

ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. COMPUTER SCIENCE AND ENGINEERING (WITH SPECIALIZATION IN CYBER
SECURITY)
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- I. Develop the proficiency, technical knowledge and skills that are needed to protect and defend applications, computer systems and networks.
- II. Plan, implement, test and monitor cyber security mechanisms to ensure the protection of IT assets of an organization
- III. Analyse and prevent vulnerabilities through ethical hacking technologies using various emerging tools.
- IV. Actively engage as cyber security professionals in research activities which allow for the continuous development of their computing and cyber security skills.
- V. Incorporate ethical, legal and social implications in the outcomes of their professional activities.

2. PROGRAM SPECIFIC OUTCOMES (PSOs):

1. Develop an in-depth knowledge and skill set in Cyber Security to monitor, prepare, predict, detect, respond and prevent cyber-attacks and ensure enterprise security.
2. Apprehend legal aspects of cyber security, risk assessment, security audit, incidence response, regulations and compliance.
3. Monitor, detect, respond, remediate cyber security threat using latest hardware and software tools and technologies, along with analytical and managerial skills.

PROGRESS THROUGH KNOWLEDGE

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CHOICE BASED CREDIT SYSTEM
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.	MA4111	Mathematical Foundations for Cyber Security	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.	CP4152	Database Practices	PCC	3	0	2	5	4
5.	CP4153	Network Technologies	PCC	3	0	0	3	3
6.	CE4151	Principles of Cyber Security	PCC	3	0	2	5	4
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.	CP4251	Internet of Things	PCC	3	0	2	5	4
2.	CP4252	Machine Learning	PCC	3	0	2	5	4
3.	BC4251	Ethical Hacking	PCC	3	0	2	5	4
4.	BC4152	Cyber Forensics and Investigation	PCC	3	0	0	3	3
5.		Professional Elective I	PCC	3	0	0	3	3
6.		Professional Elective II	PCC	3	0	0	3	3
7.		Audit Course – II*	AC	2	0	0	2	0
PRACTICALS								
8.	CE4211	Term Paper and Seminar	EEC	0	0	2	2	1
TOTAL				20	0	8	28	22

*Audit course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CP4351	Security Practices	PCC	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.	CE4311	Project Work I	EEC	0	0	12	12	6
TOTAL				12	0	14	26	19

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CE4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL NO. OF CREDITS: 75

PROGRESS THROUGH KNOWLEDGE

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.	CE4071	Cloud Security	PEC	3	0	0	3	3
2.	CE4001	E Commerce	PEC	3	0	0	3	3
3.	CP4071	Autonomous Systems	PEC	3	0	0	3	3
4.	CP4077	Mobile and Pervasive Computing	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BD4251	Big Data Mining and Analytics	PEC	3	0	0	3	3
2.	CE4002	Information Security and Privacy	PEC	3	0	0	3	3
3.	CE4003	Security Analysis of Protocols	PEC	3	0	0	3	3
4.	SE4151	Advanced Software Engineering	PEC	3	0	0	3	3
5.	MP4071	Cognitive Computing	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.	CE4004	Banking Technology and Management	PEC	3	0	0	3	3
2.	IF4079	Social Network Analysis	PEC	3	0	0	3	3
3.	CP4074	Data Visualization Techniques	PEC	3	0	0	3	3
4.	CP4076	Information Retrieval Techniques	PEC	3	0	0	3	3
5.	BD4151	Foundations of Data Science	PEC	3	0	0	3	3
6.	MP4074	Soft Computing Techniques	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.	CE4005	Cloud Computing and Security	PEC	3	0	2	5	4
2.	CP4073	Blockchain Technologies	PEC	3	0	2	5	4
3.	CE4072	Internet of Things and Security	PEC	3	0	2	5	4
4.	IF4073	Deep Learning	PEC	3	0	2	5	4
5.	MP4251	Cyber Physical Systems	PEC	3	0	2	5	4
6.	CP4072	Bioinformatics	PEC	3	0	2	5	4

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

S. 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

PROGRESS THROUGH KNOWLEDGE

COURSE OBJECTIVES:

- To understand the usage of Number theory
- To learn the applications of Algebraic Structures
- To study the concepts of Probability theory
- To practice the basics Coding Theory
- To understand Pseudorandom Number Generation

UNIT I NUMBER THEORY**12**

Number Theory: Introduction – Divisibility – Greatest common divisor – Prime numbers – Fermat's theorem – Euler function – Euler's theorem. Congruences: Definition – Basic properties of Congruences – Residue classes – Chinese remainder theorem.

