ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. BIOMETRICS AND CYBER SECURITY

REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES(PEOs):

I. Systematically plan, implement, and monitor cyber security mechanisms to help ensure end-to-end security of IT assets and thus strengthen the cyber ecosystem.
II. Possess the technical knowledge and skills needed to protect and defend computer systems and networks from cyber threats and attacks.
III. Effectively identify, analyze, and remediate cyber attacks, through sustainable research-based biometric solutions for enterprises.
IV. Adopt ethical practices, collaborate with team members and team leaders, and engage in constant updation of technical knowledge.
V. Strongly focus on ingenious ideas and critical analysis to serve the society, locally and internationally as entrepreneurs in the field of cyber security.

2. PROGRAM SPECIFIC OUTCOMES(PSOs):

1. Measure the performance of security systems within an enterprise level information system. Troubleshoot, maintain and update an enterprise level information security system.
2. Manage and strengthen cyber ecosystem with biometric access control system, and authentication mechanisms.
3. Implement cyber security solutions and be able to use cyber security techniques, vulnerability analysis, information assurance, and cyber forensics software/tools. Design operational and strategic cyber-security strategies and policies.

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I TO IV SEMESTERS CURRICULA AND 1st SEMESTER SYLLABI
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4113	Algebra and Probability	FC	3	1	0	4	4
2.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
3.	CP4151	Advanced Data Structures and Algorithms	PCC	3	0	0	3	3
4.	BC4151	Biometric Systems	PCC	3	0	2	5	4
5.	CE4151	Principles of Cyber Security	PCC	3	0	2	5	4
6.	BC4152	Cyber Forensics and Investigation	PCC	3	0	0	3	3
7.		Audit Course – I*	AC	2	0	0	2	0
PRACTICALS								
8.	CP4161	Advanced Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
			TOTAL	**19**	**1**	**8**	**28**	**22**

*Audit course is optional

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	BC4201	Applied Cryptography	PCC	3	0	2	5	4
2.	CP4252	Machine Learning	PCC	3	0	2	5	4
3.	BC4202	Biometric Data Processing	PCC	3	0	0	3	3
4.	BC4251	Ethical Hacking	PCC	3	0	2	5	4
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Audit Course – II*	AC	2	0	0	2	0
PRACTICALS								
7.	BC4211	Biometric Data Processing Laboratory	PCC	0	0	4	4	2
8.	BC4212	Term Paper and Seminar	EEC	0	0	2	2	1
			TOTAL	**17**	**0**	**12**	**29**	**21**

*Audit course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective II	PEC	3	0	0	3	3
2.		Professional Elective III	PEC	3	0	0	3	3
3.		Professional Elective IV	PEC	3	0	2	5	4
4.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
5.	BC4311	Project Work I	EEC	0	0	12	12	6
			TOTAL	**12**	**0**	**14**	**26**	**19**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	BC4411	Project Work II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

TOTAL NO. OF CREDITS: 74

PROFESSIONAL ELECTIVES

SEMESTER II, ELECTIVE I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BC4001	Principles of Secure Coding	PEC	3	0	0	3	3
2.	NE4251	Network Security	PEC	3	0	0	3	3
3.	BC4002	Public Key Infrastructure	PEC	3	0	0	3	3
4.	BC4003	Operating Systems Security	PEC	3	0	0	3	3
5.	CP4351	Security Practices	PEC	3	0	0	3	3
6.	MU4252	Media Security	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BC4004	Biometric Security	PEC	3	0	0	3	3
2.	BC4005	Secure Systems Engineering	PEC	3	0	0	3	3
3.	BD4252	Big Data Security	PEC	3	0	0	3	3
4.	CE4071	Cloud Security	PEC	3	0	0	3	3
5.	BC4006	Firewall and VPN Security	PEC	3	0	0	3	3
6.	BC4007	Mobile and Digital Forensics	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BC4008	Access Control and Identity Management	PEC	3	0	0	3	3
2.	IF4079	Social Network Analysis	PEC	3	0	0	3	3
3.	BC4009	Data Privacy	PEC	3	0	0	3	3
4.	BC4010	Security in Cyber-Physical Systems	PEC	3	0	0	3	3
5.	BC4011	Cryptanalysis	PEC	3	0	0	3	3
6.	BC4012	Data Analytics for Fraud Detection	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CE4072	Internet of Things and Security	PEC	3	0	2	5	4
2.	BC4013	Malware Analysis	PEC	3	0	2	5	4
3.	BC4014	Secure Software Design and Development	PEC	3	0	2	5	4
4.	BC4015	Security Assessment and Risk Analysis	PEC	3	0	2	5	4
5.	BC4016	Steganography and Digital Watermarking	PEC	3	0	2	5	4
6.	CP4073	Blockchain Technologies	PEC	3	0	2	5	4
7.	BC4017	Web Security	PEC	3	0	2	5	4

