| 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.

**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.

## PRESCRIBED TEXT

1. Technical English [2019], Department of English, Sathyabama Institute of Science & Technology.

## TEXT / REFERENCE BOOKS

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

## 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**

| SMTB1103 | CALCULUS AND NUMERICAL METHODS | 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 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, the students 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., New Delhi, 2003.
7. Kandasamy P., Thilagavathy K., and Gunavathy K., Applied Numerical Methods, S. Chand & Co., New Delhi, 2003.

## 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**

| SPHB1101 | PHYSICS | L | T | EL | P | 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 onedimensional 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 characterisation-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**

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

**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 analyze 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.
2. Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill Publications.
3. M.N.Avadhanulu & P.G.Kshirasagar. A text book of Engineering Physics, S. Ch.Publishing.
4. B. B.Laud, Lasers and nonlinear optics, New age International Publishers, II-Edition.
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.
8. K. K. Chattopadhyay, Introduction to nano science and nano technology, PHI publisher.
9. Sulabha Kulkarni, Introduction to Nanoscience and Nanotechnology 2nd Edition.
10. David Griffiths, Introduction to electrodynamics, Addison-Wesley publishing 3rd Edition.

**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** |

| SEEB1101 | ELECTRICAL AND ELECTRONICSENGINEERING | L | T | EL | P | 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.**

**COURSEOUTCOMES**

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

**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**

| 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 Practice:

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 – Datatypes – 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 Practice:

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 Practice:

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 Practice:

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 favourite 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 favourite 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. Write a C 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 Practice:

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 Practice 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.
2. R.G.Dromey “How to solve it by computer”, Pearson Education, Low Price Edition.
3. Balagurusamy, “Programming in ANSI C”, McGrawHill Publications, Eighth Edition.
4. Greg Perry, Dean Miller “C Programming Absolute Beginner’s Guide”, Third Edition.

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

**COURSE OBJECTIVE**

- To introduce experiments in optics, semiconductors, magnetism, thermal physics and quantum mechanics in order to acquire the first hand information and to realize the basic physics concepts.

**SUGGESTED LIST OF EXPERIMENTS** (Any SIX experiments & TWO demonstrations)

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 fibre.
11. Photoelectric effect.
12. Michelson Interferometer.
13. V-I characterisation of solar cell.
14. CRO- FUNCTIONS.
15. DFT Theory and calculations.

**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 minium deviation by spectrometer.
**CO3 -** Analyse 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 judgments.
- 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 – Complemnented 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 Mcgraw Hill Publishing Co., NewDelhi, 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 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**

| SCYB 1101 | CHEMISTRY | L | T | P | Credits | Total Marks |
|---|---|---|---|---|---|---|
| | | 3 | 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 nanochemistry.

**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 H2 – 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 (CO2 and H2O) – 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/SOCl2 cell - Li/I2 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 quantisation in molecules.
**CO2 -** Analyse 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 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**

| SCSB1261 | INTRODUCTION TO BLOCKCHAIN TECHNOLOGY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVE**

- To understand the history, types and applications of Blockchain
- To acquire knowledge about cryptography and consensus algorithms.
- Deploy projects using Web3j and design blockchain based applications.

**UNIT 1 INTRODUCTION TO BLOCKCHAIN 9 Hrs.**

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features and Types of Blockchain.

**UNIT 2 BLOCKCHAIN ARCHITECTURE 9 Hrs.**

Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET).

**UNIT 3 BLOCKCHAIN-BASED FUTURES SYSTEM 9 Hrs.**

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract.

**UNIT 4 BLOCKCHAINS IN BUSINESS AND CREATING ICO 9 Hrs.**

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchain -as-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and testing the code.

**UNIT 5 DISTRIBUTED STORAGE IPFS AND SWARM 9 Hrs.**

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup the web page.

**Max. 45 Hrs.**

**COURSE OUTCOME**

On completion of the course, student will be able to

**CO1 -** Contentedly discuss and describe the history, types and applications of Blockchain.
**CO2 -** Gains familiarity with cryptography and Consensus algorithms.
**CO3 -** Create and deploy projects using Web3j.
**CO4 -** Implement an ICO on Ethereum.
**CO5 -** Design block chain based application with Swarm and IPFS.
**CO6 -** Create and deploy projects using distributed storage.

## TEXT / REFERENCE BOOKS

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2ndEdition, Packt Publishing Ltd, March 2018.
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, “Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger”, Packt Publishing Limited, 2018.
3. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

## E BOOKS

1. https://www.velmie.com/practical-blockchain-study.

## 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** |

| SCSB1251 | ARTIFICIAL NTELLIGENCE SEARCH METHODS AND REASONING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems.
- To learn the concepts of learning and communication in AI.
- To know about the various applications of AI.

**UNIT 1 BASIC SCIENCE BEHIND AI 9 Hrs.**

Intelligence – Memory – Computation – Learning – AI's Foundation and History – Intelligent Agents: Features –Behaviour in the environment – Rationality – Nature and its Structure – Case Study: AI Programming Languages History: LISP – Prolog – Python.

**UNIT 2 SEARCHING TOWARDS SOLUTION 9 Hrs.**

Searching Strategies: Informed Search: BFS – DFS – Depth Bounded DFS – Uninformed Search: Heuristic Functions – Hill Climbing Search – Best First Search – Local Maxima – Solution Space Search – Adversarial Search – Constraint Satisfaction Problem – Case Study: N-Queens Problem.

**UNIT 3 KNOWLEDGE: ROLE AND REPRESENTATION 9 Hrs.**

Knowledge – Definition and Management – Types: Declarative and Procedural Knowledge – Knowledge Engineering behind Logical Agents: Propositional Logic – First Order Logic – Inference: Forward and Backward Chaining – Ontological Engineering – Case Study: Ontology based knowledge representation.

**UNIT 4 APPROACHES BEHIND PLANNING AND REASONING 9 Hrs.**

Algorithm for Planning as State Space Search – Analysis of Planning Approach – Reasoning: Bayes Rule – Bayesian Network and its approximation – Hidden Markov Model – Kalman Filters – Decision Networks – Case Study: Wumpus World Problem.

**UNIT 5 DECODING AND LEARNING INTELLIGENCE 9 Hrs.**

Learning Algorithms: Classification and Regression with Linear Model – Non-Parametric Models – Ensemble Learning – Explanation Based Learning – Learning with Hidden Variables – AI Real Time Applications – Case Study: Nature Inspired Computation.

**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 bayes 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”, 3rd Edition, 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., 1st Edition, 2008.
4. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, 2nd Edition,2010.
5. Ertel, Wolfgang, Introduction to Artificial Intelligence,1st Edition ,2017.

**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**

| 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.

**Practice:**

- 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.

**Practice:**

- 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.

**Practice:**

- 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).

**Practice:**

- 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.

**Practice:**

- 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. Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson,2013.
2. Python Notes for Professionals by Stack Overflow Documentation (https://books.goalkicker.com/PythonBook/).
3. Dr. Charles R. Severance, “Python for Everybody- Exploring Data Using Python 3”, 2016.
4. 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 ALGORITHM | 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.

**Practice Exercise:**

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.

**Practice Exercise:**

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.

**Practice Exercise:**

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.

**Practice Exercise:**

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.

**Practice Exercise:**

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, 2004, 2nd Edition.
3. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Edition, 2004.
4. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

| SCYB 2101 | 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.

## 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

- 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 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.**

## COURSEOUTCOMES

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 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**

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

**COURSE OBJECTIVES**

- To impart knowledge on ALU and its operations.
- To understand the types of memory organizations, interface and communication in I/O devices.
- To analyse 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, 2007.
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 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**

| SISB4301 | UNIVERSAL HUMAN VALUES | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 4 | 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**

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 the process for self- exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations.
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.
6. 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!**

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

Practice sessions to discuss the role others have played in making material goods available to me. 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- HARMONY IN HUMAN-HUMAN RELATIONSHIP**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
14. Understanding the meaning of Trust; Difference between intention and competence.
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
17. 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**

18. Understanding the harmony in the Nature.
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature.
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
21. Holistic perception of harmony at all levels of existence.

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**

22. Natural acceptance of human values.
23. Definitiveness of Ethical Human Conduct.
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. 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.
26. Case studies of typical holistic technologies, management models and production systems.
27. 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.
28. Sum up.

Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

**Total: 28 Lectures and 14 Practice Sessions**

**COURSE OUTCOMES**

On completion of the course, the student are expected

**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 andhuman 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.

**CO6 -** Develop professional ethics, foster people-friendly and eco-friendly systems, and contribute to a Universal Human Order through responsible actions in their careers.

## TEXT / 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: Ek Parichaya, 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 |
| Semester End 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 undecidable 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. Introduction to Languages and the Theory of Computation, John. C. Martin, Tata McGraw-Hill, 2003.
2. Introduction to Automata Theory, Languages and Computation, Hopcroft, Motwani and Ullman, 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**

| SCSB1361 | FUNDAMENTALS OF BITCOIN | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- Understand Bitcoin, their needed and why.
- Explore the Security and Stability of Bitcoin and Cryptocurrencies.
- Learn Bitcoin's Consensus Mechanism and reason about its Security.
- Gain a detailed understanding of the World of Blockchain and Virtual Currencies.

**UNIT 1 CORE OF BITCOIN 9 Hrs.**

Introduction - History & Philosophy of Bitcoin – Bitcoin & Ethereum - Bitcoin Core Architecture - Cryptocurrencies - Transactions (Inputs & Outputs & Constraints) - Blockchain - Soft Fork and Hard Fork- Fork categorization - Signalling, & Protocol Overview – Bitcoin Scripting System -Economic Limits of Bitcoin and the Blockchain.

**UNIT 2 SECURITY MODELS 9 Hrs.**

Security Models : Overview of Security Concerns - Bitcoin Threat Models, Bitcoin's Security Mode – Weakness , Speed - Security Trade-offs in Blockchain Protocols - Checkpoints, assume valid, minimum chain work - SPV and Light clients - Committed bloom filters – UTXO - The Onion Model of Blockchain Security- Byzantine Generals Problem - Consensus Algorithms.

**UNIT 3 MINING 9 Hrs.**

Block arrivals in the Bitcoin Blockchain - Fee Sniping - Selfish Mining - Poisson Distribution - Poisson Process - Bitcoin's Attack Vectors - Better Hash - No Reward Mining Overview - Pool overview - Pool Hopping - PPS As a Real-World Business Solution - Trustless Pools - Payment Channel Pay-outs - ASIC Boost - BCH Mining / Difficulty Adjustment – Tumble bit - Dust attack.

**UNIT 4 CONSENSUS APPROACHES AND CRYPTOGRAPHY 9 Hrs.**

Overview - GHOST - Braiding - Bitcoin-NG: A Scalable Blockchain Protocol - Sidechains - Extension Blocks - Replay Protection - Wipeout Protection - 3 Seminal Events In Cryptography - Public Key Cryptography - Finite fields, Elliptic Curves, ECDSA, Schnorr - Bitcoin, Chance and Randomness - Broken Crypto Primitives - State of Cryptography - SNARKs – Bullet proofs - Commitment schemes -Diffie-Hellman Key Exchange - Ring Signatures – RSA.

**UNIT 5 TRANSACTIONS 9 Hrs.**

Raw Bitcoin Protocol - Working with Transactions - Transaction Life Cycle - Transaction Format - Bitcoin Scripting: Transactions & Multisig - Signing transactions - Standardness - Zero-confirmation transactions - Compacted Transactions - Transaction Pools, Bitcoin Peer-to-Peer Network – Mempool - Wallet Development - Hierarchical Deterministic Wallets - Native Descriptor Wallets - Wallet key management.

**Max. 45 Hrs.**

## COURSE OUTCOMES

On completion of the course the student will be able to

**CO1 -** Learn how the individual components of the Bitcoin protocol make the whole system works: transactions, script, blocks and the peer-to-peer network.
**CO2 -** Understand How using Bitcoin works and different ways of storing Bitcoin keys.
**CO3 -** Define how mining can be re-designed in alternative Cryptocurrencies.
**CO4 -** Explain cryptographic building blocks and reason about their security.
**CO5 -** Ability to Understand Bitcoin Transactions in Real World.
**CO6 -** Exploit applications of Blockchain in Real World Scenario.

## TEXT / REFERENCE BOOKS

1. Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain” (2nd edition, 2017),Oreilly & Associates Inc, 978-1491954386.
https:// github. com/bitcoinbook/bitcoinbook.
2. Narayanan, et al., “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” (2016), Princeton University Press, 978-0691171692.
https://www.lopp.net/pdf/princeton_bitcoin_book.pdf.
3. Jimmy Song, “Programming Bitcoin: Learn How to Program Bitcoin from Scratch” (2020), Oreilly & Associates Inc, 978- 1492031499.
https://github.com/jimmysong/programmingbitcoin.

## 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**

| S613BLH31 | CYBER THREATS FOR IOT AND CLOUD | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the concepts of IoT and its applications.
- To identify the various security issues in IoT platforms.
- To learn about role of cloud computing in IoT.
- To Provide knowledge and overview about security in cloud.
- To make students aware of various security techniques in cloud.

**UNIT 1 IOT AND APPLICATIONS 12 Hrs.**

Introduction & Application to Internet of Things: The Internet of Things, Importance of IoT, Towards the IoT Universe IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, IoT Smart X Application: Smart Cities, Smart Energy & Smart Grid, Smart Mobility & transport, Smart Home, Smart Building & Infrastructure, Smart Factory & Manufacturing.

**Practice Programs:**

1. Make a study of anyone simulation tool based on parameters of data security.

**UNIT 2 PRIVACY, SECURITY & GOVERNANCE 12 Hrs.**

IoT Security Requirements -Data Confidentiality -Data Encryption -Data Authentication -Secured Access Control –IoT-Vulnerabilities – Secret-Key, Authentication/Authorization for Smart Devices - Constrained System Resources -Device Heterogeneity -Fixed Firmware. IoT Attacks -Side-channel Attacks - Reconnaissance -Spoofing -Sniffing -Neighbour -Discovery -Rogue Devices-Man-in-Middle attack.

**Practice Programs:**

1. Implement the formation of virtual modes using OMNET++.
2. Implement the networking attack using OMNET++.
3. Implement WEP and EAP security protocol using OMNET++.

**UNIT 3 IOT AND CLOUD 12 Hrs.**

Connecting IoT to Cloud: Introduction to cloud computing, Difference between Cloud Computing and IoT, Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT. Living on the Edge, Connecting IoT to cloud, Cloud Storage for IoT. Cloud-to-Device Connectivity, Challenge in integration of IoT with Cloud.

**Practice Programs:**

1. Make a study of anyone simulation tool based on parameters of data security.
2. Implement the formation of virtual modes using OMNET++.
3. Implement the networking attack using OMNET++.

**UNIT 4 CLOUD SECURITY 12 Hrs.**

Cloud Computing Software Security Fundamentals: Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements. Cloud Computing Risk Issues: Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks.

**Practice Programs:**

1. Implement WEP and EAP security protocol using OMNET++.
2. Implement secure efficient data routing in IoT using OMNET++.
3. Demonstrate the web application firewall to stop attacks.
4. Implement access management in cloud environment.

**UNIT 5 SECURITY TECHNIQUES 12 Hrs.**

Cloud Computing Security Challenges: Security Policy Implementation, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques. Cloud Computing Security Architecture: Architectural Considerations, Identity Management and Access Control, Autonomic Security.

**Practice Programs:**

1. Implement secure user management in cloud.
2. Implement identity management in cloud environment.
3. Demonstrate the intrusion detection system using any tool.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Analyse the IoT model and different platforms.
**CO2 -** Recognize the IoT security and vulnerability threats and implementation of security protocols using OMNET++.
**CO3 -** To familiarize students with different tools for cyber security.
**CO4 -** Analyse the connectivity of IoT to cloud computing.
**CO5 -** Evaluate the risk issues and threats in cloud computing.
**CO6 -** Use different open-source tools for cloud security and analysis.

**TEXT / REFERENCE BOOKS**

1. Arshdeep bahga and Vijay Madisetti," Internet of Things", Global paperback edition, 2016.
2. Kris Jamsa, Cloud Computing, Jones & Bartlett,2012.
3. Wiem Tounsi," Cyber-Vigilance and Digital Trust: Cyber Security in the Era of Cloud Computing and IoT", Wiley,2019.
4. Russell Dean Vines and Ronald L. Krutz, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley India Pvt Ltd, 2010.
5. Barrie Sosinsky, Cloud Computing Bible, Wiley India,2011.

| 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 dimensionaland 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 –FileInput 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/.

| SMTB1402 | PROBABILITY AND STATISTICS | L | T | P | Credits | Total Marks |
|---|---|---|---|---|---|---|
| | | 3 | * | 0 | 3 | 100 |

## OBJECTIVE OF THE COURSE

- 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 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., Vijaya Kumari C., Probability and Random Processes, Pearson Education, Sixth Edition, 2014.

**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**

| S731BLH31 | OPERATING SYSTEMS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 | 100 |

**COURSE OBJECTIVES**

- To have an overview of different types of operating systems. nd implement the concept of process management.
- To observe the concept of storage management.
- To understand the concept of file systems.
- To understand with the essentials of virtual machines and Mobile OS like iOS and Android.

**UNIT 1 INTRODUCTION 12 Hrs.**

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

**Practical:** Study of basic Linux commands, Linux directory commands, Linux file commands, Linux user commands, Linux filter commands, history command, man command, grep command and implementation of system calls.

**UNIT 2 PROCESS MANAGEMENT 12 Hrs.**

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

**Practical:** Study of Linux process management commands, To develop process creation and termination, inter process communication in shared memory, implementation of different kinds scheduling algorithms.

**UNIT 3 SYNCHRONIZATION AND DEADLOCKS 12 Hrs.**

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

**Practical:** To develop critical section problems, implementation of semaphores, illustrate different classical synchronization problems, to implement the deadlock avoidance algorithm.

**UNIT 4 MEMORY MANAGEMENT 12 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 Concepts - Access Methods - Directory Structure - File Sharing - Protection – File - System Structure - Implementation.

**Practical:** implement the various Memory allocation techniques (first fit, best fit, worst fit), To develop various Page replacement techniques, to implement the various file organization techniques, implement the sequential, indexed and linked file allocation strategies.

**UNIT 5 STORAGE MANAGEMENT, VIRTUAL MACHINES AND MOBILE OS 12 Hrs.**

Mass Storage Structure - Disk Structure- Disk Scheduling - Disk Management - Swap Space Management - RAID Structure - Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

**Practical:** To simulate disk scheduling algorithms, Study the Installation of the any one of the following (a) Mobile OS (b) Android OS.

**Max. 60 Hrs.**

## COURSE OUTCOMES

On completion of the course, 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, synchronization and deadlocks in real computing problems.

**CO3 -** Demonstrate the different memory and I/O management techniques used in Operating Systems.

**CO4 -** Have practical exposure to the concepts of semaphores and monitors for process synchronization.

**CO5 -** Create design and construct the following OS components: Schedulers, Memory management systems in the modern operating system.