UNIT II ALGEBRAIC STRUCTURES**12**

Algebraic Structures: Groups – Cyclic groups, Cosets, Modulo groups – Primitive roots – Rings – Subrings, ideals and quotient rings, Integral domains – Polynomial Rings – Fields – Finite fields – $GF(p^n)$, $GF(2^n)$ – Classification – Structure of finite fields.

UNIT III LINEAR ALGEBRA**12**

Vector spaces – Norms – Inner products – Eigenvalues using QR transformations – QR factorization – Generalized eigenvectors – Jordan Canonical forms – Singular value decomposition and applications – Pseudo inverse – Least square approximations.

UNIT IV CODING THEORY**12**

Coding Theory: Introduction – Basic concepts: codes, minimum distance, equivalence of codes, Linear codes – Linear codes – Generator matrices and parity-check matrices – Syndrome decoding – Hamming codes – Hadamard Code – Goppa codes.

UNIT V PSEUDORANDOM NUMBER GENERATION**12**

Pseudorandom Number Generation: Introduction and examples – Indistinguishability of Probability Distributions – Next Bit Predictors – The Blum-Blum-Shub Generator – Security of the BBS Generator.

TOTAL : 60 PERIODS**COURSE OUTCOMES:**

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

- apply fundamental number Theoretic ideas in designing algorithms.
- able to use ideas of finite fields in application problems related to Network Security.
- the students would have developed their knowledge and understanding of the concepts of Linear Algebra.
- use Coding Theory ideas in solving communication problems.
- apply a BBS generator for generating Pseudorandom numbers.

REFERENCES:

1. D.S. Malik, J. Mordeson, M.K. Sen, "Fundamentals of Abstract Algebra", Tata McGraw Hill.
2. P.K. Saikia, "Linear Algebra", Pearson Education, 2009.
3. Niven, H.S. Zuckerman and H.L. Montgomery, "An Introduction to the theory of Numbers", John Wiley and Sons, 2004.

4. D.P. Bertsekas and J. N. Tsitsiklis, "Introduction to probability", Athena Scientific, 2008.
5. Douglas Stinson, "Cryptography – Theory and Practice", CRC Press, 2006.
6. Sheldon M. Ross, "Introduction to Probability Models", Academic Press, 2003.
7. C.L. Liu, "Elements of Discrete Mathematics", McGraw Hill, 2008.
8. Fraleigh J.B., "A first course in Abstract Algebra", Narosa, 1990.
9. Joseph A. Gallian, "Contemporary Abstract Algebra", Narosa, 1998.

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.

COURSE 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.

CP4152

DATABASE PRACTICES

L T P C

3 0 2 4

COURSE OBJECTIVES:

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Understand query processing in a distributed database system
- Understand the basics of XML and create well-formed and valid XML documents.
- Distinguish the different types of NoSQL databases
- To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.

UNIT I RELATIONAL DATA MODEL

12

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language – Database Normalization.

Suggested Activities:

Data Definition Language

- Create, Alter and Drop
- Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints
- Creating Views

Data Manipulation Language

- Insert, Delete, Update
- Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join
- Aggregate Functions

- Set Operations
- Nested Queries

Transaction Control Language

- Commit, Rollback and Save Points

UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY 12

Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity.

Suggested Activities:

- Distributed Database Design and Implementation
- Row Level and Statement Level Triggers
- Accessing a Relational Database using PHP, Python and R

UNIT III XML DATABASES 12

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery

Suggested Activities:

- Creating XML Documents, Document Type Definition and XML Schema
- Using a Relational Database to store the XML documents as text
- Using a Relational Database to store the XML documents as data elements
- Creating or publishing customized XML documents from pre-existing relational databases
- Extracting XML Documents from Relational Databases
- XML Querying

UNIT IV NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS 12

NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQL Key-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store – Wide Column NoSQL Systems – Hbase Data Model – Hbase Crud Operations – Hbase Storage and Distributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.