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

MA4113 **ALGEBRA AND PROBABILITY** **L T P C**
3 1 0 4

COURSE OBJECTIVES:

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To make students understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete – time Markov chains.
- To apply the small / large sample tests through Tests of hypothesis.
- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To introduce and apply the concepts of rings, finite fields and polynomials.

UNIT I RANDOM VARIABLES **12**

Random variables – Moments – Binomial, Biometric, Poisson, Uniform, Exponential and Normal distributions – Joint distributions – Marginal – Correlation – Linear Regression distributions.

UNIT II RANDOM PROCESSES **12**

Classification – Stationary random process – Markov process – Markov chain – Poisson process – Gaussian process – Autocorrelation – Cross correlation.

UNIT III TESTING OF HYPOTHESIS **12**

Sampling distributions – Type I and Type II errors – Small and large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions, Tests for independence of attributes and goodness of fit.

UNIT IV GROUPS AND RINGS **12**

Groups: Definition – Properties – Homomorphism - Isomorphism – Cyclic groups – Cosets – Lagrange's theorem. Rings: Definition – Sub rings – Integral domain – Field – Integer modulo n – Ring homomorphism.

UNIT V FINITE FIELDS AND POLYNOMIALS **12**

Rings – Polynomial rings - Irreducible polynomials over finite fields - Factorizations of polynomials over finite fields.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

- analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
- classify various random processes and solve problems involving stochastic processes.
- apply the basic principles underlying statistical inference (estimation and hypothesis testing).
- apply the basic notions of groups, rings, fields which will then be used to solve related problems.
- explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.

REFERENCES:

1. Devore J.L.," Probability and Statistics for Engineering and sciences", Cengage learning, 9th Edition, Boston,2017.
2. Grimaldi R. P. and Ramana B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.
3. Johnson R. A. and Gupta C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson India Education, Asia, 9th Edition, New Delhi, 2017.
4. Ibe. O.C., " Fundamentals of Applied Probability and Random Processes", Elsevier U.P., 1st Indian Reprint, 2007.

RM4151 RESEARCH METHODOLOGY AND IPR L T P C
2 0 0 2

UNIT I RESEARCH DESIGN 6

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES 6

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING 6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS 6

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS 6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL : 30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

CP4151 **ADVANCED DATA STRUCTURES AND ALGORITHMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the usage of algorithms in computing
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs and its applications
- To select and design data structures and algorithms that is appropriate for problems
- To study about NP Completeness of problems.

UNIT I ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS 9

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms-Program performance measurement - Recurrences: The Substitution Method – The Recursion-Tree Method- Data structures and algorithms.

UNIT II HIERARCHICAL DATA STRUCTURES 9

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B - trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

UNIT III GRAPHS 9

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm

UNIT IV ALGORITHM DESIGN TECHNIQUES 9

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.

UNIT V NP COMPLETE AND NP HARD 9

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

1. Write an algorithm for Towers of Hanoi problem using recursion and analyze the complexity (No of disc-4)
2. Write any one real time application of hierarchical data structure
3. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Union operation
4. Find the minimum cost to reach last cell of the matrix from its first cell
5. Discuss about any NP completeness problem

OUTCOMES:

CO1: Design data structures and algorithms to solve computing problems.
CO2: Choose and implement efficient data structures and apply them to solve problems.
CO3: Design algorithms using graph structure and various string-matching algorithms to solve real-life problems.
CO4: Design one's own algorithm for an unknown problem.
CO5: Apply suitable design strategy for problem solving.