**CO6 -** Understand file system structure, visualization and compare iOS and Android Operating system.

## 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. Richard Peterson, “Linux : The Complete Reference”, 6th Edition, Tata McGraw Hills, 2008.
5. Andrew S. Tanenbaum, “Modern Operating Systems”.4th edition 2015.
6. Ramaz Elmasri, A. Gil Carrick, David Levine, Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
7. William Stallings, “Operating Systems: Internals and Design Principles”, 7th Edition, Prentice Hall, 2018.
8. Achyut S.Godbole, Atul Kahate, Operating Systems, McGraw Hill Education, 2016.

| S11BLH 41 | 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 be familiar with normalization.
- To explain the 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 -** Explain the basic concept and role of DBMS in an organization.
**CO2 -** Illustrate the design principles for database design, ER model and normalization.
**CO3 -** Demonstrate the basics of query evaluation and heuristic query optimization techniques.
**CO4 -** Apply Concurrency control and recovery mechanisms for the desirable database problem.
**CO5 -** Compare the basic database storage structure and access techniques including B Tree, B+Tress & hashing.
**CO6 -** Design and implement 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 Polyglot persistence, Addison Wesley, 2012.
5. Shashank Tiwari, Professional NoSql,Wiley ,2011.

| SCSB1461 | BLOCKCHAIN DESIGN AND USECASES | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn blockchain basics and primitives along with architecture.
- To understand how to consensus, work along with design goals.
- To build Hyperledger fabric A & B.
- To apply use cases like KYC, Financial blockchains.
- To create privacy and security policy and cryptography schemes.

**UNIT 1 INTRODUCTION TO BLOCKCHAIN 9 Hrs.**

Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms.

**UNIT 2 CONSENSUS 9 Hrs.**

Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains.

**UNIT 3 HYPERLEDGER FABRIC 9 Hrs.**

Hyperledger Fabric (A): Decomposing the consensus process, Hyperledger fabric components, Chaincode Design and Implementation Hyperledger.
Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool.

**UNIT 4 USE CASES 1 & 2 9 Hrs.**

Use case 1: Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii)Capital markets, (iv) Insurance
Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc

**UNIT 5 USE CASE 3 9 Hrs.**

Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Describe basics of blockchain and hash functions.
**CO2 -** Able to know about consensus along with protocols.
**CO3 -** Define Hyperledger fabric components and design policies.
**CO4 -** Design use cases related to trade/supply chain finance.
**CO5 -** Ability to design real life situational problems like insurance, KYC, etc.
**CO6 -** Apply privacy and security policies and cryptography systems.

**TEXT / REFERENCE BOOKS**

1. Mstering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos Blockchain by Melanie Swa, O'Reilly.
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric.
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smi. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html.

**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**

| SCSBDPROJ | DESIGN THINKING AND INNOVATION | 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

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-maximise-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 ReviewsReport Submission<br>IPR Registration |
| **Indirect Methods** | Course Exit Survey |

## WEIGHTAGES

| 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** | |

**Note:** The design thinking guidelines is suggestive and the procedures can customize the rubrics based on their domain requirement.

| SCSB1501 | DATA COMMUNICATIONS AND NETWORKS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- Classify different network architectures, transmission methods and switching techniques.
- Evaluate network errors, examine methods to detect and remove them.
- 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. WilliamStallings, ”Data and Computer Communication “, 6th Edition, Pearson Education, 2000.

**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**

| SCSB1562 | ENTERPRISE BLOCK CHAIN PLATFORMS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To teach the concepts of blockchain technologies.
- To cover the technical aspects of Hyperledger.
- To familiarize potential applications of Ripple and Stellar.
- To understand the use of Corda and Quorum.
- To learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

**UNIT 1 INTRODUCTION 9 Hrs.**

Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission- less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model.

**UNIT 2 HYPERLEDGER 9 Hrs.**

Hyperledger- Hyperledger framework - Public and Private Ledgers-Hyperledger Fabric-Hyperledger sawtooth-Hyperledger Iroha- Introduction to Decentralized Application Platform- Interplanetary File System- Hashgraph.

**UNIT 3 RIPPLE AND STELLAR 9 Hrs**

Ripple-Framework-Consensus Algorithm-Ledger-Case Study. Stellar-Framework-Consensus Protocol-Ledger-Smart Contract- Case Study-Comparison of Ripple and Stellar.

**UNIT 4 CORDA AND QUORUM 9 Hrs.**

Corda-Framework-Consensus Algorithm- Asynchronous Byzantine Fault Tolerance-Ledger-Case Study. Quorum- Framework- Consensus Protocol-Ledger-Smart Contract-Case Study.

**UNIT 5 TEZOS AND DRAGONCHAIN 9 Hrs.**

Tezos-Framework-Consensus Algorithm-Delegated Proof of Stake-Ledger-Case Study. DragonChain-Framework-Consensus Algorithm- Context-Based Verification with five levels of consensus-Ledger-Case Study.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Understand emerging abstract models for Block chain Technology.
**CO2 -** Analyse the concept of Hyperledger.
**CO3 -** Apply the tools for understanding the background of Blockchain Platforms.
**CO4 -** Identify major research challenges and technical gaps existing between various Blockchain Platforms .
**CO5 -** Understanding of latest advances in Block Chain Platform.
**CO6 -** Identify the appropriate blockchain platform for an application.

## TEXT / REFERENCE BOOKS

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O"Reilly, first edition – 2015.
2. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017.
3. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, first edition – 2012.
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner"s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing.
5. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/.
6. https://www.leewayhertz.com/blockchain-platforms-for-top-blockchain-companies/.

## 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**

| SCSB1562 | ETHICS, LAW AND POLICY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To describe the cyber Ethics.
- To explain about the various cyber Laws.
- To Analyse various types of cyber security policy catalog.
- To understand the secure and trust cyber space.
- To Learn the Indian laws related to cyber security.
- To Know the ethics, law and policy following the cyber data.

**UNIT 1 INTRODUCTION OF CYBER ETHICS 9 Hrs.**

Introducing Ethics, Cyber Ethics, Ethical issues in cyber security, Ethics, Law, and Policy: How Are They Different, How Are They Linked?, Policy and Law, Making and Analysing Policy, Law as a Toolbox for Policy; Ethics as Its Foundation, Disability Policy and Law, What's Wrong With Calling It "Disability Law and Policy"?, Disability Policy and the Models of Disability, The Social Model of Disability, The Social Model and the Rights Approach, Enduring Themes of Disability Policy and Law, Disability Ethics.

**UNIT 2 INTRODUCTION TO CYBER LAWS 9 Hrs.**

Repair Deemed Unlawful, CyberLaw (May 1993), Free Speech & Toasters, CyberLaw (Oct. 1993), The End of Fair Use, CyberLaw (Nov. 1993),Pirates, CyberLaw (April 1994), Information & Infrastructure, CyberLaw (July 1994), Apple Loses, CyberLaw (Sept. 1994), Photocopying Unlawful, CyberLaw (Dec. 1994),Methods of Operation, CyberLaw (March 1995),Internet Infringement, CyberLaw (April 1995), Restraining Access, CyberLaw (June 1995),Government Recommendations, CyberLaw (Sept. 1995),Notice of Infringement, CyberLaw (Nov. 1995),Losing Data, CyberLaw (Jan. 1996), Online Defamation, CyberLaw (May 1995).

**UNIT 3 CYBER SECURITY POLICY CATALOG 9 Hrs.**

What Is Cyber Security Policy?, Domains of Cyber Security Policy , Laws and Regulations, Enterprise Policy ,Technology Operations , Technology Configuration, Strategy versus Policy, Cyber security Policy Taxonomy, cyber Governance Issues, Cyber User Issues, Cyber Conflict Issues, Cyber Management Issues, Cyber Infrastructure Issues, Government's Approach to Cyber Security Policy, A Brief History of Cyber Security Public Policy Development in the U.S. Federal Government.

**UNIT 4 SECURITY AND TRUST IN CYBER SPACE 9 Hrs.**

Introduction, threat of cybercrime in the financial sector, types of cybercrime in financial institutions, bases for trust building, national culture and trust, trustworthiness: could it be demonstrated?, antecedents of trust, marketing and the internet, creating trust in cyber space, trust issues in cyber space, the private sector role in securing cyberspace - national governments and their role in securing cyberspace - international law's role in securing cyberspace.

**UNIT 5 CYBER MEDIA, CYBER EDUCATION ETHICS AND CASE STUDIES IN ETHICS 9 Hrs.**

Cyber Ethics Requires Critical Thinking of Citizens, Cyber Bullying, child protection online: UNICEF India Recommendations, Virtual House Calls: Cyber Home Health Care, The Virtual House Call, Dial-Up Medicine, Cybercare, Avoiding Drug-Drug Interactions, An Interactive Support Group for ALS, Information and Support on the Internet, Fear and Communication.

**Max. 45 Hrs.**

**COURSE OUTCOME**

On completion of the course the student will be able to

**CO1 -** Explain the ethics and disability ethics.
**CO2 -** Categorize the various types of cyber laws.
**CO3 -** classify the various cyber security policy catalog.
**CO4 -** summarize the secure and trust of cyber space.
**CO5 -** Interpret the cyber media, cyber education ethics.
**CO6 -** Analyse the various case studies in ethics.

**TEXT / REFERENCE BOOK**

1. Cybersecurity Ethics, Legal, Risks, and Policies by Ishaani Priyadarshini, Chase Cotton,2021, Apple Academic Press.
2. Gary L. Albrech, ETHICS, LAW AND POLICY. The SAGE Reference Series on Disability: Key Issues and Future Directions Series.
3. Jonathan Rosenoer, CyberLaw - The Law of the Internet, 1997 Springer-Verlag New York, Inc.
4. Ethics and Information Technology: A Case-Based Approach to a Health Care System in Transition James G. AndersonKenneth W. Goodman SPRINGER.
5. Cyber Ethics 4.0: Serving Humanity with Values (Globethics.net Global Series), by Christoph Stückelberger (Author), Pavan Duggal (Author).

**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**

| S613BLH41 | INTRODUCTION TO ETHEREUM AND SOLIDITYPROGRAMMING LANGUAGE | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 1 | 4 | 100 |

**COURSE OBJECTIVES**

- To impart strong understanding about the Ethereum technologies and smart contract.
- To gain the knowledge of secure payment.
- To understand how Block chain and Ethereum works.
- To gain the knowledge on basics and advanced level of solidity programming language.
- To design and develop a smart contract and distributed application using solidity programming language.

**UNIT 1 INTRODUCTION TO ETHEREUM 12 Hrs.**

Blockchain Basics and its Components -Birth of Ethereum-Block chain and Ethereum Architecture-Ethereum for Newbies -Ethereum Ecosystem-Ethereum Clients - Working of Ethereum: Bitcoin – Ether-Ethereum Mining-Ethereum Storage: Hardware Wallets, Desktop Wallets, Mobile Wallets, Web Wallets, Paper Wallets.

**Practice Exercise :**

- Program to implement simple counter smart contract using solidity programming language
- Program to implement variables, datatypes.

**UNIT 2 FEATURES AND APPLICATIONS OF ETHEREUM 12 Hrs.**

Ethereum Features: Cryptocurrency – Smart Contracts – Ethereum Virtual Machine – Decentralized Application – Autonomous Organization – Application of Ethereum.

**Practice Exercise :**

- Program to implement data structures inside smart contract using solidity programming language (Array and Mapping).
- Program to check the given number is even or not using conditionals and looping inside smart contract using Solidity Programming Language.

**UNIT 3 INTRODUCTION TO SOLIDITY PROGRAMMING LANGUAGE 12 Hrs.**

Solidity-Setup of Environment-Syntax: Pragma, Contract, Importing Files, Reserve Keywords, Comments, Types, Variables, Variable Scope, Operators, Loops, Decision Making, String, Arrays, Enums, Structs, Mapping, Conversion, Ether units, Special Variables, Style Guide-Solidity Function: Functions, Function Modifiers, View function, Pure function, Fallback function, Function Overloading, Mathematical Functions, Cryptographic Functions.

**Practice Exercise :**

- .Program to implement smart contract for simple marketplace.

**UNIT 4 ADVANCED SOLIDITY PROGRAMMING LANGUAGE 12 Hrs.**

Contracts - Inheritance – Constructors - Abstract Contracts – Interfaces – Libraries – Assemble -Events - Error Handling - A Simple Smart Contract using solidity programming language: Storage and Sub-currency example.

**Practice Exercise :**

- Program to build a code cryptocurrency payment in smart contract for hotel rooms.

**UNIT 5 CASESTUDY 12 Hrs.**

Smart Contract-Simple Bank Smart Contract Development-Voting Exercise-Token Exercise.

**Practice Exercise :**

- Program to perform the operation in multiple smart contracts inside solidity using inheritance and factories.
- Program to create a shipping contract by using the blockchain development kit for Ethereum.

**Max. 60 Hrs.**

## COURSE OUTCOMES

On completion of the course the student will be able to

**CO1 -** Understand the basics & advanced features of Solidity & Ethereum Virtual Machine features.
**CO2 -** Ability to analyse and develop algorithms for smart contract.
**CO3 -** Explain the performance of Ethereum virtual machine.
**CO4 -** Ability to develop a small application using solidity programming language.
**CO5 -** Strong knowledge in advanced level of solidity programming language.
**CO6 -** Ability to develop and design the smart contract application using solidity programming language.

## TEXT / REFERENCE BOOKS

1. Mayukh Mukhopadhyay, “Ethereum Smart Contract Development: Build blockchain based decentralized application using solidity”, Packt> (Mumbai) 2018.
2. Andreas M. Antonopoulos, Gavin Wood Ph.D., “Mastering Ethereum: Building Smart Contracts DApps”, O’REILLY 2019.
3. Ritesh Modi, “Solidity Programming Essentials: A Beginners Guide to build smart contracts for Ethereum and Blockchain”, Packt>(Mumbai) 2018.
4. Chris Dannen, “Introducing Ethereum and Solidity: Foundation of Cryptocurrency and Blockchain Programming for Beginners”, Apress 2017.
5. Solidity − Official Website of Solidity and Documentation: https://docs.soliditylang.org/en/v0.8.4/
6. Barthwal R Barthwell, Industrial Economics – An Introductory Text Book, New Age International Pvt Ltd, 2000.
7. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.
8. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

| S613BLH42 | NETWORK SECURITY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 1 | 4 | 100 |

**COURSE OBJECTIVES**

- To learn how tunneling is carried out in network using VPN. To get expose to Firewall configuration in Linux.
- To explore the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit data. networks To learn various mechanisms for network security to protect against the threats in the network.

**UNIT 1 BASICS OF CRYPTOGRAPHY 12 Hrs.**

The OSI Security Architecture -Services, Mechanisms and Attacks - A Model for Network Security – Classical Encryption Technique – Symmetric Cipher Model Substitution Technique – Rotor Machines – Steganography.

**Practice Program**

1. Learn to setup and configure a OpenVPN server.
2. Generate OpenVPN client configuration flies and connect to server.

**UNIT 2 DATA SECURITY 12 Hrs.**

Stream Cipher- SDES - Block Cipher principles – The Data Encryption Standard – The strength of DES – Advanced Encryption Standard- Triple DES.

**Practice Program**

1.Study and setup letsencrypt certificate (auto renew) .
2.Study about iptables and understand firewalls in Linux.

**UNIT 3 KEY DISTRIBUTION AND KEY MANAGEMENT 12 Hrs.**

Random key Generation- Requirements- Linear Congruential Generators- Blum BlumShubGeneratorPlacement of encryption - Traffic confidentiality – Key distribution-Public key cryptography and RSA – Key Management Diffie-hellman Key exchange.

**Practice Program**

1.Use UFW to configure a basic firewall to allow only web traffic (port 80 and 443).
2.Use https://www.shodan.io/ to check for webcam streams.

**UNIT 4 NETWORK PROTECTION, MONITORING AND DETECTION 12 Hrs.**

Firewalls, packet filter and stateful firewalls, application aware firewalls, personal firewalls- Intrusion Detection System- Signature and Anomaly based detection,Honeypots and Honeynets.

**Practice Program**

1. Encrypt and decrypt messages encrypted using PGP keys.
2. Configure secure SSH access on server (fail2ban, restrict password – only keys).

**UNIT 5 AUTHENTICATION AND HASH FUNCTIONS 12 Hrs.**

Authentication requirements – Authentication functions – message authentication codes – Hash functions – Security of hash functions and MAC'S – MD 5 (Message Digest Algorithm) – HMAC. Digital Signatures and authentication protocols: Digital Signatures – Authentication protocols – Digital Signature Standard Kerberos – X.509 Authentication Service.

**Practice Program**

1. Use Wireshark to monitor the HTTP messages while connecting to https://www.sathyabama.ac.in/ and understand the result.
2. Use Wireshark to determine which port had the highest traffic while browsing YouTube.

**Max. 60 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** To use VPN for both public and private networks with same security levels.

**CO2 -** To do secure communication using Firewall setup.

**CO3 -** To do self-monitoring of the network exposure using webcam streams.

**CO4 -** Analyse and design suitable network protection, monitoring and detection strategies that detect or (prevent from) the threat.

**CO5 -** Defend the network from external or internal authentication threats.

**CO6 -** Design security strategies and resolve security issues in networks and computer systems to secure an organization / IT infrastructure.

**TEXT / REFERENCE BOOKS**

1. William Stallings, Cryptography and Network Security: Principles and Practice,8th Edition, Pearson edition, 2020.
2. Behrouz A. Forouzan, Cryptography & Network Security, McGraw-Hill, 3rd Edition 2015.
3. W. Stallings, Network Security Essentials: Applications and Standards,6th Edition, Pearson Prentice Hall, 2016.
4. Bryan Sullivan and Vincent Liu, Web Application Security, A Beginner's Guide, McGraw-Hill Education, 2012.
5. Kaufman, R. Perlman and M. Speciner, Network Security: Private Communication in a Public World, 2nd Edition, Prentice Hall PTR, 2002.

| | | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| SCSB1661 | SMART CONTRACT | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand about Ethereum and differentiate with Bitcoin.
- To learn about open Blockchain Platform.
- To understand smart contracts, Dapps, and DAOs.
- To learn about open Blockchain platform's and ICOs.
- To create private blockchain, new crypto-currency and Mine for tokens.
- To set-up a blockchain development environment and Program using Solidity.
- To build a smart contracts Dapps.

**UNIT 1 INTRODUCTION 9 Hrs.**

Ethereum, Ethereum Vs Bitcoin, Ethereum Clients, Account Management, Ether, The Ethereum network, Mining, History of Ethereum, Community, The Ethereum Foundation. Smart Contracts, Dapps, And DAOs, Quick Start Overview of Remix using JavaScript VM.

