security & Surveillance, Smart Virtual Assistance – Leadership & Policy Makers, Challenges & Solutions in Building AI, IoT, case study: IoT Application for Water & Waste Management.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1 - Comprehend the requirements of product design.
CO2 - Analyse of different design.
CO3 - Develop different interfaces.
CO4 - Work in different communication medium.
CO5 - Understand the automation process.
CO6 - Develop applications using AI technique.

TEXT / REFERENCE BOOKS

1. Adrian McEwen & Hakim Cassimally, Wiley Designing the Internet of Things, 2014.
2. Krzysztof Iniewski, Smart Sensors for Industrial Applications (Devices, Circuits, and Systems), CRC Press, 2017.
3. Anbazhagan k ,IoT Google, Amazon Alexa, Signal Jammer, ESP 8266 Node MCU and Location Tracker etc.,: New model technology development, 2019 .

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100 **Exam Duration: 3 Hrs.**

PART A: 10 questions of 2 marks each –No choice	**20 Marks**
PART B: 2 questions from each unit of internal choice; each carrying 16 marks	**80 Marks**