REFERENCES:

1. S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.
3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
5. E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

BC4151 **BIOMETRIC SYSTEMS** **L T P C**
3 0 2 4

COURSE OBJECTIVES:

1: To learn and understand biometric technologies and their functionalities.
2: To learn the role of biometric in the organization
3: To Learn the computational methods involved in the biometric systems.
4: To expose the context of Biometric Applications
5: To learn to develop applications with biometric security

UNIT I INTRODUCTION **9+3**

Introduction – history – type of biometrics – General architecture of biometric systems – Basic working of biometric matching – Biometric system error and performance measures – Design of biometric systems – Applications of biometrics – Biometrics versus traditional authentication methods – character recognition – authentication technologies, biometric technologies, Finger, face, voice and iris biometric technologies.

UNIT II FINGERPRINT, FACE AND IRIS AS BIOMETRICS **9+3**

Fingerprint biometrics – Fingerprint recognition system – Minutiae extraction – Fingerprint indexing – experimental results – Biometrics using vein pattern of palm – Advantages and disadvantages – Basics of hand geometry

Background of face recognition – Design of face recognition system – Neural network for face recognition – Face detection in video sequences – Challenges in face biometrics – Face recognition methods – Advantages and disadvantages

Iris segmentation method – Determination of iris region – Experimental results of iris localization – applications of iris biometrics – Advantages and disadvantages.

UNIT III PRIVACY ENHANCEMENT AND MULTIMODAL BIOMETRICS 9+3

Privacy concerns associated with biometric developments – Identity and privacy – Privacy concerns – biometrics with privacy enhancement – Comparison of various biometrics in terms of privacy – Soft biometrics - Introduction to biometric cryptography – General purpose cryptosystem – Modern cryptography and attacks – Symmetric key ciphers – Cryptographic algorithms – Introduction to multimodal biometrics – Basic architecture using face and ear – Characteristics and advantages of multimodal biometrics characters – AADHAAR : An Application of Multimodal Biometrics.

UNIT IV WATERMARKING TECHNIQUES & BIOMETRICS: SCOPE AND FUTURE 9+3

Data hiding methods – Basic framework of watermarking – Classification, Applications, Attacks, Performance Evaluation and Characteristics – General Watermarking process – Image watermarking techniques – Watermarking algorithm – Effect of attacks on watermarking techniques –Scope and future market of biometrics

Applications of Biometrics and information technology infrastructure – Role of biometrics in enterprise security – Role of biometrics in border security – Smart card technology and biometric – Radio frequency identification biometrics – DNA Biometrics – Comparative study of various biometrics techniques.

UNIT V IMAGE ENHANCEMENT TECHNIQUES & BIOMETRICS STANDARDS 9+3

Current research in image enhancement techniques – Image enhancement algorithms– Frequency domain filters – Databases and implementation – Standard development organizations – Application programming interface – Information security and biometric standards – Biometric template interoperability biometrics for network security and biometrics for transaction.

LIST OF EXPERIMENTS (Experiments can be designed with similar use cases as below):

1. Student school smart card
2. Secure lab access using card scanner plus face recognition
3. Student bus pass with barcode card scan
4. Student bus pass with webcam scan
5. Employee attendance system by Qr scan
6. Student examination datacard
7. School student attendance system by barcode scan
8. School student attendance system by Qr scan
9. School student attendance with fingerprint reader
10. Fingerprint voting system project
11. Employee hourly attendance by barcode scan
12. Visual product identification for blind

COURSE OUTCOMES:

CO1: Identify the various biometric technologies.
CO2: Design of biometric recognition for the organization.
CO3: Develop simple applications for privacy.
CO4: Understand the need of biometric in the society
CO5: Understand the research in biometric techniques.