**UNIT 2 ETHEREUM TECHNOLOGY OVERVIEW & CURRENT AND POTENTIAL USES OF ETHEREUM 9 Hrs.**

Architectural Overview, Ethereum Blockchain Platform, Ethereum Virtual Machine, Create your private Ethereum blockchain, Download the main Ethereum blockchain, Analyse Ethereum blockchain. Current Ethereum, Applications, Initial Coin Offerings, Payment Systems, Investing in Gold, Crowdfunding, Corporate Finance, The Internet of Things, Casinos, Lotteries, And Online Gambling, Prediction Markets, Web Hosting, Social Networks, Insurance, Entertainment, Real Estate, Energy Transfer, Marriage Contracts and Wills, Decentralized Cryptocurrency Exchange, Supply Chain Management, Financial Markets, Election and Votes.

**UNIT 3 INTRODUCTION TO PROGRAMMING SMART CONTRACTS & PROGRAMMING TUTORIAL - INSTALLING, BUILDING, TESTING, & DEPLOYING 9 Hrs.**

A Simple Smart Contract, Account Types, Gas, and Transactions, Contracts, Accessing Contracts and Transactions, Mix, Dapps, Developer Tools, Ethereum Tests, Web3 Base Layer Services, Ethereum Nodes, Building A Private Blockchain Network, MetaMask Browser Plug In, Mist Browser, Ethereum Wallet, Web3 Ethereum JavaScript API, Remix Web Browser IDE, Geth (Go Ethereum) Command Line Interface.

**UNIT 4 SOLIDITY PROGRAMMING 9 Hrs.**

Layout of a Solidity Source File, Structure of a Contract, Types, Units and Globally Available Variables Input Parameters and Output Parameters, Control Structures, Function Calls, Creating Contracts via new Order of Evaluation of Expressions, Assignment, Scoping and Declarations, Error handling: Assert, Require, Revert and Exceptions, Creating Contracts, Visibility and Getters, Function Modifiers, Constant State Variables, Functions Events, Inheritance, Abstract Contracts, Interfaces, Libraries.

**UNIT 5 DECENTRALIZED APPS – CODING DETAILS, STYLE GUIDE, DESIGN PATTERNS 9 Hrs.**

Decentralized Application Architecture, Connecting to the Blockchain and Smart Contract, Web3js, Deployment Sample Web Pages (HTML/CSS/JavaScript), Voting Contract and App, Blind Auction Contract and App Safe Remote Purchase Contract and App, Micropayment Channel Contract and App, Coding Style Guide Code Layout, Naming Conventions, Common Design Patterns, Withdrawal from Contracts, State Machine.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Knowledge on Ethereum and it's significant difference from Bitcoin.
**CO2 -** Technological overview on Ethereum and it's uses.
**CO3 -** Step to set-up for Smart Contract.
**CO4 -** Development of application using Smart Contract Programming.
**CO5 -** Decentralised application study.
**CO6 -** Scope and significant uses of Smart Contract.

**TEXT / REFERENCE BOOKS**

1. Ethereum Homestead Documentation, Ethereum Community, March 01, 2017: http://www.ethdocs.org/en/latest/index.html.
2. Solidity Documentation, Ethereum Community, May 14, 2021:. https://solidity.readthedocs.io/en/develop/index.html.
3. http://www.ethdocs.org/en/latest/introduction/what-is-ethereum.html.
4. https://solidity.readthedocs.io/en/develop/introduction-to-smart-contracts.html.
5. http://www.ethdocs.org/en/latest/contracts-and-transactions/index.html.
6. https://solidity.readthedocs.io/en/develop/solidity-in-depth.html.
7. https://solidity.readthedocs.io/en/develop/solidity-by-example.html.
8. https://solidity.readthedocs.io/en/develop/style-guide.html.
9. https://solidity.readthedocs.io/en/develop/common-patterns.html.

**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**

| SCSB1662 | BUILDING PRIVATE BLOCKCHAIN | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVE**

- To deploy Private Blockchain and smart contracts on Ethereum.
- To understand the importance of consensus.
- To implement Blockchain for various use cases.

**UNIT 1 INTRODUCTION TO BLOCKCHAIN 9 Hrs.**

What is Block chain? Basic ideas behind Blockchain, how it is changing the landscape of digitalization, Uses of Blockchain. Abstract Models for BLOCKCHAIN - GARAY model - RLA Model,what is Multichain? Objective of Multichain, Features of Multichain, Uses of Multichain, Processof mining in Multichain technology, Analyse Multichain platform, why it is better than other openplatforms Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hash chain to Blockchain, Basic consensus mechanisms.

**UNIT 2 CONSENSUS & DAPPS 9 Hrs.**

Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains (DAPPS) - Characteristics of Decentralized application, Setting up a Private Blockchain, Multiple configurable Blockchains using Multichain Deployment scenarios of Multichain, Centralized currency settlement, Bond issuance and peer-to-peer trading Consumer-facing rewards scheme in Decentralized Applications.

**UNIT 3 HYPERLEDGER FABRIC 9 Hrs.**

Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chain code Design and Implementation Hyperledger Fabric (B): Beyond Chain code: fabric SDKand Front End (b) Hyperledger composer tool.

**UNIT 4 USECASE MODEL – PRIVACY BLOCKCHAIN 9 Hrs.**

**Use case 1:** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance.

**Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supplychain finance, invoice management discounting, etc.

**UNIT 5 USECASE MODEL – BLOCKCHAIN DIGITAL IDENTITY 9 Hrs.**

Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain

**Max. 45 Hrs.**

## COURSE OUTCOME

On completion of the course, student will be able to

**CO1 -** Recall the structure and mechanism of Bitcoin, Ethereum, Hyperledger andMultichain Blockchain platforms.

**CO2 -** Infer the importance of consensus in transactions and how transactions are storedon B lockchain.

**CO3 -** Setup your own private Blockchain and deploy smart contracts on Ethereum.

**CO4 -** Deploy the business network using Hyperledger Composer.

**CO5 -** Implement Blockchain in private sector.

**CO6 -** Implement Blockchain for Digital Identity.

## TEXT / REFERENCE BOOKS

1. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015.
2. Melanie Swa “Blockchain”, First Edition, O’Reilly Jan 2015.
3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric 2.Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smit. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html.

## 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** |

| S613BLH61 | INTRUSION DETECTION SYSTEM | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To apply data mining techniques and methods to large data sets.
- Be familiar with the algorithms of data mining.
- Be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
- Be exposed to web mining and text mining.
- To use network security tools and vulnerability assessment tools.
- To compare and contrast the various classifiers.

**UNIT 1 PRE-CRIME DATA MINING 12 Hrs.**

Behavioural Profiling, Rivers of Scraps, Data Mining, Investigative Data Warehousing, Link Analysis, Software Agents, Text Mining, Neural Networks, Machine Learning, Precrime, September 11, 2001, Criminal Analysis and Data Mining, Profiling via Pattern Recognition, Calibrating Crime, Clustering Burglars: A Case Study.

**Practice Program:**

1. Apriori Algorithm.
2. FP-Growth Algorithm.
3. K-means clustering.
4. One Hierarchical clustering algorithm.

**UNIT 2 INVESTIGATIVE DATA WAREHOUSING 12 Hrs.**

Relevant Data, Data Testing, The Data Warehouse, Internet Data, XML, Data Preparation, Interrogating the Data, Data Integration, Security and Privacy, Choice Point: A Case Study, Tools for Data Preparation, Link Analysis: Visualizing Associations, Using Link Analysis Networks, Fighting Wireless Fraud with Link Analysis: A Case Study, Link Analysis Tools.

**Practice Program:**

1. Bayesian Classification.
2. Decision Tree.
3. Support Vector Machines.

**UNIT 3 TEXT MINING:CLUSTERING CONCEPTS 12 Hrs.**

Text Mining Definition, Working of Text Mining Work, Text Mining Applications, Searching for Clues in Aviation Crashes: A Case Study, Clustering News Stories: A Case Study, Text Mining for Deception, Text Mining Threats, Text Mining Tools.

**Practice Program:**

1. Applications of classification for web mining.
2. Case Study on Text Mining or any commercial application.
3. Demonstrate intrusion detection system (ids) using any tool e.g. Snort or any other s/w.

**UNIT 4 INTRUSION DETECTION: TECHNIQUES AND SYSTEMS 12 Hrs.**

Cybercrimes, Intrusion MOs, Intrusion Patterns, Anomaly Detection, Misuse Detection, Intrusion Detection Systems, Data Mining for Intrusion Detection: A Case Study from the Mitre Corporation, Types of IDSs, Misuse IDSs, Anomaly IDSs, Multiple-Based IDSs, Data Mining IDSs, Advanced IDSs, Forensic Considerations, Early Warning Systems

**Practice Program:**

1. Automated Attack and Penetration Tools, Exploring N-Stalker, a Vulnerability Assessment Tool
2. Demonstrate Intrusion Detection System (IDS) using any tool (snort or equivalent software).
3. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

**UNIT 5 MAPPING CRIME: CLUSTERING CASE WORK 12 Hrs.**

Crime Maps, Interactive Crime GIS, Crime Clusters, Modelling the Behaviour of Offenders Who Commit Serious Sexual Assaults: A Case Study, Decomposing Signatures Software, Computer Aided Tracking and Characterization of Homicides and Sexual Assaults (CATCH), Forensic Data Mining, Alien Intelligence, Weka tool: Introduction to WEKA, The Explorer – Getting started, Exploring the explorer.

**Practice Program:**

1. Setup a honey pot and monitor the honeypot on network (KF Sensor).
2. Penetration testing, IDS.

**Max. 60 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Study the pre crime data mining techniques.
**CO2 -** Be familiar with the searchable database.
**CO3 -** Learn the clustering concepts using text mining.
**CO4 -** Evaluate and analyse the intrusion detection, techniques and systems.
**CO5 -** Learn to map the crime using clustering.
**CO6 -** Learn the different tools for applying mining concepts.

**TEXT REFERENCE BOOKS**

1. Investigative Data Mining for Security and Criminal Detection, Jesús Mena, Butterworth Heinemann, Elsevier Science, 2003.
2. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
4. Intrusion detection systems Edited by Pawel Skrobanek Intrusion Detection Systems Edited by Pawel Skrobanek Published.

| S613BLH62 | DEVOPS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 | 100 |

**COURSE OBJECTIVES**

- To understand DevOps the advanced process of software engineering for faster problem resolution & team collaboration.
- To understand about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- To learn the integration of Cloud with DevOps.
- To understand the Configuration Tool.
- To Understand the Monitoring Tool.

**UNIT 1 INTRODUCTION TO DEVOPS 12 Hrs.**

Introduction to DevOps – DevOps vs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD & DevOps Tools–Version Control – Build Automation – Configuration Management- Containerization –– Continuous Deployment – Continuous Integration – Continuous Testing –Continuous Monitoring.

**Practice Program:**

1. Version Control to Perform Version Control on websites/ Software using different Version control tools like RCS/ CVS/GIT/Mercurial.
2. Virtualization & Containerization to Install and Configure Docker for creating Containers of different Operating System Images 04 LO 1 LO 4.

**UNIT 2 AGILE SOFTWARE DEVELOPMENT 12 Hrs.**

Software Development- using Extreme Programming – Roles & Rules - Software Development using Scrum Framework – Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.

**Practice Program:**

1. Implement IaaS with AWS.
2. Implement PaaS with AWS.

**UNIT 3 CLOUD COMPUTING AND AWS 12Hrs**

Cloud computing -Characteristics of cloud computing - Cloud implementation models - Cloud service models - Elastic Cloud Computing – Simple Storage Service – Elastic Block Storage - Elastic Load Balancer – Auto Scaling – Identity Access Management -Relational Database Server.

**Practice Program:**

1. Implement SaaS with Azure.
2. Virtualization & Containerization to Build, deploy and manage web application on Docker.

**UNIT 4 GIT AND CONFIGURATION MANAGEMENT TOOL 12 Hrs.**

GIT Basics-Different Git tools - Git Installation and Configuration - Setting up Git Bash and Git UI -GIT commands –Configuration Management Tool: Overview of Chef-Workstation Setup - Organization Setup- Test Node Setup -Puppet Architecture -Installation and Configuration.

1. **Practice Program:**
2. Virtualization & Containerization to Build, deploy and manage java application on Docker.
3. Implement and GUI for Kubernetes.

**UNIT 5 DEPLOYMENT AND MONITORING TOOL 12 Hrs.**

Deployment Tool - Jenkins - Build Cycle - Jenkins Architecture-Installing and configuring Jenkins using WAR and RPM-Securing Jenkins- Dockers vs Virtualization - Docker Architecture - Docker Networking-Monitoring tool - About New Relic - Installing and Configuring New Relic - Application Monitoring using New Relic - Server Monitoring using New Relic - Alerts policies.

**Practice Program:**

1. Provisioning to Perform Software Configuration Management and provisioning using Chef / Puppet / Ansible or Saltstack.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Apply DevOps faster problem resolution & team collaboration.
**CO2 -** Implement Agile software methodology for faster development of quality software.
**CO3 -** Describe how to improve collaboration between Cloud and DevOps.
**CO4 -** Implement Configuration Management.
**CO5 -** Implement Automated Installations and Deployments.
**CO6 -** Unresolved different transformations of a product or a service through brainstorming and incremental approach, etc.

**TEXT / REFERENCE BOOKS**

1. KalloriVikram, ―Introduction to DevOps, 1 st Edition, KalloriVikram Publication, 2016.
2. Jaokim Verona, ―Practical DevOps, 2 nd Edition, Packt. Publication, 2018.
3. Stephen Fleming, Pravin, ―DevOps Handbook: Introduction of DevOps Resource Management―,1st Edition, Createspace Independent Pub., 2010.
4. Len Bass, Ingo Weber, Liming Zhu, G., ―DevOps: A Software Architect's Perspective, 1st Edition, Addison-Wesley Professional, 2015.
5. Alistair Cockburn, "Agile Software Development", 2nd ed, Pearson Education, 2007.

| SCSB1761 | BLOCKCHAIN AND FINTECH | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the benefits of using blockchain in financial sector.
- To visualize how decentralized nature of blockchain is impacting banking and financial sector.
- To get an insight on the trading logics in decentralized Markets.
- To understand the limitation of cryptocurrency Regulations.
- To know how blockchain regulations and future trends related to blockchain to be used in financial sector.

**UNIT 1 INTRODUCTION 9 Hrs.**

Cryptocurrencies: Concept, Cryptocurrency Mining, Uses of Cryptocurrencies, Tokens, Token vs Crypto Coin, Concept of ICOs (Initial Coin Offerings), Benefits of Using ICOs, STOs (Security token offerings), ICO vs STO, Cryptocurrency wallets.

**UNIT 2 DECENTRALIZED FINANCE 9 Hrs.**

Decentralized Finance (DeFi): Concept, Benefits and Risks Associated with DeFi, Centralized vs Decentralized finance, DeFi Projects, DeFi future trends.

**UNIT 3 TRADING LOGICS 9 Hrs.**

Decentralized Markets: Concept of Decentralized markets, impact of decentralization on financial market, Decentralized Exchanges (DEX), Security, control and privacy concerns related to DEX, Liquidity and Usability of DEX, best DEXs for trading, Fund Management and Trading logic of DEX, Concept of Decentralized Web.

**UNIT 4 CRYPTOCURRENCY REGULATIONS 9 Hrs.**

Blockchain & Cryptocurrency Regulations: Introduction, History Stance of the Government, Judicial Approach to Cryptocurrency, Possible Reasons for Ban, Virtual Currency Regulations, Global Perspective of Regulations on Blockchain, Future needs for Regulations.

**UNIT 5 BANKING AND BLOCKCHAIN 9 Hrs.**

Blockchain in Banking Sector: Cross-Border Payments Using Blockchain and Its Benefits, Study of blockchain platforms used for cross-border payments, Impact of Blockchain on Banking Services. Stable Coin: Concept, Uses and Types of Stable Coins.
Case-Study: Tether and Libra Coins.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Analyse the basic of blockchain and currency in finance sector.
**CO2 -** Demonstrate the trading logics in blockchain.
**CO3 -** Understand difference between different types of coins and tokens related to blockchain technology.
**CO4 -** Study the benefits of blockchain in banking sector.
**CO5 -** Analyse the concept of decentralized markets.
**CO6 -** Understand the concept of banking and block chain.

## TEXT / REFERENCE BOOKS

1. Melanie Swan, Blockchain: Blueprint for a new economy, Shroff Publisher/O'Reilly Publisher.
2. Ron Quaranta, Blockchain in Financial Markets and Beyond: Challenges and Applications, Risk Books Publisher.
3. Richard Hayen, Blockchain & FinTech: A Comprehensive Blueprint to Understanding. Blockchain & Financial Technology.
4. Bitcoin, FinTech, Smart Contracts, Cryptocurrency, Risk Books Publisher.

## 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**

| S613LH71 | INTRODUCTION TO HYPERLEDGER FABRIC | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 0 | 2 | 100 |

**COURSE OBJECTIVES**

- Gain an in-depth understanding of Blockchain & its implementation.
- Perform comprehensive labs on writing chaincode.
- implement the blockchain applications with Ethereum, Hyperledger Fabric and Composer.
- Build our own Blockchain enterprise with acquired knowledge.

**LIST OF EXPERIMENTS**

Suggested List of Experiments

1. Create a Simple Blockchain in any suitable programming language.
2. Use Geth to Implement Private Ethereum Block Chain.
3. Build Hyperledger Fabric Client Application.
4. Build Hyperledger Fabric with Smart Contract.
5. Create Case study of Block Chain being used in illegal activities in real world.
6. Using Python Libraries to develop Block Chain Application.
7. Create a Fabric Demo on Blockchain Cloud.

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Understand and explore the working of Blockchain technology.
**CO2 -** Understand and analyse the working of Hyperledger.
**CO3 -** Apply the Concept of private and public Blockchain, and smart contract.
**CO4 -** Learn the features of the Fabric model including chaincode, SDKs, Ledger, Security and Membership Services.
**CO5 -** Gain a detailed understanding of the benefits, components, and architecture of Hyperledger Composer.
**CO6 -** Build applications on Hyperledger Fabric v1.1.

**END SEMESTER EXAM QUESTION PAPER PATTERN**

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

| | | | |
|---|---|---|---|
| **CAE :** | Evaluation of Regular Lab class Model practical exam | **15 Marks** | |
| **ESE :** | End Semester Practical Exam | **10 Marks** | **25 Marks** |

| SCSB3461 | BLOCKCHAIN ECOSYSTEM | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand a broad overview of the essential concepts of blockchain technology.
- To Learn techniques and tools to tackle the security related issues of blockchain.
- To understand the working and importance of smart contracts.
- To understand different types of Decentralized applications developed using blockchain technology.
- To learn and apply security analysis and performance-enhancing techniques related to blockchain.

**UNIT 1 NETWORK AND SECURITY 9 Hrs.**

Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Blockchain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Blockchain.

**UNIT 2 BLOCKCHAIN SECURITY ISSUES 9 Hrs.**

Blockchain Related Issues, Higher-Level Language (Solidity) Related Issues, EVM Bytecode Related Issues, Real-Life Attacks on Blockchain Applications/ Smart Contracts, Trusted Execution Environments.