Suggested Activities:

- Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.
- Writing simple queries to access databases created using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.

UNIT V DATABASE SECURITY 12

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security.

Suggested Activities:

Implementing Access Control in Relational Databases

TOTAL : 75 PERIODS**COURSE OUTCOMES:**

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

- Convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.
- Understand and write well-formed XML documents
- Be able to apply methods and techniques for distributed query processing.
- Design and Implement secure database systems.
- Use the data control, definition, and manipulation languages of the NoSQL databases

REFERENCES:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education 2016.
2. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.
3. C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006
4. Raghu Ramakrishnan, Johannes Gehrke "Database Management Systems", Fourth Edition, McGraw Hill Education, 2015.
5. Harrison, Guy, "Next Generation Databases, NoSQL and Big Data" , First Edition, Apress publishers, 2015
6. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Sixth Edition, Pearson Education, 2015

CP4153**NETWORK TECHNOLOGIES****L T P C****3 0 0 3****COURSE OBJECTIVES:**

- 1:To understand the basic concepts of networks
- 2:To explore various technologies in the wireless domain
- 3:To study about 4G and 5G cellular networks
- 4: To learn about Network Function Virtualization
- 5: To understand the paradigm of Software defined networks

UNIT I**NETWORKING CONCEPTS****9**

Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. Osi Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router. Firewall, IP addressing.

UNIT II**WIRELESS NETWORKS****9**

Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS – Bluetooth – Protocol Stack – Security – Profiles – zigbee

UNIT III MOBILE DATA NETWORKS 9

4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Concepts of 5G – channel access –air interface -Cognitive Radio-spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO, mmWave, Introduction to 6G.

UNIT IV SOFTWARE DEFINED NETWORKS 9

SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. OpenFlow Logical Network Device. Flow Table Structure. Flow Table Pipeline. The Use of Multiple Tables. Group Table. OpenFlow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. OpenDaylight. OpenDaylight Architecture. OpenDaylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.

UNIT V NETWORK FUNCTIONS VIRTUALIZATION 9

Motivation-Virtual Machines –NFV benefits-requirements – architecture- NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

- 1: Execute various network utilities such as tracert, pathping, ipconfig
- 2: Implement the Software Defined Networking using Mininet
- 3: Implement routing in Mininet
- 4: Install a virtual machine and study network virtualization
- 5: Simulate various network topologies in Network Simulator

REFERENCES:

1. James Bernstein, “Networking made Easy”, 2018. (UNIT I)
2. HoudaLabiod, Costantino de Santis, HossamAfifi “Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)
3. Erik Dahlman, Stefan Parkvall, Johan Skold, 4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013 (UNIT 3)
4. Saad Z. Asif – “5G Mobile Communications Concepts and Technologies” CRC press – 2019 (UNIT 3)
5. William Stallings –“Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud” 1st Edition, Pearson Education, 2016.(Unit 4 and 5)
6. Thomas D.Nadeau and Ken Gray, SDN – Software Defined Networks, O’Reilly Publishers, 2013.
7. Guy Pujolle, “Software Networks”, Second Edition, Wiley-ISTE, 2020

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 Home Land Security.

LIST OF EXPERIMENTS:

1. Implementation to gather information from any PC connected to the LAN using
2. whois, port scanners, network scanning, Angry IP scanners etc.
3. Implementation of Claiming ownership of digital entity

4. Implementation of Tracing the digital theft in cyberspace
5. Implementation of Data hiding in different image types
6. Implementation of MITM- attack using Wireshark/ network sniffers
7. Implementation of Windows security using firewall and other tools
8. Implementation to identify web vulnerabilities, using OWASP project
9. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.
10. Implementation of OS hardening and RAM dump analysis to collect the artifacts and other information.
11. 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

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.

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

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

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

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

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

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

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.

SUGGESTED READING

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
 - ஐந்திணை 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