TOTAL : 75 PERIODS

REFERENCES:

1. G R Sinha and Sandeep B. Patil, Biometrics: Concepts and Applications, Wiley, 2013
2. Paul Reid, Biometrics for Network Security, Pearson Education, 2003
3. Samir Nanavathi, Micheal Thieme, Raj Nanavathi, Biometrics – Identity verification in a networked world, Wiley – dream Tech, 2002.
4. John D Woodward, Jr.; Nicholas M Orlans; Peter T Higgins, Biometrics – The Ultimate Reference, Wiley Dreamtech.College Publications, 2015.
5. Khalid Saeed, “New Directions in Behavioral Biometrics', CRC Press 2020.
6. Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Guide to Biometrics, Springer 2009.
7. Rafael C. Gonzalez, Richard Eugene Woods, Digital Image Processing using MATLAB, 2nd Edition, Tata McGraw-Hill Education 2010.

CE4151 **PRINCIPLES OF CYBER SECURITY** **L T P C**
3 0 2 4

COURSE OBJECTIVES:

- To know the cyber security principles, as well as the issues, policy and standards
- To understand the difference between threat, risk, attack and vulnerability and
- how threats materialize into attacks.
- Where to find information about threats, vulnerabilities and attacks.
- To be familiar with the typical threats, attacks and exploits and the motivations behind them.
- To study the defensive techniques against these attacks
- To describe remedies for various existing cyber security breaches and to show the methodologies required to make future systems less prone to security failures

UNIT I **INTRODUCTION TO CYBER SECURITY** **9+3**

Basic Cyber Security Concepts, layers of security, Vulnerability, Threat, Harmful acts, Internet Governance - Controls - Authentication -Access Control and Cryptography – Challenges and Constraints, Computer Criminals, CIA Triad, Motive of Attackers, Active Attacks, Passive Attacks, Software Attacks, Hardware Attacks, Spectrum of Attacks, Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks, Taxonomy of various attacks, IP spoofing, Methods of defence, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Malicious code , Countermeasures.

UNIT II **SECURITY IN OPERATING SYSTEMS & NETWORKS** **9+3**

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network Security Attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT III **DEFENCES: SECURITY COUNTERMEASURES** **9+3**

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data. Cloud Security Tools & Techniques,

UNIT IV **PRIVACY IN CYBERSPACE** **9+3**

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -

Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V MANAGEMENT AND INCIDENTS 9+3

Comprehensive Cyber Security Policy Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber-crime - Cyber Warfare and HomeLand Security.

LIST OF EXPERIMENTS:

1. Implementation to gather information from any PC connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Claiming ownership of digital entity
3. Implementation of Tracing the digital theft in cyberspace
4. Implementation of Data hiding in different image types
5. Implementation of MITM- attack using wireshark/ network sniffers
6. Implementation of Windows security using firewall and other tools
7. Implementation to identify web vulnerabilities, using OWASP project
8. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.
9. Implementation of OS hardening and RAM dump analysis to collect the artifacts and other information.
10. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.

TOTAL : 75 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the broad set of technical, social & political aspects of Cyber Security

CO2: Describe the operational and organizational Cyber Security Aspects

CO3: Identify and assess different types of Cyber security breaches and possible solutions for a robust system

CO4: understand cyber-attacks, and also how to protect the entire Internet community from such attacks

CO5: Demonstrate the ability to select and design among available security solutions based on different domains of cyber systems

REFERENCES:

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2018
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt. Ltd. , 2011
3. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithms, Applications, and Perspectives, CRC Press, 2018.
4. George K.Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013.
5. Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation, Springer International Publishing Switzerland 2015
6. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press T&F Group, 2013.
7. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, CRC Press T&F Group, 2011

BC4152 **CYBER FORENSICS AND INVESTIGATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain a comprehensive understanding of cyber forensic principles and the collection, preservation, and analysis of digital evidence
- To combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- To understand the different applications and methods for conducting network and digital forensic acquisition and analysis
- To learn the E-evidence collection and preservation, investigating operating systems and file systems, network, cloud and mobile device forensics
- To gain knowledge on digital forensics legislations, digital crime, forensic processes and procedures.