**UNIT 3 SMART CONTRACTS 9 Hrs.**

Definition and Need, Features of Smart Contracts, LifeCycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages. Building A Simple Smart Contract with Solidity, Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.

**UNIT 4 PERFORMANCE RELATED ISSUES 9 Hrs.**

Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems, Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications. Performance Improvements: Off-Chain State Channels, Sidechains, Parallels Chains, Concurrent Smart Contract Transactions, Sharding Technique and Its Benefits, Atomic Swaps Between Smart Contracts.

**UNIT 5 CHALLENGES IN BLOCK CHAIN 9 Hrs.**

Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication – Data management in industry 4.0 – future prospects. Blockchain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality – Healthcare Value - Challenges for using blockchain for healthcare data.

**Max. 45 Hrs.**

## COURSE OUTCOMES

On completion of the course, student will be able to

**CO1 -** Illustration of essential components of a blockchain platform.
**CO2 -** Applying security analysis and performance-enhancing techniques related to blockchain.
**CO3 -** Study the working and importance of smart contracts.
**CO4 -** Understand the security and performance perspective of blockchain technology.
**CO5 -** Scrutinize different types of uses of blockchain and apply it to some real-life scenarios accordingly.
**CO6 -** Apply the best features of engineering and natural sciences to program real life problems.

## TEXT / REFERENCE BOOKS

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (March 17, 2017).
2. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
3. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.

## 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**

| SCSB3462 | PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the key concepts of public key infrastructures.
- To learn about the need of Identity Management Process and its importance in public key infrastructure.
- To understand the PKI Essentials and Functions.
- To focus on PKI in enterprise.
- To explore the basics of Trust Management.
- To acquire knowledge on applications and usage of PKI.

**UNIT 1 INTRODUCTION, INFRASTRUCTURE CONCEPTS AND PKI SYSTEM ESSENTIALS 9 Hrs.**

Introduction, PKI Features, PKI Hierarchy, Pervasive security services, Building a comprehensive security model, Public key cryptosystems, public key encryption, Necessity authentication in public key systems, Authentication protocols, Key management techniques - establishment, management and certification.

**UNIT 2 PKI FUNCTIONS 9 Hrs.**

Encryption, Decryption, Signature, Verification Certification Authority, Certificate repository, Key recovery, Server & User Certificates, PKI & IPSec, PKI Technologies, PKI Solutions Interoperability.

**UNIT 3 ENTERPRISEWIDE PKI 9 Hrs.**

Internal PKI Architectures, Key Deployment & Management, Certification Process, Keys & Policies, Password Validation Procedures, Managing Keys, Key Distribution, Key Backup & Recovery, PKCS standards.

**UNIT 4 PKI TRUST CONCEPTS 9 Hrs.**

Generating, using and validating digital signatures, Building a Certification Authority and extending trust through PKI, Integrating a PKI with existing directory systems, Linking PKIs using cross-certification, Identifying certificate components, P2P trust, Web of Trust, Trust Models, Constraints.

**UNIT 5 INTEGRATING A PKI WITH APPLICATIONS AND PRACTICAL IMPLEMENTATION 9 Hrs.**

Expiration and Revocation, Implementing a PKI solution to support a selected environment, Advanced topics.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Differentiation of public key technology and a public key infrastructure.
**CO2 -** Discuss about PKI Essentials and Functions.
**CO3 -** Obtain the importance of a rigorous identity management process needs and its role in a public key infrastructure.
**CO4 -** Distinguish the necessary components of a certificate policy and practices statement.
**CO5 -** Improvise the knowledge on implementation of a public key infrastructure, including the technology, policy, standards, and long-term maintenance considerations.
**CO6 -** Familiarise on the applications of PKI.

## TEXT / REFERENCE BOOKS

1. Bruce Scheneir: "Applied Cryptography", 2/E, John Wiley, 1996.
2. Menezes, Oorschot, Vanstone: "Handbook of Applied Cryptography", CRC Press, 1996.
3. Philip. Robinson, Harald. Vogt, Waleed. Wagealla ,"Privacy, Security, and Trust Within the Context of Pervasive Computing", 1/E, Springer, 2004.
4. David Chadwick, Gansen Zhao, "Public Key Infrastructure: Second European PKI Workshop: Research and Applications, EuroPKI 2005, Canterbury, UK, 2005, Revised Selected Papers (Lecture Notes in Computer Science) ", 1/E, Springer; 2005.
5. Ketil Stølen , William H. Winsborough ,Fabio Massacci, "Trust Management: 4th International Conference, iTrust 2006, Proceedings (Lecture Notes in Computer Science) ", 1/E, Springer, 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**

| SCSB3413 | MATHEMATICS FOR INTELLIGENT SYSTEMS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To lay down the basic concepts and techniques of linear algebra, calculus and basic probability theory.
- To explore the concepts initially through computational experiments and then try to understand the concepts/theory.
- To provide an appreciation of the wide application of these disciplines within the scientific field.
- To provide connection between the concepts of linear algebra, differential equation and probability theory.

**UNIT 1 LINEAR ALGEBRA 9 Hrs.**

Highlights of Linear Algebra: Four Fundamental Spaces, Eigenvalues and Eigenvectors, SVD, PCA and best low rank matrix. Raleigh Quotients and Generalized Eigenvalues, Norms of vectors andmatrices, Factoring matrices and tensors. Computation with Large matrices: Krylov subspaces and Arnoldi iteration, Linear System solution by Arnoldi and GMRES, Conjugate gradient method.

**UNIT 2 THEORY OF OPTIMIZATION 9 Hrs.**

(Convex and Non-convex basics) - Unconstrained optimization methods, Direct methods for convex functions, sparsity inducing penalty functions, Newton methods for non-convex functions. Constrained Convex Optimization problems, Formulating problems as LP and QP, support vector machines, solving by packages (CVXOPT) , Lagrangian multiplier method, KKT conditions, Introduction to Alternating direction method of multipliers- the algorithm. Kalman Filter, Optimal Sensor based Control, , Full state Feedback of Cartpole Pendulum, Robust Control and Frequency domain Techniques.

**UNIT 3 SIGNAL PROCESSING 9 Hrs.**

Applications in signal processing and pattern classification. Introduction to PDEs arising in Physics and Engineering (problem formulations and simple numerical methods for solutions).

**UNIT 4 NEURAL NETWORKS 9 Hrs.**

Gradient Descent, Stochastic gradient descent and ADAM (adaptive methods), Loss function The Construction of Deep Neural Networks, CNNs, Back propagation and Chain Rule, Hyper Parameters, The world of Machine learning.

**UNIT 5 PROBABILITY AND STATISTICS 9 Hrs.**

Probability and statistics - Moments, cumulants, and inequalities of statistics, Covariance matrices and joint probabilities, Multivariate Gaussian and weighted least squares, Markov chains, Markov decision process - advanced aspects. Expectation- Maximization, Variational Inference, Variational Learning, Support Vector Machines, Neural Networks, Bayesian Modelling.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** To develop an understanding of the basic concepts and techniques of linear algebra, calculus and basic probability theory needed for AI.

**CO2 -** To provide an appreciation of the wide application of these disciplines within the scientific field.

**CO3 -** To provide connection between the concepts of linear algebra, differential equation and probability theory.

**CO4 -** To develop an insight into the applicability of linear algebra in business and scientific domains.

**CO5 -** To enable the students to understand the use of calculus and Linear algebra in modelling electrical and mechanical elements.

**CO6 -** To equip the students to understand the role of probability theory in providing data sets for computational experiments in data science.

**TEXT / REFERENCE BOOKS**

1. 'Linear Algebra and learning from data', Gilbert Strang, Wellesley, Cambridge press, 2019.
2. 'Data Driven Science and Engineering', Steve Brunton and Nathan Kutz, Cambridge University Press, 2018 'Machine Learning: A Probabilistic Perspective', Kevin Murphy and Francis Bach, 2012.
3. Differential Equations and Linear Algebra', Gilbert Strang, Wellesley, Cambridge press, 2018.
4. 'Linear Algebra and learning from data', Gilbert Strang, Wellesley, Cambridge press, 2019.
5. 'Convex Optimization', Stephen Boyd and Lieven Vandenberghe, Cambridge University Press, 2018.

**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**

| SCSB3038 | ADVANCED COMPUTER NETWORKS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To introduce topics related to computer networks and internet operating system together with knowledge on how to develop products over them.
- 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, Makefile 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, 2010, ISBN: 8131758184.
2. Andrew S.Tanenbaum, David J.Wetherall, Computer Networks, 5th Edition, Pearson, ISBN-13: 978-0-13-212695-3.
3. M J Bach, The Design of the Unix Operating System, 1st edition, Pearson Education,2015, ISBN: 9332549575.
4. J Cooperstein, Writing Linux Device Drivers - A Guide with Exercises, Createspace, 2009, ISBN: 1448672384.

**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**

| SCSB3028 | CYBER DIGITAL TWIN | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To gain knowledge in cyber security and digital firmware.
- To identify types of digital twin and data IoT technologies.
- To make a twin Modelling.
- To understand about Modelling, Risk Management and Twin Constructions.
- To make students aware of security concerns while implementing Cyber Digital Twin Technology.

**UNIT 1 INTRODUCTION 9 Hrs.**

Introduction- Cyber Digital twin-definition-uses and benefits-need for digital twin-working principle Technology Digital thread- digital shadow-building blocks of digital twin-digital twin technology drivers and enablers**.**

**UNIT 2 DATA MODELING ENVIRONMENT 9 Hrs.**

Types of digital twin-Based on Product and Process-Based on Functionality-Based on Maturity. Development considerations- Overview of Data-Modeling Environment. Modelling-model and data management-Managing data-implementing the model- Cloud and IOT technologies.

**UNIT 3 DIGITAL TWIN OPTMIZATION 9 Hrs.**

Cyber range vs digital twin-human behavior modeling in digital twin-optimization using digital twin-digital twin and cyber security- Techniques. Technologies-Industrial IOT and Digital Twin-simulation and digital twin-Machine learning and digital twin-virtual reality and digital twin-cloud technology and digital twin.

**UNIT 4 RISK MANAGEMENT 9 Hrs.**

Digital twin and Risk Assessment-Digital twin reference model-Implementation-Development of risk assessment plan- Development of communication and control system-Development of digital twin tools-Integration-platform validation-Difficulties- Practical implications.

**UNIT 5 APPLICATIONS 9 Hrs.**

Applications: Digital Twin in Manufacturing-Digital Twin in Automotive-Digital Twin in Healthcare-Digital Twin in Utilities-Digital Twin in Construction.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Implement fundamental Cyber System and Digital Twin Technology.

**CO2 -** Understand types and data modelling of Digital twin.

**CO3 -** Understand the optimization, simulation and validation.

**CO4 -** Know about the risk and Control development.

**CO5 -** Understand the application in different fields.

**CO6 -** Develop applications using Cyber digital Twin Technologies.

**TEXT / REFERENCE BOOKS**

1. Cyber-physical System and Digital Twins - Michael E. Auer Kalyan Ram B. Digital - Part of the Lecture Notes in Networks and Systems book series.
2. Development and Deployment on the Cloud – Nassim Khaed, BibinPattel and Affan Siddiqui – Elsevier 2020.
3. Hacking Exposed Industrial Control Systems: ICS and SCADA Security Secrets & Solutions (1st Edition), by Clint Bodungen, Bryan Singer, Aaron Shbeeb, Kyle Wilhoit, and Stephen Hilt, ISBN: 978-1259589713.
4. Applied Cyber Security and the Smart Grid: Implementing Security Controls into the Modern Power Infrastructure (1st Edition), by Eric D. Knapp and Raj Samani.
5. The Art of Invisibility - Kevin Mitnick,2017.

**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**

| SCSB3451 | INTERPRETABLE MACHINE LEARNING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To oversee and understand the machine learned decisions.
- To understand and ensure that the ML models are unbiased in predictions, robustness and trustable in every situation.
- Understand the advanced model of machine interpretation.

**UNIT 1 MACHINE INTERPRETATION 9 Hrs.**

Introduction – Machine Learning Terminology – Importance of Interpretability – Taxonomy and scope of Interpretability Methods – Evaluation of Interpretability – Explanations.

**UNIT 2 ML MODELS 9 Hrs.**

Interpretable models: Linear regression – logistic regression – Generalized Linear Models (GLM) – Generalized Additive Model (GAM)– Decision Tree and Rules – RuleFit – Naive Bayes classifier – k-nearest neighbor.

**UNIT 3 INTERPRETATION OF MODELS 9 Hrs.**

Model-agnostic interpretation methods: partial dependence plot – Individual Conditional Expectation – Accumulated local effects– Feature interaction – Permutation feature importance – Anchors – Shapley Values – Shapley additive explanations (SHAP).

**UNIT 4 ADVANCED MODELS 9 Hrs.**

Global Surrogate and Local Surrogate (LIME) models – Counterfactual explanation – Adversarial examples – Prototypes and Criticisms – Maximum Mean Discrepancy (MMD) – Influential Instances.

**UNIT 5 NN MODEL INTERPRETATION 9 Hrs.**

Neural Network Interpretation: Feature visualization – Network Dissection – Pixel Attribution – Testing with Concept Activation Vectors– The future of ML and Interpretability.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Have an insight about the need and scope of interpretability in machine learning (ML.)
**CO2 -** Understand how a complete ML model works and how every single decision was taken during model execution.
**CO3 -** Understand how ML models access the information and perform the correlation.
**CO4 -** Understand the concept and able to construct the Surrogate models.
**CO5 -** Understand and interpret the neural network architectures.
**CO6 -** Apply neural network architectures to real world classification problems.

**TEXT / REFERENCE BOOKS**

1. Molnar, Christoph. Interpretable machine learning. Lulu Press, 2019.
2. Hall, Patrick, and Navdeep Gill. An introduction to machine learning interpretability. O'Reilly Media, Incorporated, 2019.

**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**

| SCSB3561 | BLOCK CHAIN TECHNOLOGY-BUSINESS INNOVATION AND APPLICATIONS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand and implement business model.
- To know how the structures and architecture of firms in Blockchain.
- To learn about digital contracts in blockchain.
- To define digital contracting.
- To understand various trust models.

**UNIT 1 INTRODUCTION TO BUSINESS MODELS 9 Hrs.**

New Business Models, opportunities for blockchain to disrupt or displace traditional centralized business models. blockchain technology can support “open networked enterprise” business models through the inclusion of native payment systems, reputation systems, no-censorable content, trustless transactions, smart contracts, and autonomous agents.

**UNIT 2 BLOCKCHAIN AND THE C-SUITE 9 Hrs.**

Blockchain and the C-Suite, blockchain changes the deep structures and architecture of the firm, it will consequently transform our models of mana gement and the roles of the C-Suite. Navigating the balance between blockchain’s hype and its true potential is a key responsibility of an organization’s management team, decisions and changes that business leaders can anticipate when considering how the future of blockchain will unfold within t heir business.

**UNIT 3 THE NEXT ERA 9 Hrs.**

Leadership for the Next Era, Blockchain alone is just a tool, fulfil its long-term promise, humans must lead. Rather than relying on state-based institutions, blockchain must be primarily self- governed through collaborations of civil society, private sector, government, and stakeholders in non- state networks, the idea of blockchain governance networks and explain how they can support blockchain stewardship at three levels: The platform level , the application level, and the ecosystem level. As well, you will learn about the conditions that are necessary for a blockchain-based hub of innovation to succeed.

**UNIT 4 DIGITAL CONTRACTING 9 Hrs.**

Blueprint for a New Social Contract, digital revolution unfolds, global economy, labour markets, old institutions, and society as a whole. To realize the potential of the blockchain revolution, we need business leaders to come to the table as responsible and active participants in a new s ocial contract for both their own long-term interests as well as in the interest of a healthy society and economy, possible directions for a new social contract—i.e., the agreements, laws, and behaviours that people, companies, civil society, and their governments adhere, catalyse investigation, debate, and action.

**UNIT 5 TRUST AND VULNERABILITY 9 Hrs.**

Trust and Vulnerability Short history of the scaling out of human trust. High and Low trust societies, Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Analysis opportunity in blockchain properly.
**CO2 -** Able to implement any problem by writing their own business idea.
**CO3 -** Define a Suitable Model.
**CO4 -** Analyzing business and propose model in blockchain.
**CO5 -** Design an efficient blockchain business administrator.
**CO6 -** Realize the Trust and Vulnerability in block chain.

**TEXT / REFERENCE BOOKS**

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps Kindle Edition, by Daniel Drescher.
2. Bitcoin and Cryptocurrency Technologies, by Arvind Narayanan, Joseph Bonneau, Edward Felten.

**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**

| SCSB3037 | COMPREHENSIVE LINUX FOR ALL | 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 serverRHEL- 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.

**Max. 45 Hrs.**

## COURSE OUTCOMES

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

**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** |

| SCSB3562 | BLOCKCHAIN IN HEALTHCARE | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To Learn about healthcare business needs.
- To understand the role of Blockchain in healthcare.
- To provide instruction on how to apply Blockchain to your healthcare business needs and requirements.
- To build Blockchain-based healthcare systems.

**UNIT 1 INTRODUCTION 9 Hrs.**

Healthcare Industry Overview-Healthcare services, Healthcare Market Analysis-Drug Counterfeiting-Clinical Trials-Healthcare Record Management- Blockchain Technology: A Strategic Resource-Blockchain Technology and its applications in Healthcare Sector. Digital Transformation in Healthcare: Innovation and Technologies.

**UNIT 2 FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY 9 Hrs.**

History of blockchain-Decentralization/centralization-Distributed ledger-private vs public-Mining and consensus mechanisms-Dapps and Smart Contracts-Intro to healthcare on blockchain including Medical records FHIR, HL7.

**UNIT 3 HEALTHCARE RECORD MANAGEMENT 9 Hrs.**

Case study of NHS Ransomware, Equifax Data Breach- Limitations of Healthcare Records Management-Blockchain for Healthcare Records- Secure and Decentralized Management of Health Records-Blockchain Technology Applications for Improving Quality of Electronic Healthcare System.

**UNIT 4 PREVENTING DRUG COUNTERFEIT 9 Hrs.**

Blockchain in Pharmaceutical Sector -Pharmaceutical Supply Chain-Cold Supply Chain-Blockchain in stopping Drug Counterfeit- Managing medical supply chain using blockchain technology.

**UNIT 5 CLINICAL TRIAL 9 Hrs.**

Problem overview-Mismanagement of Data, Challenges faced in clinical trial-Standardization of Data Collection-Prevention of Data Manipulation-Simplified Data Provenance for Data Scientists- IoT-Based Healthcare Monitoring Using Blockchain- Blockchain Technology in Medical Data Management and Protection in India: The Law in the Making.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Analyze real-life use cases in the Healthcare Sector.

**CO2 -** Construct a strategy to make use of blockchain for varying healthcare industry need.

**CO3 -** Understand the hosting and mining options.

**CO4 -** Design innovative products.

**CO5 -** Implement Automated Installations and Deployments.

**CO6 -** Design Healthcare Monitoring system.

**TEXT / REFERENCE BOOKS**

1. Namasudra, Suyel, Deka, Ganesh Chandra, — Applications of Blockchain in Healthcare, Springer 2021.
2. Vikram Dhillon , John Bass, Max Hooper-Blockchain in Healthcare: Innovations that Empower Patients, Connect Professionals and Improve Care (HIMSS Book Series) Hardcover – Illustrated, 24 January 2019.
3. Sheikh Mohammad Idrees, Parul Agarwal,M. Afshar Alam-Blockchain for Healthcare Systems Challenges, Privacy, and Securing of Data- 2021 by CRC Press.
4. Melanie Swan, "Block Chain: Blueprint for a New Economy", O"Reilly, first edition – 2015.
5. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 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** |

| SCSB3554 | DATA MINING AND PREDICTIVE MODELING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn, how to develop models to predict categorical and continuous outcomes.
- To learn techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
- To know the use of the binary classifier and numeric predictor nodes to automate model selection.
- To advice on when and how to use each model. Also learn how to combine two or more models to improve prediction.

**UNIT 1 INTRODUCTION TO DATA MINING 9 Hrs.**

Introduction, what is Data Mining? Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

**UNIT 2 DATA UNDERSTANDING AND 9 Hrs.**

Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.

**UNIT 3 MODEL DEVELOPMENT AND TECHNIQUES 9 Hrs.**

Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

**UNIT 4 MODEL EVALUATION AND DEPLOYMENT 9 Hrs.**

Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Meta Level Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

**UNIT 5 PREDICTION METHODS 9 Hrs.**

Linear Regression: Best Subset Selection-Forward Selection, Backward Selection, Step-wise Regression, All Subsets Regression, Penalized Regression Methods- Ridge, LASSO, Adaptive LASSO, and Elastic Net, k-Nearest Neighbors, Regression Trees- CART, CHAID, Neural Nets.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Able to understand the data mining concepts.

**CO2 -** Understand the process of formulating business objectives, data selection/collection.

**CO3 -** Able to design, build, evaluate and implement predictive models for a various business application.

**CO4 -** Compare the underlying predictive modeling techniques.

**CO5 -** Select appropriate predictive modeling approaches to identify cases to progress with.

**CO6 -** Apply predictive modeling approaches using a suitable package such as SPSS Modeler.

## TEXT / REFERENCE BOOKS

1. Predictive & Advanced Analytics, 2017 (IBM ICE Publication).
2. Data Mining Methods and Models, Daniel T. Larose,2006.
3. Data Mining for Business Intelligence by GalitShmueli, Nitin R. Patel, and Peter C. Bruce, Wiley, 3rd ed., 2016.
4. Data Mining and Predictive Analytics, Daniel T. Larose, 2015.
5 Predictive Analytics and Data Mining: Concepts and Practice with RapidMiner, Bala Deshpande, Vijay Kotu,2014 END SEMESTER EXAMINATION QUESTION PAPER PATTERN.

### 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** |

| SCSB4005 | HARDWARE INTERFACES AND ITS APPLICATION | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the components on the motherboard.
- To understand different storage media.
- Install and Repair computer system.
- Install Network devices, configuration, optimization.
- Understand the features of different I/O peripheral devices and their interfaces.

**UNIT 1 INTRODUCTION TO PC AND MEMORY 9 Hrs.**

Evolution of Personal Computers - Overview of Systems and Components - Processor Modes - Modern CPU Concepts - Architectural Performance Features - Intel Core X-Series Processor - CPU Over Clocking - Essential Memory Concepts - Memory Packages - Logical Memory Organizations - Memory Considerations - Memory Types - SSD - OPTANE Memory - Memory Techniques - Selecting and Installing Memory - CPU Coolers.

**UNIT 2 MOTHERBOARD DESIGNS 9 Hrs.**

Motherboard Form Factors - IBM PC XT -IBM PC AT - The Baby AT - Micro-AT -LPX and Mini-LPX - ATX - Mini-ATX - NLX - Active Motherboards - Sockets and Expansion Slots – DIMM.2 - M.2 Expansion Card – PCIE GEN3 M.2 - Intel D850GB - Upgrading a Mother Board -DDR4 BOOST - Chipsets - Intel - Non-Intel Chipsets - North Bridge - South Bridge - CMOS - Motherboard BIOS - RGB Headers - Live Dash OLED - NEXT GEN Connectivity 802.11 AD WIFI - USB 3.1 GEN2 Controller.

**UNIT 3 POWER SUPPLIES AND STORAGE DEVICES 9 Hrs.**

Power Supplies and Power Management - Modular – Non-Modular - Concepts of Switching Regulation - Potential Power Problems - Power Management -The Floppy Drive - Magnetic Storage - Floppy Drive - Hard Drive - SSD- CD-ROM Drive - DVD-ROM - DVD Media - DVD Drive and Decoder.

**UNIT 4 I/O PERIPHERALS AND BUS ARCHITECTURE 9 Hrs.**

Parallel Port - Signals and Timing Diagram - IEEE1284 Modes - Asynchronous Communication - Serial Port Signals - Video Adapters - Mice - Keyboards - Sound Cards – ISA - PCI - AGP.

**UNIT 5 NETWORK COMPONENTS 9 Hrs.**

Introduction of Network Cable - Ethernet Cable - FIBER Optics – HUB - Unmanageable Switch - Manageable Switch – Router – Modem - Wi-Fi - Access Point - PCI Wireless Card - USB Wireless Device - Print Server.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Explain the relationship between hardware and software.
**CO2 -** Classify and explain the function of different computer hardware components.
**CO3 -** Understand purpose and functions of networking.
**CO4 -** Understand the purpose and functions of the computer peripherals.
**CO5 -** Understand diagnostic procedures and troubleshooting techniques to personal computers, portable devices, operating systems and computer peripherals.
**CO6 -** Simulate various Hardware intetfaces.

## TEXT / REFERENCE BOOKS

1. Stephen J Bigelow, “Trouble Shooting, maintaining and Repairing PCs”, Tata McGraw-Hill.
2. Ron Gilster, “PC Hardware: A Beginner's Guide”, Tata McGraw-Hill.
3. Craig Zacker and John Rourke, “The complete reference: PC hardware”, Tata McGraw-Hill.
4. Mike Meyers, “Introduction to PC Hardware and Troubleshooting”, Tata McGraw-Hill.
5. B.Govindarajulu, “IBM PC and Clones hardware trouble shooting and maintenance”, Tata McGraw-Hill.

### 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** |

| SCSB3564 | ADVANCE BLOCK CHAIN TECHNOLOGY AND ARCHITECTURE | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn basic and system of block chain.
- To understand how the structures and architecture of firms.
- To concede about digital contracts in block chain.
- To Apply the Transaction in Ethereum.
- To implement cryptographic protocols.

**UNIT 1 INTRODUCTION 9 Hrs.**

Block chain - The growth of block chain technology-Distributed Systems-The History of block chain and Bitcoin-Types of Blockchain-Consensus-CAP theorem and block chain.

**UNIT 2 DECENTRALIZATION 9 Hrs.**

Decentralization- Decentralization using blockchain- Methods of decentralization- Routes of decentralization-Block chain and full ecosystem decentralization- Smart contracts- Decentralization Organizations-Platforms for decentralization.

**UNIT 3 ETHEREUM 9 Hrs.**

Overview of Ethereum - Ethereum accounts -Transactions-Consensus-Timestamp-Nonce-Block Time-Forking-Genesis block- Ether virtual machine-Geth-Ethereum Wallet-Mist.

**UNIT 4 BLOCKCHAIN GOVERNANCE 9 Hrs.**

Blockchain for Government: Digital identity, and records and other kinds of record keeping between government entities, public distribution system social. Blockchain Cryptography Privacy and Security on Block chain, Block chain consensus protocols, Various recent works on scalability.

**UNIT 5 CRYPTOGRAPHIC PROTOCOLS 9 Hrs.**

Secure cryptographic protocols on Block chain Secured, Multi-party Computation, Blockchain, for science: making better use of the data-mining network, Case Studies: Comparing Ecosystems - Bitcoin, Hyper ledger, Ethereum and more.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Understand the basics of block chain Architecture.
**CO2 -** Design & implement blockchain as a digital asset properly.
**CO3 -** Define Ethereum accounts and Transactions.
**CO4 -** Identify the records and understand the protocols.
**CO5 -** Ability to apply cryptographic protocol.
**CO6 -** Apply Block chain for science.

**TEXT / REFERENCE BOOKS**

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps Kindle Edition, by Daniel Drescher.
2. Bitcoin and Cryptocurrency Technologies, by Arvind Narayanan, Joseph Bonneau, Edward Felten.

## 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** |

| SCSB3855 | VULNERABILITY ANALYSIS AND PENETRATION TESTING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**UNIT 1 INTRODUCTION 9 Hrs.**

Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non-Disclosure Agreement Checklist, Phases of hacking, Open-source/proprietary Pentest Methodologies.

**UNIT 2 INFORMATION GATHERING AND SCANNING 9 Hrs.**

Information gathering methodologies- Foot printing, Competitive Intelligence 3DNS Enumerations- Social Engineering attacks, Port Scanning-Network Scanning Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting- Enumeration.

**UNIT 3 SYSTEM HACKING 9 Hrs.**

Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Error based, Union-based, Time-based, Blind SQL, Out-of-band. SQL Injection Prevention Techniques.

**UNIT 4 ADVANCED SYSTEM HACKING 9 Hrs.**

Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS - Stored, Reflected, DOM Based.

**UNIT 5 WIRELESS PENTEST 9 Hrs.**

Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Misassociation, Wireless Hacking Methodology, Wireless Traffic Analysis.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Understanding about penetration testing phases and methods.
**CO2 -** Gathering of conceptual information and Vulnerability Scanning and attacks.
**CO3 -** Demonstrate the different SQL injection techniques and password cracking techniques.
**CO4 -** Have practical exposure to the concepts of authentication advance hacking methods.
**CO5 -** Analysing wireless pen test and types of encryption attacks.
**CO6 -** Apply the concepts of WLAN attacks and methodology for analysis.

**TEXT / REFERENCE BOOKS**

1. Kali Linux Wireless Penetration Testing Beginner's Guide by Vivek Ramachandran, Cameron Buchanan,2015 Packt Publishing.
2. SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication.
3. Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016 Packt Publishing.
4. Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver, June 2016 Packt Publishing.
5. Kali Linux Revealed: Mastering the Penetration Testing Distribution – June 5, 2017, by Raphael Hertzog (Author), Jim O'Gorman (Author), Offsec Press Publisher.

## 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** |

| SCSB3661 | BITCOIN MINING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn cryptocurrencies and its basics.
- To understand how bitcoin centralization and decentralization works.
- To build a mechanics bitcoin transaction and its limitations.
- To learn use and storage mechanisms and its services.
- To describe bitcoin mining system with mining strategies.

**UNIT 1 INTRODUCTION TO CRYPTO AND CRYPTOCURRENCIES 9 Hrs.**

Cryptographic Hash Functions-Hash Pointers and Data Structures-Digital Signatures-Public Keys as Identities-A Simple Cryptocurrency.

**UNIT 2 DECENTRALIZATION 9 Hrs.**

Centralization vs. Decentralization-Distributed Consensus-Consensus without Identity: The Block Chain-Incentives and Proof of Work- How Bitcoin Achieves Decentralization- Choosing Mining Equipment.

**UNIT 3 MECHANICS OF BITCOIN 9 Hrs.**

Bitcoin Transactions- Bitcoin Scripts- Applications of Bitcoin Scripts- Bitcoin Blocks- The Bitcoin Network-Limitations & Improvements.

**UNIT 4 BITCOIN USE & STORAGE 9 Hrs.**

Store and use bitcoins-Hot and Cold Storage- Splitting and Sharing Keys- Online Wallets and Exchanges-Payment Services- Currency Exchange Markets.

**UNIT 5 BITCOIN MINING 9 Hrs.**

Task of Bitcoin Miners-Mining Hardware-Energy consumption ecology-Mining Pools-Mining incentives and strategies-Case studies-Filecoin: A Decentralized Storage Network, Enigma: Decentralized Computation Platform with Guaranteed Privacy.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Able to know about crypto and hash functions, pointers.
**CO2 -** Understand decentralization consensus in blockchain along with proof of work.
**CO3 -** Describe mechanics of bitcoin and its applications, limitations and improvements.
**CO4 -** Ability to know bitcoin use and its storage systems.
**CO5 -** Apply bitcoin mining tasks and energy consumption strategies.
**CO6 -** CO6: Design case studies like decentralization storage and computation platforms.

**TEXT / REFERENCE BOOKS**

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.
2. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayanan, Steven Goldfeder, Joseph Bonneau, Edwar d Felten, Andrew Miller,2016.
3. Bitcoin Fact,Fiction and Future by hill owen, 2018.
4. Mastering Ethereum: Building Smart Contracts and DApps Andreas Antonopoulos,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 carrying16 marks | **80 Marks** |

| SCSB3662 | BLOCKCHAIN IN GOVERNANCE | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand how blockchain is used in governance.
- To learn types of governance in blockchain.
- To understand governance strategies.
- To learn how to use governance in prediction.
- To understand the concepts of decentralized autonomous organization.

**UNIT 1 INTRODUCTION 9 Hrs.**

Blockchain- A Primer -Blockchain Platforms for Real life Applications, Blockchain Governance Principles-What is Governance - Governance Types -Standard Governance, Blockchain Governance, Blockchain Governance -Getting Started Blockchain Governance Importance.

**UNIT 2 BLOCKCHAIN GOVERNANCE 9 Hrs.**

Design Thinking & Blockchain Solution design-Blockchain Governance Importance -Blockchain Governance Responsibility-Core Developers-Node Operators-Token Holders-Blockchain Team-Complexities with Blockchain System Governance.

**UNIT 3 BLOCKCHAIN GOVERNANCE STRATEGIES AND ELEMENTS 9 Hrs.**

Blockchain and Governments-Blockchain Countries-Key Government applications of Blockchain-Blockchain Application patterns for Integration and Interoperability -Blockchain Governance Elements-Consensus-Incentives-Information -Governing Structure- Understanding the Two Types of Blockchain Governance: Off-Chain and On-Chain-Desirable elements in a Blockchain Consortium.

**UNIT 4 BLOCKCHAIN STACK IN BLOCKCHAIN GOVERNANCE 9 Hrs.**

Role of Blockchain Stack In Blockchain Governance-The Internet Layer-Internet Service Providers-(ISPs)Deep Package Inspection (DPI)-ISP data caps-Country-based Firewalls-The Blockchain Layer-The Application Layer.

**UNIT 5 CHALLENGES AND LIMITATION & DECENTRALIZED AUTONOMOUS ORGANIZATION 9 Hrs.**

DAO- Design -smart contracts in governance -prediction. Case study, Challenges and Limitations of implementing Blockchain Solutions-Encouraging Blockchain adoption & educating the new generation for adoption.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Explain how Blockchain governance principles can be implied.
**CO2 -** Understand how governance is done with blockchain.
**CO3 -** Establish a view on strategies and elements of blockchain.
**CO4 -** Analyse blockchain & stack.
**CO5 -** Conceptualize a view on blockchain and ISP and firewall.
**CO6 -** Apply and adopt block chain for new generation.

## TEXT / REFERENCE BOOKS

1. Blockchain in e-Governance, Rajesh Dhuddu, Srinivas Mahankali publications.
2. https://101blockchains.com/blockchain-governance/.

### 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** |

| SCSB3663 | DIGITAL WATERMARKING AND STEGANOGRAPHY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn about the watermarking models and message coding.
- To learn about watermark security and authentication.
- To learn about watermark data hiding and integrity of data.
- To learn about steganography. Perceptual models.
- To provide an insight to steganography techniques.

**UNIT 1 INTRODUCTION 9 Hrs.**

Introduction: Information Hiding, Steganography and Watermarking – History of watermarking – Importance of digital watermarking, Steganography. Applications and Properties: – Applications – Properties – Evaluating watermarking systems. Applications of Steganography, Properties of Watermarking Systems, Evaluating Watermarking Systems, Properties of Steganographic and Steganalysis Systems, Evaluating and Testing Steganographic Systems.

**UNIT 2 MODELS OF WATERMARKING & BASIC MESSAGE CODING 9 Hrs.**

Models of Watermarking: Notation-Communication-Communication Based Models of Watermarking, Geometric Models of Watermarking, Modeling Watermark Detection by Correlation,

Basic Message Coding: Mapping Messages into Message Vectors, Error Correction Coding, Detecting Multisymbol Watermarks.

**UNIT 3 WATERMARKING WITH SIDE INFORMATION AND PERCEPTUAL MODELS 9 Hrs.**

Watermarking with side information & analysing errors: Informed Embedding – Informed Coding- dirty paper codes – Structured dirty- paper codes - Message errors – False positive errors – False negative errors – ROC curves – Effect of whitening on error rates.

Perceptual models: Evaluating perceptual impact – General form of a perceptual model- Watson's model – Adaptive watermarking- – Examples of perceptual models – Robust watermarking approaches - Redundant Embedding, Spread Spectrum Coding, Embedding in Perceptually significant coefficients.

**UNIT 4 WATERMARK SECURITY & AUTHENTICATION 9 Hrs.**

Watermark Security Secret Writing, Steganography and authentication: Security requirements – Watermark security and cryptography.

– Attacks – Exact authentication – Selective authentication – Localization – Restoration.

**UNIT 5 STEGANOGRAPHY 9 Hrs.**

Steganography: Steganography communication – Notation and terminology – Information Theoretic Foundations of Steganography– Practical steganographic methods - Spatial Domain, transform domain techniques, spread spectrum, Statistical steganography – Minimizing the embedding impact – Steganalysis- Steganalysis Scenarios, Some Significant Steganalysis Algorithms.

**Max. 45 Hrs.**

## COURSE OUTCOMES

On completion of the course, student will be able to

**CO1 -** Know the History and importance of watermarking and steganography.
**CO2 -** Learn the concept of information hiding.
**CO3 -** Analyse Applications and properties of watermarking and steganography.
**CO4 -** Demonstrate Models and algorithms of watermarking.
**CO5 -** Possess the passion for acquiring knowledge and skill in preserving authentication of Information Identify theoretic foundations of steganography and steganalysis.

## TEXT / REFERENCE BOOKS

1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, “Digital Watermarking and Steganography”, Margan Kaufmann Publishers, New York, 2008.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, “Digital Watermarking”, Margan Kaufmann Publishers, New York, 2003.
3. Frank Y. Shih, “Digital Watermarking and Steganography: Fundamentals and Techniques”, CRC Press, USA, 2007.
4. Stefan Katzenbeisser, Fabien A. P. Petitcolas, “Information Hiding Techniques for Steganography and Digital Watermarking”, Artech House, 2000.
5. Jessica Fridrich, “Steganography in Digital Media: Principles, Algorithms, and Applications”, Cambridge university press, 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** |

| SCSB3612 | DEEP REINFORCEMENT LEARNING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

## COURSE OBJECTIVES

- This course aims to provide the cutting-edge concepts in deep reinforcement learning.
- It also helps the students to train an agent which can perform a variety of complex tasks.
- It will also help students to learn about the core challenges and approaches, including generalization and exploration and also make the students well versed in the key ideas and techniques for deep reinforcement learning.