UNIT I CYBER FORENSICS SCIENCE **9**

Cyber Forensics Science: Forensics Science, Forensics Fundamentals, Computer Forensics, and Digital Forensics.

Cyber Crime: Criminalistics as it relates to the Investigative Process, Analysis of Cyber Criminalistics Area, Holistic Approach to Cyber-forensics, Computer Forensics and Law Enforcement- Indian Cyber Forensic - Forensics Services, Professional Forensics Methodology- Types of Forensics Technology

UNIT II NETWORK SECURITY FORENSICS SYSTEM AND SERVICES **9**

Forensics system and Services : Forensics on - Internet Usage – Intrusion - Firewall and Storage Area Network; Occurrence of Cyber-crimes- Cyber Detectives- Fighting Cyber Crimes- Forensic Process

Open-source Security Tools for Network Forensic Analysis, Requirements for Preservation of Network Data

Computer Forensics - Data Backup and Recovery - Test Disk Suite.

UNIT III DIGITAL FORENSICS PRESERVATION AND FORENSIC DATA ANALYSIS **9**

Digital Repositories - Evidence Collection – Data Preservation Approaches – Meta Data and Historic records – Legal aspects. Basic Steps of Forensic Analysis in Windows and Linux – Forensic Scenario – Email Analysis – File Signature Analysis – Hash Analysis – Forensic Examination of log files

Data-Recovery Solution, Hiding and Recovering Hidden Data, Evidence Collection and Data Seizure

UNIT IV CLOUD, NETWORK AND MOBILE FORENSICS **9**

Working with the cloud vendor, obtaining evidence, reviewing logs and APIs

Mobile Forensics techniques, Mobile Forensics Tools - Android Device – Analysis- Android Malware – iOS Forensic Analysis – SIM Forensic Analysis – Case study

Recent trends in Mobile Forensic Technique and methods to Search and Seize Electronic Evidence

UNIT V LEGAL ASPECTS OF DIGITAL FORENSICS **9**

IT Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies, Act 2000,

amendment of IT Act 2008.

Current Cyber Forensic Tools: Overview of different software packages – Encase-Autopsy-Magnet – Wireshark - Mobile Forensic Tools – SQLite

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the responsibilities and liabilities of a computer forensic investigator

CO2: Identify potential sources of electronic evidence.

CO3: Understand the importance of maintaining the integrity of digital evidence.

CO4: Demonstrate the ability to perform basic forensic data acquisition and analysis using computer and network based applications and utilities.

CO5: Understand relevant legislation and codes of ethics.

REFERENCES:

1. J. R. Vacca, Computer forensics: Computer Crime Scene investigation, 2nd Ed. Hanover, NH, United States: Charles River Media, 2002, Laxmi Publications, 1st Edition, 2015.
2. C. Altheide, H. Carvey, and R. Davidson, Digital Forensics with Open Source Tools: Using Open Source Platform Tools for Performing Computer Forensics on Target Systems: Windows, Mac, Linux, Unix, etc, 1st Ed. United States: Syngress, 2011.
3. S. Bommisetty, R. Tamma, and H. Mahalik, Practical Mobile Forensics: Dive into Mobile Forensics on IOS, Android, Windows, and blackBerry devices with this action-packed, practical guide. United Kingdom: Packt Publishing, 2014.
4. G. Gogolin, Digital Forensics Explained, 1st Ed. Boca Raton, FL: CRC Taylor & Francis, 1st Edition, Auerbach Publications, 2013.
5. A. Hoog and J. McCash, Android forensics: Investigation, Analysis, and Mobile Security for Google Android. Waltham, MA: Syngress Media, U.S., 2011.
6. B. Nelson, A. Phillips, F. Enfinger, and C. Steuart, Guide to Computer Forensics and Investigations, Second edition, 2nd Ed. Boston: Thomson Course Technology, 2009.
7. C. Altheide and H. Carvey, “Digital Forensics with Open Source Tools”, 2011 Publisher(s): Syngress.
8. J. Sammons, “The Basics of Digital Forensics- The Primer for Getting Started in Digital Forensics”, 1st Edition, Syngress, 2012.
9. Nelson, Phillips and Enfinger Steuart, “Guide to Computer Forensics and Investigations”, 6th Edition, Cengage Learning, New Delhi, 2020.