**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 RECURRENT AND RECURSIVE NEURAL NETWORKS 9 Hrs.**

Tree Recursive Neural Networks and Constituency Parsing - Recurrent neural networks for language modeling Dynamic Networks for Question Answering.

**UNIT 3 CONVOLUTIONAL NEURAL NETWORKS 9 Hrs.**

Convolutional Neural Networks -Recurrent and Recursive Neural Networks - Backpropagation Algorithms - Regularization Optimization Techniques for Training such Networks.

**UNIT 4 DYNAMIC PROGRAMMING 9 Hrs.**

Dynamic Programming - Monte Carlo and Temporal Difference and Function Approximation - Reinforcement Learning Algorithm Applications of Deep and Reinforcement Learning.

**UNIT 5 DEEP REINFORCEMENT LEARNING 9 Hrs.**

Value function methods - Deep RL with Q-learning – Multi agent RL - Eligibility Traces – Policy Gradient Methods – Application Case studies.

**Max. 45 Hrs.**

## COURSE OUTCOMES

On completion of the course the student will be able to

**CO1 -** Comprehend the basics of deep reinforcement learning.
**CO2 -** Implement in code deep reinforcement learning algorithms.
**CO3 -** Criticize the core challenges and opportunities in the field of deep reinforcement learning.
**CO4 -** Apply Monte Carlo reinforcement learning algorithms.
**CO5 -** Apply temporal-difference reinforcement learning algorithms.
**CO6 -** Construct on-policy reinforcement learning algorithms with function approximation.

## TEXT / REFERENCE BOOKS

1. Richard.S. Sutton and Andrew G. Barto, Reinforcement Learning, second edition, MIT Press, 2018.
2. "Deep Learning" by Ian Good fellow,Yoshua Bengio, and Aaron Courville (MIT Press, 2016) http://www.deeplearningbook.org/;.
3. "Reinforcement Learning: An Introduction" by Richard S.Sutton and Andrew G. Barto http://incompleteideas.net/book/the- book-2nd.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** |

| SCSB3008 | CYBER FORENSICS AND INFORMATION SECURITY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To impart knowledge on Cyber Crime and Cyber Forensics.
- To learn about Cyber Investigation and Evidence Management.
- To understand Digital Forensics.

**UNIT 1 UNRSTANDING THE THREAT FROM CYBER CRIME 9 Hrs.**

Introduction Cyber Threat – Definition of Cyber Crime – Classification – Current Threats and Trends – Diversity of Cyber Crime – Cyber Hate Crimes – Cyber Terrorism.

**UNIT 2 RESPONDING TO CYBER CRIME 9 Hrs.**

Cyber Strategy – National Security Strategy – Cyber Security Strategy – Organized Crime Strategy – Cyber Crime Strategy - Policy ber Crime – International Response National Cyber Security Structure – Strategic Policy Requirements – Police and Crime Commissioners.

**UNIT 3 INVESTIGATING CYBER CRIME 9 Hrs.**

Preventing Cyber Crime – Password Protection – Get Safe Online – Cyber Security Guidance for Business - Cyber Crime Investigation Skills – Criminal Investigation Code of Ethics – Evidence – Hi-Tech Investigations – Capturing and Analysing Digital Evidence.

**UNIT 4 DIGITAL FORENSICS 9 Hrs.**

Introduction to Digital Forensics - Forensic Software and Hardware - Analysis and Advanced Tools - Forensic Technology and Practices - Forensic Ballistics and Photography - Face, Iris and Fingerprint - Recognition - Audio Video Analysis - Windows System Forensics - Linux System Forensics - Network Forensics.

**UNIT 5 CASE STUDY 9 Hrs.**

Latest Study Topics on Cyber Crime and Investigations - Recent Cyber Crime Cases – Recent Digital Forensics Cases – Bridging the Gaps in Cyber Crime Investigations between the cyber security stake holders.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1 -** Infer the various ideas about cybercrime.
**CO2 -** Describe the Cyber Crime Strategy.
**CO3 -** Identify the Cyber Crime Investigation Methodology.
**CO4 -** Generalize the knowledge on Digital Forensics.
**CO5 -** Apply the Concepts of Cyber Crime and Digital Forensics in Real Time Scenarios.
**CO6 -** Apply the Concepts of Cyber Crime to bridge the gaps between stake holders.

**TEXT / REFERENCE BOOKS**

1. Thomas Halt, Adam M. Bossler and Kathryn C. SeigfriedSpellar, ―Cybercrime and Digital Forensics: An Introductionǁ, Routledge Taylor and Francis Group 2017.
2. Bernadette H Schell, Clemens Martin, ―Cybercrimeǁ, ABC – CLIO Inc, California, 2004.

**E BOOKS**

https://books.google.co.in/books/about/Cybercrime_and_Digital_Forensics.html?id=7SA6DwAAQBAJ&redir_esc=y.

**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** |

| SCSB3761 | BLOCKCHAIN IN ASSET MANAGEMENT | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn about the Blockchain technology and distributed ledgers.
- To learn about Adoption and Deployment of blockchain technology.
- To learn about Asset management Model.
- To learn about Asset management framework and Inherent Risks of Digital Asset Exchange
- To learn about Cryptoassets.

**UNIT 1 BLOCKCHAIN TECHNOLOGY AND DISTRIBUTED LEDGERS 9 Hrs.**

Blockchain 1.0: Currency, Technology Stack: Blockchain, Protocol, Currency-The Double-Spend and Byzantine Generals' Computing Problems-Cryptocurrency Works - eWallet Services and Personal - Cryptosecurity-Merchant Acceptance of Bitcoin, Relation to Fiat Currency. Blockchain 2.0: Contracts, Financial Services, Crowdfunding-Bitcoin Prediction Markets-Smart property - Trustless Lending-Coloured coins. Smart Contracts- Blockchain and smart contract flow diagram Distributed databases and Distributed Ledger Technologies (DLT) - Public and private blockchains- Traditional Ledger-Permissioned Private Ledger-Permissioned Public Ledger - Unpermissioned Public Ledger-Consensus.

**UNIT 2 ADOPTION AND DEPLOYMENT OF BLOCKCHAIN TECHNOLOGY 9 Hrs.**

Challenges of adoption and deployment of blockchain technology -Common standards-Misconceptions and lack of knowledge- Confidentiality vs transparency-Finding and replacing paper-based processes - Gap between digital twin and physical asset-X-Decks- Distribution of liabilites-Key features for X-Decks-key features of the blockchain technology in application to X-Decks-linear and hierarchical building and management process- adoption scenarios for blockchain-based trading in the parking industry-Stakeholders- Interview Analysis-Discussion-Business and Information flows-Innovation & Fictions-Conceptions and Expectations.

**UNIT 3 ASSET MANAGEMENT MODEL 9 Hrs.**

Asset management Model -Core consortium asset management flow-Core consortium asset management flow on the blockchain-B2B asset management process flow-B2B asset management flow on the blockchain-B2C asset management process flow -B2C asset management flow on the blockchain-asset management in the supply chain of the X-Decks case be applied to a blockchain enabled asset management framework- stakeholder attitudes affect the framework.

**UNIT 4 ASSET MANAGEMENT FRAMEWORK AND INHERENT RISKS OF DIGITAL ASSET EXCHANGE 9 Hrs.**

Blockchain enabled asset management framework-Business Network Overview-further research in the asset management framework- Risk Management-Criteria of business transactions-Risks within an electronic (digital) environment-Inherent risks with the exchange of digital assets.

**UNIT 5 CRYPTOASSETS 9 Hrs.**

Defining Cryptoassets as A New Asset Class-Asset Class-Key Differentiators Between Asset Classes-Economic Characteristicsof an Asset Class-The Evolution of Cryptoasset Market Behaviour-Analysis and A Valuation Framework for Cryptoassets. Operating Health of Cryptoasset Networks and Technical Analysis-Investing Directly Incryptoassets: Mining, Exchanges, and Wallets.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Outline the Blockchain technology and Distributed ledgers.

**CO2 -** Explore the Adoption and Deployment of blockchain technology.

**CO3 -** Use the Asset management Model.

**CO4 -** Explore the Asset management framework and Inherent Risks of Digital Asset Exchange.

**CO5 -** Outline the Cryptoassets.

**CO6 -** Explore the Health of Cryptoasset Networks and Technical Analysis.

**TEXT / REFERENCE BOOKS**

1. Burniske, C., & Tatar, J. Cryptoassets: The innovative investor's guide to bitcoin and beyond. New York: McGraw- Hill Education.2018
2. Swan, Melanie. Blockchain: Blueprint for a new economy. " O'Reilly Media, Inc.", 2015.
3. Weihs, Benjamin. "Blockchain enabled asset management in the case of X-Decks: Cooperation enhanced by decentralization in the building industry." (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 carrying16 marks | **80 Marks** |

| SCSB3516 | WEB SECURITY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand and implement web technology.
- To get an insight on the authentication in web-based application.
- To manage sessions and implement web security principles.
- To define the limitations of web application.
- To know various protocols in web security.

**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 Defence-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, student will be able to

**CO1 -** Able to understand web security.
**CO2 -** Able to authenticate for different application.
**CO3 -** Define sessions and security principles.
**CO4 -** Analyze the vulnerabilities of application.
**CO5 -** Test session vulnerabilities and forgery.
**CO6 -** Implement the right protocol for the respective application.

## TEXT / REFERENCE BOOKS

1. B. Sullivan, V. Liu, and M. Howard, Web Application Security, A B Guide. New York: McGraw-Hill Education, 2011. (ISBN No.: 978-0-07-177616-5).
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. (ISBN No.: 978-1-46-659261-2).
4. M. Shema and J. B. Alcover, Hacking Web Apps: Detecting and Preventing Web Application Security Problems. Washington, DC, United States: Syngress Publishing, 2014. (ISBN No.978-1-59-749951.

## 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** |

| SCSB3762 | ANDROID SECURITY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the mobile technologies.
- To assess the security of mobile applications with respect to data protection, privacy and undesirable application behaviour.
- To understand the tools and techniques which exploit SSL/TLS channels.
- To understand the tricks in software and hardware part of mobile phone.
- To protect mobile device data and mitigate against malware targeted to mobile devices.

**UNIT 1 INTRODUCTION TO ANDROID 9 Hrs.**

Introduction to mobile technologies, mobile operation systems, Mobile devices - pros and cons, Introduction to Android, Versions, Features, Architecture, UI Widgets and Events handling, Layouts, Required tools - Eclipse, ADT, AVD, Application structure, Android Manifest file, Creating Android applications.

**UNIT 2 BUILDING BLOCKS AND DATABASES 9 Hrs.**

Introduction to Activities and Intents - Understanding Activity life cycle, Linking Activities, Passing Data, Toast, Displaying a Dialog Window and Notifications. Content Provider, Services, Broadcast receivers, accessing databases, Location and sensors, Multimedia audio, video and camera, Deploying and publishing application.

**UNIT 3 SECURE MOBILE APPLICATION DEVELOPMENT 9 Hrs.**

Leverage TLS/SSL – Follow secure programming practices – validate input – leverage the permissions model used by OS – use the least privilege model for system access – store sensitive information properly – sign application code – figure out a secure and strong update process – understand mobile browser's security strength and limitations – zero out nonthreats – use secure mobile URLs.

**UNIT 4 SOFTWARE AND HARDWARE TRICKS IN MOBILE PHONE 9 Hrs.**

Net monitor – GSM network service codes – mobile phone codes – catalogue tricks – AT command set – software – hardware.

**UNIT 5 MOBILE PHONE FORENSICS 9 Hrs.**

Crime and mobile phones – The evidence – Forensic procedures – File present in SIM card – Device data – external memory dump – external memory cards and computers – evidence in the operator's network.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Learn and understand the technology and business trends impacting mobile applications.
**CO2 -** Discuss on the concept of secure mobile application development.
**CO3 -** Analyse the hardware and software tricks used in mobile phone.
**CO4 -** Demonstrate how to protect mobile device data and mitigate against data loss.
**CO5 -** Understand the tools and techniques that can exploit secure mobile application.
**CO6 -** Analyze the evidence from mobile phone from both external and internal.

## TEXT / REFERENCE BOOKS

1. Reto Meier, “Professional Android Application Development”, Wrox Edition.
2. Mobile Application Security, Himanshu Dwivedi, Chris Clark and David Thiel, 1st Edition.
3. Mobile Phone Security and Forensics – A practical Approach, Iosif I. Androulidakis, Springer second edition.

### 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** |

| SCSB3716 | OPEN-SOURCE SYSTEMS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand open-source licenses and learn the implications for users, developers and the software community.
- To Understand the motivation, theory, strengths and weakness of open-source software.
- To become familiar with and become adapt using the tools of open-source development.
- To learn GNU.
- To practice open-source programming techniques.

**UNIT 1 OVERVIEW OF FREE/OPEN-SOURCE SOFTWARE 9 Hrs.**

Overview of Free/Open-Source Software - Definition of FOSS & GNU - History of GNU/Linux and the free software movement -Advantages of free software and GNU/Linux –Licensing - Types of licensing, Intellectual Proprietary Right, Commercial License vs. Open-source license- Open-Source Licensing, Contract and Copyright Law: Basic principles of copyright law, contract and copyright, open-source software licensing, Issues with copyrights and patents, warranties. The FOSS Philosophy, usage -Trends and potential -global and Indian –. FOSS Licenses – GPL- AGPL- LGPL – FDL – Implications – FOSS examples. Review of common programming practices and guidelines for GNU/Linux and FOSS.

**UNIT 2 LINUX 9 Hrs.**

Linux OS Installation and Hardware Configuration - Configure disk partitions & file systems and install a GNU/Linux distribution -Basic shell commands - Logging in, Listing files, editing files, copying/moving files, viewing file contents, changing file modes and permissions, process management User and group management -File ownerships and permissions -PAM authentication -Introduction to common system configuration files & log files -Configuring networking -Basics of TCP/IP networking and routing - Connecting to the Internet ,System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

**UNIT 3 OPEN-SOURCE TOOLS AND TECHNOLOGIES FOR HARDWARE AND E-MAIL SERVER 9 Hrs.**

Configuring additional hardware -Sound cards -Displays & display cards-Network cards-Modems -USB drives -CD writers - The OS boot up process -Performing everyday tasks using GNU /Linux - Accessing the Internet -Playing music -Editing documents and spreadsheets -Sending and receiving email -Copy files from disks and over the network -Playing games - Writing CDs -X Window system configuration and utilities -Configure X windows -Detect display devices -Installing software - From source code as well as using binary packages -Setting up email servers-Using postfix -(SMTP services) -Courier (IMAP & POP3 services) -Squirrel mail (web mail services) -Setting up web servers -Using Apache (HTTP services) - PHP (server- side scripting) -Perl (CGI support) -Setting up file services -Using samba (file and authentication services for windows networks) –Using NFS (file services for gnu/Linux / Unix networks) - Setting up proxy services -Using squid (http / ftp / https proxy services) – Printer Installation.

**UNIT 4 UNDERSTANDING GNU LIBC LIBRARIES, COMPILERS AND LINKER 9 Hrs.**

GNU compiler tools - The C compiler (gcc) and the C++ compiler (g++) - Linking against object archives (a libraries) and dynamic shared object libraries (.so libraries) -Generating statically linked binaries and libraries -Generating dynamically linked libraries -Using the GNU debugging tools - Gdb to debug programs -Graphical debuggers like ddd -Memory debugging/profiling libraries mpatrol and valgrind - Introduction to Bash, sed & awk scripting.

**UNIT 5 OPEN-SOURCE PROGRAMMING TECHNIQUES 9 Hrs.**

Application Programming-Basics of the X Windows server architecture-Qt programming-Gtk+ programming -Python programming - Execution Environment - Programming GUI applications with localisation support, Open-Source Equivalent of existing commercial software.

**Max. 45 Hrs.**

## COURSE OUTCOMES

On completion of the course, student will be able to

**CO1 -** Understands the importance of open-source and how it can be used in efficient manure.
**CO2 -** Understands the importance of licensing, legal impacts.
**CO3 -** Configured Hardware using open-source tools and technologies.
**CO4 -** Get experience with python programming language.
**CO5 -** Understand various system software tools.
**CO6 -** Implement various applications using open-source software.

## TEXT / REFERENCE BOOKS

1. N. B. Venkateshwarlu (Ed), “Introduction to Linux: Installation and Programming”, B S Publishers; 2005. (NRCFOSS Publication.
2. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 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** |

| SCSB3817 | FAULT TOLERANT SYSTEM | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To become familiar with general and state of the art techniques in fault tolerance system.
- To learn the design and analysis of fault-tolerant digital systems.
- Study and investigate existing fault-tolerant systems.
- To Learn both Hardware and software methods.
- To Learn new research topics in the fault tolerance system.

**UNIT 1 DEPENDABILITY CONCEPTS AND FAULT TOLERANT STRATEGIES 9 Hrs.**

Dependable system, techniques for achieving dependability, dependability measures, fault, error, failure, faults and their manifestation, classification of faults and failures. Fault detection, masking, containment, location, reconfiguration, and recovery. Fault tolerant design techniques and Testing: Hardware redundancy, software redundancy, time redundancy, and information redundancy. Testing and Design for Testabil ity.

**UNIT 2 INFORMATION REDUNDANCY AND FAULT TOLERANCE IN DISTRIBUTED SYSTEMS 9 Hrs.**

Coding techniques, error detection and correction codes, burst error detection and correction, unidirectional codes, Byzantine General Problem, consensus protocols, check pointing and recovery, stable storage and RAID architectures, and data replication and resiliency.

**UNIT 3 DEPENDABILITY EVALUATION TECHNIQUES AND TOOLS 9 Hrs.**

Fault trees, Markov chains; HIMAP tool. Analysis of fault tolerant hardware and software architectures. System-level fault tolerance and low overhead high-availability technique.

**UNIT 4 FAULT TOLERANCE IN REAL-TIME SYSTEMS 9 Hrs.**

Time-space trade-off, fault tolerant scheduling algorithms, Dependable communication: Dependable channels, survivable networks, fault-tolerant routing.

**UNIT 5 FAULT TOLERANT INTERCONNECTION NETWORKS 9 Hrs.**

Hypercube, star graphs, and fault tolerant ATM switches. Case studies of fault tolerant multiprocessor and distributed systems.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Familiar with general and state of the art techniques in fault tolerance system.
**CO2 -** Design and analysis of fault-tolerant digital systems.
**CO3 -** Investigate existing fault-tolerant systems.
**CO4 -** Understand both Hardware and software methods.
**CO5 -** Implement scheduling algorithms in faulty tolerance system.
**CO6 -** Develop new research topics in the fault tolerance system.

## TEXT / REFERENCE BOOKS

1. Avizienis and J. Laprie, ``Dependable Computing: From Concepts to Design Diversity," Proc. IEEE, Vol.74, No.5, pp.629-638.
2. A.K. Somani and N.H. Vaidya, ``Understanding fault-tolerance and reliability," IEEE Computer, Vol.30, No.4, pp.45-50.
3. M. Pease, R.Shostak, and L. Lamport, ``Reaching Agreement in the Presence of Faults," M. Pease, R.Shostak, and L. Lamport, Journal of ACM, #27 (180), pp.228-234.
4. The Byzantine Generals Problem, ACM Trans. Prog. Languages and Systems, 4(1982) pp. 382-401.
5. S. Ghosh, R. Melhem, and D. Mosse, ``Fault-tolerance through scheduling of aperiodic tasks in hard real-time multiprocessor systems," IEEE Trans. Parallel and Distributed Systems, Vol.8, No.3, pp.272-284.

## 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** |

| SCSB3763 | FINANCIAL SOFTWARE QUALITY ASSURANCE | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To provide deeper understanding of the basic tenets of software quality and quality factors.
- To explain the Software Quality Assurance (SQA) architecture and the details of SQA components.
- Understand of how the SQA components can be integrated into the project life cycle.
- To familiarize with the software quality infrastructure.
- Be exposed to the management components of software quality.

**UNIT 1 INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9 Hrs.**

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall"s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

**UNIT 2 SQA COMPONENTS AND PROJECT LIFE CYCLE 9 Hrs.**

Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

**UNIT 3 SOFTWARE QUALITY INFRASTRUCTURE 9 Hrs.**

Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions - Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

**UNIT 4 SOFTWARE QUALITY MANAGEMENT, METRICS AND STANDARDS 9 Hrs.**

Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model. Quality management standards – ISO 9001 and ISO 9000-3, SQA project process standards – IEEE st 1012 & 1028.

**UNIT 5 QUALITY ASSURANCE FOR FINANCIAL APPLICATION 9 Hrs.**

Quality assurance in financial services-key characteristics of quality assurance-Security, Reliability, Performance, Regulatory Compliance-testing techniques that used while testing finance applications-Challenges of Testing Financial Applications, Typical stages involved in testing the financial applications.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Utilize the concepts in software development life cycle.
**CO2 -** Demonstrate their capability to adopt quality standards.
**CO3 -** Examine the quality of software products.
**CO4 -** Apply the concepts in preparing the quality plan & documents can be prepared using concepts.
**CO5 -** Assure the quality for financial applications.
**CO6 -** Apply quality tools and technique in their projects.

**TEXT / REFERENCES BOOK**

1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.

2. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 1997.
3. Mordechai Ben-Menachem “Software Quality: Producing Practical Consistent Software”, International Thompson Computer Press, 1997.
4. Ordon G Schulmeyer, “Handbook of Software Quality Assurance”, Third Edition, Artech House Publishers 2007.
5. https://www.altexsoft.com/blog/engineering/quality-assurance-in-fintech/.

**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** |

| SCSB3471 | AUDIT AND MONITORING FOR INFORMATION SECURITY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To introduce the fundamental concepts and techniques in computer network security.
- To introduce the terminology, technology and its applications.
- To enable a clear understanding and knowledge of security analyst.
- To expose the latest trend of computer attack and defence.
- To introduce the tool, technologies and programming languages which is used by security analyst.

**UNIT 1 INTRODUCTION TO INFORMATION SECURITY 9 Hrs.**

Concept and objective of information security – importance of information security – Performance metrics and reporting – Issues and factors affecting performance metrics – Information Security Audits structure and reports – Infrastructure, Networks and Communication – IS methodologies (Grey- box, white-box, black-box) – phases in IS Audit and strategies.

**UNIT 2 CRYPTOGRAPHIC TECHNIQUES 9 Hrs.**

Cryptographic techniques – symmetric encryption, asymmetric encryption, message authentication and cryptographic hash functions, digital signatures and digital certificates, public-key infrastructure and web of trust.

**UNIT 3 SECURITY AUDITS 9 Hrs.**

Pre-audit checklist - data collection - vulnerability analysis - internal and external security audit – firewall security audit –IDS security audit – social engineering security audit, web application security audit – IS audit deliverables & report – result analysis, post auditing actions, report retention.

**UNIT 4 NETWORK AND HOST SECURITY 9 Hrs.**

Types of network attacks – host-based attack, network-based attack, web-based attacks, Network defence techniques – intrusion detection systems and firewall, IPSec and DNSSec, IPv6, cloud computing – Types of host attacks – virus, worm, Trojan horse, Rootkit & Stealth and stack-based buffer overflow – Host defence techniques.

**UNIT 5 MANAGING VULNERABILITIES 9 Hrs.**

IS based vulnerabilities – threats and vulnerabilities (human-based social engineering, computer-based social engineering, social media countermeasures) – vulnerability management – scanning – testing – threat management & remediation - vulnerability assessment and its types – phases in vulnerability assessment – assessment reports – IS risk assessment.

**Max. 45 Hrs.**

**COURSE OUTCOME**

On completion of the course, student will be able to

**CO1 -** Describe fundamental concepts of information security and system auditing.
**CO2 -** Understand the difference between security metrics and audits.
**CO3 -** Knowledge on Vulnerability Management.
**CO4 -** Analyze the latest trend of computer security threats and defense.
**CO5 -** Identify security weaknesses in information systems and rectify them with appropriate security mechanisms.
**CO6 -** Evaluate the security of information systems.

## TEXT / REFERENCE BOOKS

1. Assessing Information Security strategies tactics logic and framework by Andrew Vladimirov, Konstantin Gavrilenko, and Andriej Michajlowski.
2. The Art of Computer Virus Research and Defense, Addison-Wesley by Peter Szor.
3. William Stallings and Lawrie Brown, Computer Security Principles and Practice, (3rd Edition), Pearson, 2014.
4. Bruce Schneier, Applied Cryptography: Protocols, Algorithms and Source Code in C, Wiley, 2015.
5. Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno, Cryptography Engineering: Design Principles and Practical Applications, 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** |

| SCSB3512 | DISTRIBUTED SYSTEM | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To Understand the design principles in distributed systems and the architectures for distributed systems.
- To illustrate the middleware technologies.
- To Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, voting etc.
- To demonstrate the concept of Resource and Process Management.
- To design Distributed Consensus in open and closed Environment.

**UNIT 1 INTRODUCTION TO DISTRIBUTED SYSTEM 9 Hrs.**

Fundamentals and Message Passing: Fundamentals: Evolution of distributing computing system – Distributed computing system Models- Issues in Designing a distributed operating system- Message Passing: Desirable features of a good message passing system – Issues in IPC by message passing – Synchronization – Buffering – Multi datagram messages – Encoding and decoding of message data – process addressing – failure handling - Group Communication.

**UNIT 2 REMOTE PROCEDURE CALL 9 Hrs.**

Introduction – The RPC Model – Transparency of RPC – Implementing RPC mechanism– Stub generation– RPC messages – Marshaling arguments and results – Server Management parameter – Passing Semantics– call semantics – Communication protocols for RPC's – Complicated RPC's – Client Server Binding–Exception Handling – Security – some special types of RPC's – RPC in Heterogeneous environments –Light Weight RPC – Optimization for Better performance – Case studies: SUN RPC, DCE RPC.

**UNIT 3 DISTRIBUTED SHARED MEMORY AND SYNCHRONIZATION 9 Hrs.**

Distributed shared Memory: General Architecture of DSM systems – Design and Implementation issues of DSM – Granularity – Structure of shared memory space – Consistency Models – Replacement strategy – Thrashing – Other approaches to DSM – Heterogeneous DSM – Advantages of DSM. Synchronization: Clock synchronization – Event ordering – mutual exclusion – Deadlock – Election Algorithms.

**UNIT 4 RESOURCE MANAGEMENT AND DISTRIBUTED FILE SYSTEM 9 Hrs.**

Resource Management: Introduction – Desirable features of a good global scheduling algorithm – Task assignment approach – Load Balancing approach – Load sharing approach. -Process management: Introduction – process migration – Threads. Distributed File Systems: Desirable features of a good distributed file system – File models – File accessing Models – File sharing semantics – File caching schemes – File Replications – Fault tolerance – atomic Transactions.

**UNIT 5 BITCOIN AND DISTRIBUTED CONSENSUS 9 Hrs.**

Consensus introduction -Distributed consensus in open environments-Consensus in a Bitcoin network Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW, Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn – Proof of Elapsed Time – Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment-Paxos. Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Demonstrate knowledge of the basic elements and concepts related to distributed system technologies.

**CO2 -** Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.

**CO3 -** Analyze the various techniques used for clock synchronization and mutual exclusion

**CO4 -** Demonstrate the concepts of Resource and Process management and synchronization algorithms.

**CO5 -** Understand on Bitcoin and Bitcoin Network.

**CO6 -** Implement Distributed Consensus in Closed Environment.

**TEXT / REFERENCE BOOKS**

1. Pardeep K. Sinha, Distributed Operating Systems, Prentic-Hall India -1997.
2. George Coulouris, Jean Dollimore and Tim Kindberg - Distributed Systems Concepts and Design, Pearson Education, 3rd Edition 2002.
3. Sape Mullender - Distributed Systems,Addison Wesley, 2nd Edition, 1993.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
5. Svetlin Nakov and SoftUni Team-Practical Blockchain for Developers: July 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 carrying16 marks | **80 Marks** |

| SCSB3861 | AI ENHANCED CYBER THREATS | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVE**

- To understand the knowledge in solving AI problems.
- To study the fundamentals of Cyber security.
- To learn and analyse the impact of AI on cyber security.
- To secure the web with AI and develop the Web Application Security.
- To study the cyber threats.

**UNIT 1 INTRODUCTION AND PROBLEM SOLVING 9 Hrs.**

Introduction – Understanding AI Basics – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies - Searching with partial Information. Fundamentals of AI for Security- deep learning fundamentals from a security perspective - cyber security space problem solution.

**UNIT 2 FUNDAMENTALS OF CYBER SECURITY 9 Hrs.**

Identity, authentication, confidentiality, privacy, anonymity, availability and integrity-Exploring cryptographic algorithms together with major attacks- Exploring high-level security protocols- biometric authentication - Compliance and security assessment – introduction to penetration testing - Active Directory Security Assessment (ASDA) and cyber insurance risk assessment.

**UNIT 3 IMPACT OF AI ON CYBER SECURITY 9 Hrs.**

Threat hunting in memory, file system and network data - introductory analysis of malicious programs - cyber threat hunting and digital investigation -detailed analysis of real-world case studies - unusual and non-virulent types of malwares: KNN (K - Nearest Neighbours) for threat visualisers, Isolation Forest for anomaly detection, LSTM for multi-vector correlation, DBSCAN for riskware detection and fraud, LSTM (Autoencoder) for endpoint protection.

**UNIT 4 SECURE WEB AND APPLICATION 9 Hrs.**

Securing web with AI - making websites secure using AI techniques for injection - using regular expressions and identifying patterns and matching with existing scores – Applications using statistical patterns and Bayesian statistics -Web Application Security, Injection, Broken authentication, Sensitive data exposure, XML External Entities (XXE), Broken access control, Security misconfiguration, Cross-Site Scripting (XSS), Insecure deserialization, Using components with known vulnerabilities and Insufficient logging and monitoring.

**UNIT 5 CYBER THREATS 9 Hrs.**

Future of AI in Advancing Security and Promoting, Artificial Intelligence vs. Data Analytics, Applying AI to cybersecurity, Some early AI adopters, AI Use by Adversaries, Using Artificial Intelligence Tools to Enhance Security, Deep learning applications, Cyber Security Threats and Development of Secure Software, Securing IOT Infrastructure, Secure AI Development, Large scale deployment of AI algorithms on production, End-to-end case study for a secure IoT application in a develops ecosystem.

**Max. 45 Hrs.**

## COURSE OUTCOME

On completion of the course, student will be able to

**CO1 -** Understand the knowledge in solving AI problems .
**CO2 -** Study the fundamentals of Cyber security.
**CO3 -** Learn and analyse the impact of AI on cyber security.
**CO4 -** Secure the web with AI and develop the Web Application Security.
**CO5 -** Study the cyber threats.
**CO6 -** Learn the case study for secure IOT application.

## TEXT / REFERENCES BOOKS

1. Enhanced Methods in Computer Security, Biometric and Artificial Intelligence Systems, Jerzy Peja and rzej Piegat Technical University of Szczecin, Poland, Springer.
2. https://www.coursera.org/learn/ibm-cyber-threat-intelligence#instructors.
3. https://www.captechu.edu/search?keywords=syllabus.
4. http://polisci.rutgers.edu/images/syllabi/Cyber_Security_and_AI_790_574_90_Course_Syllabus_V1_19493.pdf.
5. https://www.conted.ox.ac.uk/courses/artificial-intelligence-for-cyber-security-online.
6. https://www.conted.ox.ac.uk/courses/artificial-intelligence-for-cyber-security-online#application_container.

## 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 Understand the concepts of privacy in today's environment.
- To Illustrate the legal, ethical and professional issues in data privacy by using statistics.
- To Design models for protecting the data.
- To obtain the role of private regulatory and self-help efforts for protecting delimited data.
- To have an understanding of how emerging issues are affecting society and business, with a concentration on ho w information security must shape corporate practices.
- To apply the best features of privacy techniques to program real life problems.

**UNIT 1 INTRODUCTION 9 Hrs.**

Fundamental Concepts –Data Privacy Definitions, Data Privacy vs Data Security, Statistics, Data Privacy Attacks, Data linking and profiling, access control models, role-based access control, Data privacy policies, laws and acts, their specifications, languages and implementation, privacy polic y languages, privacy in different domains- medical, financial, etc.

**UNIT 2 DATA EXPLOSION 9 Hrs.**

Statistics and Lack of barriers in Collection and Distribution of Person-specific information, Mathematical model for characterizing and comparing real-world data sharing practices and policies and for computing privacy and risk measurements, Demographics and Uniqueness.

**UNIT 3 PROTECTION MODELS 9 Hrs.**

Protection Models- Null-map, k-map, Wrong map -Survey of techniques- Protection models (null-map, k-map, wrong map), Disclosure control, Inferring entity identities, Strength and weaknesses of techniques, entry specific databases.

**UNIT 4 COMPUTATION SYSTEMS FOR PROTECTING DELIMITED DATA 9 Hrs.**

Computation systems for protecting delimited data- MinGen, Datafly, Mu-Argus, k-Similar, Protecting textual documents: Scrub.

**UNIT 5 TECHNOLOGY, POLICY, PRIVACY AND FREEDOM 9 Hrs.**

Technology, Policy, Privacy and Freedom- Medical privacy legislation, policies and best practices, Examination of privacy matters specific to the World Wide Web, Protections provided by the Freedom of Information Act or the requirement for search warrants.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Understand the concepts of privacy in today's environment.
**CO2 -** Illustrate the legal, ethical and professional issues in data privacy.
**CO3 -** Explore expectations concerning privacy and the increasingly interconnected issue of security.
**CO4 -** Obtain the knowledge of the role of private regulatory and self-help efforts.
**CO5 -** Define corporate practices based on information security.
**CO6 -** Apply the best features of privacy techniques to program real life problems.

## TEXT / REFERENCE BOOKS

1. B. Raghunathan, The Complete Book of Data Anonymization: From Planning to Implementation, Auerbach Pub, 2018.
2. Alyssa Abkowitz, The Internet Tightens: (Links to an external site) Popular Chinese WeChat App to Become Official ID (Links to an external site.), Wall Street Journal, January 1, 2018.
3. Bill Marczak and John Scott-Railton, Keep Calm and (Don't) Enable Macros: A New Threat Actor Targets UAE Dissidents (Links to an external site.), Citizen Lab, 2016.
4. L. Sweeney, Computational Disclosure Control: A Primer on Data Privacy Protection, MIT Computer Science, 2012.
5. Ewan MacAskill, Julian Borger, Nick Hopkins, Nick Davies, and James Ball, GCHQ: Mastering the Internet, (Links to an external site.) The Guardian, July 21, 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** |

| SCSB3864 | INFORMATION TECHNOLOGY SECURITY EVALUATION | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVE**

- To introduce the information technology and security techniques.
- To study the security functional requirements.
- To learn the security assurance requirements.
- To be familiar with protecting of the profile and the target security issues.
- To evaluate and analyse the security techniques.

**UNIT 1 INTRODUCTION AND GENERAL MODEL 9 Hrs.**

Scope, Over view, General Model – Security Context, Common Criteria approach, Security concepts, CC descriptive material, Types of evaluation, Common Criteria requirements and evaluation results.

**UNIT 2 SPECIFICATION AND SECURITY FUNCTIONAL REQUIREMENTS 9 Hrs.**

Specification: Common Criteria project (informative), Specification of Protection Profiles, Specification of Security Targets. Security Functional Requirements: Scope, Security functional components – Over view, Component catalogue, Class FAU: Security audit- Security audit automatic response, Security audit data generation, Security audit analysis, Security audit review, Security audit event selection, Security audit event storage.

**UNIT 3 SECURITY ASSURANCE REQUIREMENTS 9 Hrs.**

Class FCO: Communication, Class FCS: Cryptographic support, Scope, Security assurance requirements – Structures, Component taxonomy, Protection Profile and Security Target evaluation criteria class structure, Usage of terms in ISO/IEC 15408-3, Assurance categorisation, Assurance class and family overview, Maintenance categorisation, Maintenance of assurance class and family overview.

**UNIT 4 PROTECTION PROFILE AND SECURITY TARGET CRITERIA 9 Hrs.**

Overview, Protection Profile criteria overview, Security Target criteria overview, Class APE: Protection Profile evaluation- Class APE: Protection Profile evaluation, Security environment, PP introduction, Security objectives, IT security requirements. Explicitly stated IT security requirements.

**UNIT 5 SECURITY EVALUATION 9 Hrs.**

Class ASE: Security Target evaluation, Evaluation assurance levels, Assurance classes, families, and components, Class AVA: V ulnerability assessment, Class AMA: Maintenance of assurance.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Understand the basics of information technology and security techniques.
**CO2 -** Identify the security functional requirements.
**CO3 -** Apply the security assurance requirements.
**CO4 -** Analyse and validate the protection profile and target the criteria of security.
**CO5 -** Apply the Security evaluation techniques.
**CO6 -** Understand the study of Maintenance assurance.

**TEXT / REFERENCES BOOK**

1. Information Technology — Security techniques — Evaluation criteria for IT security, INTERNATIONAL STANDARD, ISO/IEC 15408-1, First edition 1999-12-01 — Part 1: (UNIT 1, UNIT 5).
2. Information Technology — Security techniques — Evaluation criteria for IT security, INTERNATIONAL STANDARD, ISO/IEC 15408-2, First edition 1999-12-01 — Part 2: (Unit 2).
3. Information Technology — Security techniques — Evaluation criteria for IT security, INTERNATIONAL STANDARD, ISO/IEC 15408-3, First edition 1999-12-01 — Part 3: (UNIT 1, UNIT 5).
4. Information Technology Security Evaluation Criteria (ITSEC) by IBM ICE Publications.

| SCSB3765 | CYBER FORENSICS AND INVESTIGATION | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To learn about the Cyber Crime.
- To learn about Cyber Forensics.
- To learn about Cyber Investigation.
- To learn about Evidence Management.
- To learn about Cyber Laws and Authorities.