CP4161	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L T P C 0 0 4 2

COURSE OBJECTIVES:

- To acquire the knowledge of using advanced tree structures
- To learn the usage of heap structures
- To understand the usage of graph structures and spanning trees
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
- To understand the necessary mathematical abstraction to solve problems.

LIST OF EXPERIMENTS:

1: Implementation of recursive function for tree traversal and Fibonacci
2: Implementation of iteration function for tree traversal and Fibonacci
3: Implementation of Merge Sort and Quick Sort
4: Implementation of a Binary Search Tree
5: Red-Black Tree Implementation
6: Heap Implementation
7: Fibonacci Heap Implementation
8: Graph Traversals
9: Spanning Tree Implementation
10: Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)
11: Implementation of Matrix Chain Multiplication
12: Activity Selection and Huffman Coding Implementation

HARDWARE/SOFTWARE REQUIREMENTS

1: 64-bit Open source Linux or its derivative
2: Open Source C++ Programming tool like G++/GCC

TOTAL : 60 PERIODS

COURSE OUTCOMES:

CO1: Design and implement basic and advanced data structures extensively
CO2: Design algorithms using graph structures
CO3: Design and develop efficient algorithms with minimum complexity using design techniques
CO4: Develop programs using various algorithms.
CO5: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.

REFERENCES:

1. Lipschutz Seymour, “Data Structures Schaum's Outlines Series”, Tata McGraw Hill, 3rd Edition, 2014.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
3. http://www.coursera.org/specializations/data-structures-algorithms
4. http://www.tutorialspoint.com/data_structures_algorithms
5. http://www.geeksforgeeks.org/data-structures/

AUDIT COURSES

AX4091 **ENGLISH FOR RESEARCH PAPER WRITING** **L T P C**
2 0 0 0

COURSE OBJECTIVES:

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES

CO1 –Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

AX4092 DISASTER MANAGEMENT L T P C
2 0 0 0

COURSE OBJECTIVES:

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION **6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS **6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA **6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT **6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT **6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1: Ability to summarize basics of disaster

CO2:Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, Pradeep Et.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

AX4093 **CONSTITUTION OF INDIA** **L T P C**
2 0 0 0

COURSE OBJECTIVES:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution 1917 And its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION 6

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION 6

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES 6

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE 6

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION 6

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION 6

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct

elections through adult suffrage in the Indian Constitution.

- Discuss the passage of the Hindu Code Bill of 1956.

REFERENCES:

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., LexisNexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, LexisNexis, 2015.

AX4094	**நற்றமிழ் இலக்கியம்**	**L T P C** **2 0 0 0**

UNIT I **சங்க இலக்கியம்** **6**

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
– எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
- இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
- போரை நிறுத்திய ஔவையார்

UNIT II **அறநெறித் தமிழ்** **6**

1. அறநெறி வகுத்த திருவள்ளுவர்
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
– ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III **இரட்டைக் காப்பியங்கள்** **6**

1. கண்ணகியின் புரட்சி
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV **அருள்நெறித் தமிழ்** **6**

1. சிறுபாணாற்றுப்படை
- பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
- அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)

- இயமம் நியமம் விதிகள்

4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
   - சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
   நற்றிணை (11) - நண்டு
   கலித்தொகை (11) - யானை, புறா
   ஐந்தினை 50 (27) - மான்
   ஆகியவை பற்றிய செய்திகள்

UNIT V **நவீன தமிழ் இலக்கியம்** **6**

1. உரைநடைத் தமிழ்,
   - தமிழின் முதல் புதினம்,
   - தமிழின் முதல் சிறுகதை,
   - கட்டுரை இலக்கியம்,
   - பயண இலக்கியம்,
   - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
- www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
-https://ta.wikipedia.org
3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம்
   - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
   - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
   - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்