**UNIT 1 CYBER CRIME 9 Hrs.**

Cyber Space – Cyber Crime – Criminal Behaviour – Jurisdictional Concerns - Jurisprudential Inconsistency – eCash Security – Prepaid Cards – Stored Values Cards – Mobile Payments – Internet Payment Services - Cyber stalking - Cyber extortion – Cyber terrorism - Cyber warfare –Cyber weapons -ATM frauds – Phreaking – Internet Gambling.

**UNIT 2 CYBER FORENSICS 9 Hrs.**

Digital device – Hard disk –Disk characteristics - Disk imaging - Data Carving – Techniques - commercial piracy - soft lifting – Steganography – Network components - Port scans - Wireshark - pcap analysis - Trojans and Backdoors – Botnets - DoS – DDoS Attacks - Honey Pots – Malware – Virus and Worms.

**UNIT 3 CYBER INVESTIGATION 9 Hrs.**

Concepts of Investigation - cyber investigation, Network Investigation - Investigating audit logs - Investigating Web attacks - Investigating Computer Intrusions - Profiling – Cyber Criminal profiling – Stylometric Techniques – Warranted searches – Warrantless searches – Undercover Techniques.

**UNIT 4 EVIDENCE MANAGEMENT 9 Hrs.**

Evidence – Digital Evidence - Types – physical evidence – Real evidence – Circumstantial evidence – network evidence - Evidence collection – Evidence Analysis - Contextual Information –Evidence Management – pre search activities – On Scene activities – Report Preparations.

**UNIT 5 CYBER LAWS AND AUTHORITIES 9 Hrs.**

Information Technology Act 2000 – Digital signature - Electronic Governance - Secure electronic records - Regulation of certifying authorities – CERNTin - Electronic signature certificates - Penalties compensation - Future Trends and Emerging Concerns.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Outline the Cyber-crime and its types.
**CO2 -** Explore the Cyber Forensics Techniques.
**CO3 -** Use the Cyber Investigation Techniques.
**CO4 -** Explore the Cyber Evidence Management Techniques.
**CO5 -** Outline the Cyber Laws in India.
**CO6 -** Implement the Case Study for Cyber Laws.

## TEXT / REFERENCE BOOKS

1. Marjie T. Britz, “Computer Forensics and Cyber Crime”, Pearson, 2013.
2. Garima Tiwari, “Understanding Laws– Cyber Laws and Cyber Crimes”, Lexis Nexis, 2014.
3. Chuck Easttom, Jeff Taylor, “Computer Crime, Investigation, and the Law”, Course Technology, 2018.
4. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet”, Eoghan Casey, 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 carrying16 marks | **80 Marks** |

| SCSB3874 | FIREWALL AND NETWORK PROTECTION | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To introduce the concepts of system and network security.
- To introduce the terminology, technology and its applications.
- To enable a clear understanding and knowledge of security analyst.
- To expose the latest trend of computer attack and defence.
- To introduce the tool, technologies and programming languages which is used by security analyst.

**UNIT 1 NETWORK SECURITY 9 Hrs.**

Concepts of system security – security services and mechanisms – security attacks – network security – protection methods – network concepts – threats in networks – network security controls.

**UNIT 2 SYMMETRIC AND PUBLIC KEY ENCRYPTION 9 Hrs.**

Symmetric Cipher model- substitution and transposition techniques -Data encryption standard (DES) algorithm, Double and Triple DES – Advanced encryption standard (AES) algorithm – Comparison of AES and DES – RSA algorithm – Diffie-Hellman Key Exchange - Digital signatures – certificates.

**UNIT 3 INTERNET SECURITY 9.Hrs.**

Cloud security – transport level security – wireless network security – Electronic mail security - IP security – web security – IOT security.

**UNIT 4 MALICIOUS SOFTWARE 9 Hrs.**

Types of malicious software – viruses, worms, SPAM, Trojans, system corruption, Zombie, Bots, keyloggers, Phishing, Spyware, Backdoors, Rootkits - Distributed Denial of service attacks – IP spoofing attacks – case study (cryptographic solutions).

**UNIT 5 INTRUSION DETECTION AND FIREWALLS 9 Hrs.**

Intruders - intrusion detection – password management - Need for Firewalls – characteristics – types of firewalls – firewall basing - firewall location and configurations.

**Max. 45 Hrs.**

**COURSE OUTCOME**

On completion of the course, student will be able to

**CO1 -** Demonstrate system security skills through firewall implementation and testing.
**CO2 -** Use system tools, practices and relevant technologies to implement a security plan.
**CO3 -** Evaluate practices, tools and technologies to identify security sources of attacks and protect mission critical systems.
**CO4 -** Establish an appropriate level of security based on an analysis of security logs.
**CO5 -** Use relevant tools to secure a network, respond to and follow up on various types of attacks.
**CO6 -** Describe the types of malicious software.

## TEXT / REFERENCE BOOKS

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN13:9780133354690.
2. “Cryptography & Network Security”, Tata Mc Graw Hill by Atul Kahate.
3. “Cryptography & Network Security”, McGraw-Hill by Behrouz Forouzan.

## 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** |

| SCSB3820 | DIGITAL TRANSFORMATION AND FUTURE SOCIETIES | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To understand the society 5.0, Cyberspace and Physical Space to solve.
- To Provide knowledge and overview about Big data, IoT and Artificial Intelligence for Society 5.0.
- Discuss To understand Augmented Reality and Virtual Reality, Next Generation Sensors.
- To discuss about Challenges and Technologies towards Society 5.0, Security of Cyber Physical Systems.
- Discuss to apply society 5.0 Innovation with Future Trends with Applications.

**UNIT 1 INTRODUCTION TO SOCIETY 5.0 9 Hrs.**

Introduction –Schema of society 5.0-Characteristics of Society 5.0. Introduction to communication technologies: Artificial Intelligence – robotics - 3D Printing. People: Centric Society -Knowledge Sharing-Physical space- Cyberspace – Humanity VS Society 5.0 –Elements of Society 5.0-Data Driven to Society-Modelling real world Issues.

**UNIT 2 EMERGING TECHNOLOGIES WITH SOCIETY 5.0 9 Hrs.**

Introduction to Big Data – Issues and Challenges in the traditional systems –Intelligent Data Analysis – Big Data Storage Statistical Concepts: Sampling Distributions - Re-Sampling - Prediction Error – Random Sampling– Artificial Intelligence – - Foundations of AI - Intelligent agent - Types of agents - Structure - Problem solving agents -Internet of Things- Introduction to IoT- Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT-Robotics- Robotics system components - Robot classification Coordinate frames - degree of freedom - dynamic stabilization of robots.

**UNIT 3 INTRODUCTION TO INDUSTRY 4.0 9 Hrs.**

Introduction-Globalization and Emerging Issues, LEAN Production Systems, Smart and Connected Business Perspective, Cyber Physical Systems and Next Generation Sensors, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis- An emerging industrial structure for IoT -Cyber security in Industry 4.0-Basics of Industrial IoT. Common Issues in Industry 4.0 and Society 5.0.

**UNIT 4 CHALLENGES AND TECHNOLOGIES TOWARDS SOCIETY 5.0 9 Hrs.**

Overcome with Economic Development and Solution to Social Problems in Society 5.0- Security of Cyber Physical Systems - Embedded and CPS security - attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, malware attacks and counter-measures, security protocols- Social Issues in Society 5.0 - human-centered society (Society 5.0)-Sustainable Development Goals- Economic Advancement- Resolution to Social Problems.

**UNIT 5 INNOVATION WITH FUTURE TRENDS WITH APPLICATIONS 9 Hrs.**

Mobility – Health Care –Agriculture- Food Products – Disaster Prevention.

**Max. 45 Hrs.**

## COURSE OUTCOMES

On completion of the course, student will be able to

**CO1 -** Understand the Social Problems by A System That Highly Integrates Cyberspace and Physical Space to solve.

**CO2 -** Get Skills for Economic Development and A Human-Centered Society That Balances Economic Advancement.

**CO3 -** Achieve a High Degree of Convergence Between Cyberspace (Virtual Space) And Physical Space (Real Space).

**CO4 -** Use of Emerging Technologies with Society 5.0 To Achieve More Production / Avoid Loss of Productions.

**CO5 -** Internet and IoT, Big data for production lines to be adaptive, intelligent, and flexible enough to meet the updated requests.

**CO6 -** Design and apply in Health Care, Agriculture, Food Products, Disaster Prevention.

## TEXT / REFERENCE BOOKS

1. Society 5.0 A People –Centric Super –Smart Society, Hitachi –Utokyo Laboratory, Springer,2020.
2. Society 5.0 Industy of the Future Technologies Methods and Tools By Bruno Salgues,Willey, 2018
3. Stuart J.Russel, Peter Norvig, “Artificial Intelligence A Modern Approach ”, 3rd Edition, Pearson Education, 2009.
4. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi.,2012.
5. McKerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.

## 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** |

| SCSB3863 | INTELLIGENT DECISION MAKING | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- To become familiar with the fundamental concepts of Big Data.
- To be competent in identifying the challenges in handling large volumes of data.
- To propose scalable solutions.
- To understand the impact of Big Data in business intelligence, scientific discovery, and in day-to-day life.
- To learn the tools and techniques for handling large datasets.

**UNIT 1 INTRODUCTION 9 Hrs.**

Introduction to Big Data – Issues and Challenges in the traditional systems - Evolution of Big Data – Four V's of Big Data – Big Data Use Cases and characteristics – Intelligent Data Analysis – Data Analytic Tools – Big Data Storage Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error – Random Sampling.

**UNIT 2 BIG DATA TOOLS I 9 Hrs.**

Big Data Applications using Pig and Hive – Fundamentals of HBase and ZooKeeper – IBM Infosphere Big Insights – Introduction to FLUME – KAFKA.

**UNIT 3 BIG DATA TOOLS II 9 Hrs.**

Introduction to NoSQL - MongoDB – Spark – Cassandra - Cassandra Data Model – Data Design – Cassandra Architecture – Read and Write Data - Clients – Integrate with Hadoop. Introduction - Importance of Effective Data Visualization - Introduction to Tableau - Choosing the Right Chart Type Using the Colour Effectively Reducing Clutter - Dashboard Creation and Formatting.

**UNIT 4 HADOOP 9 Hrs.**

Introduction to Hadoop – Hadoop Distributed File System – Analysing data with Hadoop – Scaling – Streaming – Clustering: Single Node and Multi Node – Working with Hadoop Commands – Working with Apache Oozie.

**UNIT 5 MAP REDUCE 9 Hrs.**

Algorithms using map reduce - Matrix-Vector – Multiplication – Word Count - Understanding inputs and outputs of MapReduce, Data Serialization – Introduction to YARN – MapReduce Vs YARN – YARN Architecture – Scheduling in YARN – Fair Scheduler – Capacity Scheduler.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Configure the tools required for setting up Big Data Ecosystem.
**CO2 -** Understand conceptually how Big Data is stored and organized.
**CO3 -** Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.
**CO4 -** Interpret data findings effectively in visual formats.
**CO5 -** Explore the fundamentals of various big data applications.
**CO6 -** Implement the Algorithms for data analytics.

## TEXT / REFERENCE BOOKS

1. Joshua N. Milligan, “Learning Tableau”, Packt Publishing, 2015.
2. Chuck Lam, “Hadoop in Action”, Manning Publications Co., 2018.
3. Tom White, “Hadoop the Definitive Guide”, Oreilly, 4th Edition, 2015.
4. Eben Hewitt, “Cassandra: The Definitive Guide”, O’Reilly, 2010.
5. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, Edition I, 6. ISBN-10: 1107015359 | ISBN-13: 978-1107015357, 2011.
6. Jimmy Lin and Chris Dyer, “Data-Intensive Text Processing with MapReduce”, Morgan and Claypool Publishers, 2010.
7. Jonathan R. Owens, Brian Femiano, and Jon Lentz, “Hadoop Real World Solutions Cookbook”, Packt Publishing, ISBN-10: 1849519129 | ISBN-13: 978-1849519120, 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** |

| SCSB3864 | SUPPLY CHAIN MANAGEMENT | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 0 | 4 | 100 |

**COURSE OBJECTIVES**

- To understand the importance and role of Supply Chain Management.
- To evaluate and analyse Network Decisions.
- To know the supply chain integration and sustainability.

**UNIT 1 INTRODUCTION TO SUPPLY CHAIN MANAGEMENT 9 Hrs.**

Supply Chain Management – Definition, Nature, Objectives, Importance - Historical Perspective – Value Chain Perspectives – Decision Phases in Supply Chain - Process Views of a Supply Chains.

**UNIT 2 SUPPLY CHAIN DRIVERS AND NETWORK DESIGN 9 Hrs.**

Drivers of Supply Chain Performance – Impellers of Supply Chain – Financial Measures of Performance – Framework for Structuring drivers – Framework for Network Design Decisions – Factors Influencing Network Design Decisions – Models for Facility Location and for decision making. The making of Network Design Decisions in Practice – The Impact of Uncertainty on Network Design.

**UNIT 3 SUPPLY CHAIN INVENTORIES AND SOURCING DECISIONS 9 Hrs.**

Supply Chain Inventory Management: EOQ Models – Reorder Point Models – Multi Channel Inventory Systems – Supply Chain Facilities Layout – Capacity Planning – Inventory Optimization – The role of Sourcing in Supply Chain – In House or Outsource – Supplier Selection: Auctions and Negotiations – Contracts, Risk Sharing and Supply Chain Performance – Design Collaboration – The Procurement Process – Designing a Sourcing Portfolio: Tailored Sourcing – Risk Management in Sourcing.

**UNIT 4 SUPPLY CHAIN TRANSPORTATION 9 Hrs.**

Role of Transportation in Supply Chain – Modes of Transportation and Their Performance Characteristics – Transportation Infrastructure and policies – Design Options for a Transportation Network – Trade-offs in Transportation Design – Tailored Transportation- Risk Management in Transportation – IT Solutions – e- procurement – Bar coding and RFID Technology – Supply Chain IT in Practice.

**UNIT 5 SUPPLY CHAIN INTEGRATION AND SUSTAINABILITY 9 Hrs.**

Supply Chain Integration – Internal and External integrations – Ethical Supply Chains – Emerging Technologies in Supply Chain Integration – The Role of Sustainability in Supply Chain – The Tragedy of the commons – Key Metrics for Sustainability – Sustainability and Supply Chain Drivers – Closed-loop Supply Chains.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Understand the fundamentals of Supply Chain Concepts.
**CO2 -** Evaluate the various sourcing decisions.
**CO3 -** Apply knowledge to evaluate and manage effective supply chain decisions.
**CO4 -** Determine the various transportation models in supply Chain.
**CO5 -** Align the management of a supply chain with corporate goals and strategies.
**CO6 -** Analyse and improve the supply chain integration for sustainability.

## TEXT / REFERENCE BOOKS

1. Sunil Chopra , Peter Meindl , D.V. Kalra , Supply Chain Management, Pearson Publication, 6th Ed., 2016.
2. Janat Shah, Supply Chain Management, Pearson Publication, 2016.
3. Bowersox, Supply Chain Logistics Management, Tata McGraw Hill Publication, 2011.
4. Chandrasekaran. N, Supply Chain Management, Oxford University Press, 2010.

## END SEMESTER EXAM QUESTION PAPER PATTERN

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

**Part A:** 5 Questions to be answered out of 8 Questions, each Question carrying 6 Marks **30 marks**
**Part B:** 2 questions from each unit of internal choice, each carrying 10 marks **50 marks**
**Part C:** 1 Case Study Compulsory, carrying 20 marks **20 marks**

| SCSB3865 | BLOCKCHAIN IN SECURITY | L | T | P | EL | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 | 100 |

**COURSE OBJECTIVES**

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
- To securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from blockchain technology into their own projects.

**UNIT 1 BASICS 9 Hrs.**

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

**UNIT 2 BLOCKCHAIN AND DISTRIBUTED CONSENSUS 9 Hrs.**

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and P ublic blockchain. Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

**UNIT 3 CRYPTOCURRENCY 9 Hrs.**

History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin.

**UNIT 4 CRYPTOCURRENCY REGULATION 9 Hrs.**

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain

**UNIT 5 BLOCKCHAIN SECURITY OVERVIEW 9 Hrs.**

The Bitcoin Network and Security Overview: Assumptions about Bitcoin Security -Security Architecture Principles; Weaknesses and Vulnerabilities: Network Attacks -Node Security -Centralized Integration - User Security; Attacks on Private Keys: BIP-32/BIP-39 and PBKDF2 -Cracking Mnemonics Keys; Attacks on Privacy: Blockchain-based Attacks-Non-Blockchain-based Attacks - Defences for Privacy; Malicious Uses of Blockchain: Ransomware and Crypto-Lockers- Crypto jacking -ICO Scams and Ponzi Schemes.

**Max. 45 Hrs.**

**COURSE OUTCOMES**

On completion of the course, student will be able to

**CO1 -** Explain design principles of Bitcoin and Ethereum.
**CO2 -** Explain the Simplified Payment Verification protocol.
**CO3 -** List and describe differences between proof-of-work and proof-of-stake consensus.
**CO4 -** Interact with a blockchain system by sending and reading transactions.
**CO5 -** Design, build, and deploy a distributed application.
**CO6 -** Evaluate security, privacy, and efficiency of a given blockchain system

**TEXT / REFERENCE BOOKS**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
4. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger", Yellow paper.2014.
5. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

**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.
- Use proper statistical techniques to compare several alternatives.
- Design measurement and simulation experiments to provide the most information with the least effort
- Use simple queuing models to analyze the performance of systems.

**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, Work load 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 TECHNIQUE 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 DATAREPRESENTATION AND GAME RATIO 9 Hrs.**

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

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

Introduction, Queueing Modelling 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 the student will be able to

**CO1 -** Develop both analytical and simulation modeling of computer systems.
**CO2 -** Compute probabilities.
**CO3 -** Infer properties of samples and associate confidence measures to sampled statistics.
**CO4 -** Extract the salient features from as ample 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. RajJain, The Art of Computer System Performance Analysis: Techniques for Experimental Design Measurements Simulation and Modeling, 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**

| SBAB4001 | PRINCIPLES AND PRACTICESOF 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 analyze 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 carrying16 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 & 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 & 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 carrying16 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 carrying16 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 CITIES USES CASE 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. Designing the Internet of Things, Adrian McEwen & Hakim Cassimally, Wiley, 2014.
2. Smart Sensors for Industrial Applications (Devices, Circuits, and Systems) by Krzysztof Iniewski, CRC Press, 2017.
3. IOT Google, Amazon Alexa, Signal Jammer, ESP 8266 Node MCU and Location Tracker etc.. New model technology development, Anbazhagan k, 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**