M. TECH in CYBER FORENSICS

National Institute of Electronics and Information Technology
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M. TECH – CYBER FORENSIC

National Institute of Electronics and Information Technology

In the rapidly evolving landscape of cyber security, the need for proficient professionals in cyber forensics has become paramount. The Master of Technology (M.Tech) program in Cyber Forensics by NIELIT Deemed to be University is designed to equip students with the knowledge, skills, and practical experience necessary to investigate and analyze digital evidence in the context of cybercrimes and security incidents. This interdisciplinary field combines principles from computer science, law, and forensic science to identify, preserve, and analyze digital evidence while adhering to legal and ethical standards. Through a blend of theoretical coursework and hands-on training, this program prepares students to tackle real-world challenges in cybercrime investigation, digital forensics, and incident response.

The primary objective of this M.Tech program is to produce competent professionals who can effectively navigate the complexities of cybercrime investigation and digital forensics. Students will develop a deep understanding of various forensic techniques, tools, and methodologies used to collect, analyze, and present digital evidence in legal proceedings. Additionally, the program aims to foster critical thinking and problem-solving skills essential for addressing emerging threats and evolving technologies in cyberspace. Through practical exercises, case studies, and research projects, students will gain hands-on experience in conducting forensic examinations, interpreting findings, and communicating results to diverse stakeholders.

The curriculum of the M.Tech in Cyber Forensics is structured to provide a comprehensive education in both foundational principles and advanced topics relevant to the field. Core courses cover essential concepts such as digital crime, network forensics, file systems analysis, and forensic tool development. Elective courses allow students to specialize in areas such as mobile device forensics, cloud forensics, malware analysis, or cyber security law and ethics, based on their interests and career goals. A strong emphasis is placed on practical skills development through laboratory sessions, simulated investigations, and internships with industry partners. By the end of the program, graduates will be well equipped to pursue careers as forensic analysts, incident responders, cyber security consultants, or researchers in government agencies, law enforcement, corporate security, or academia.

Program Education Objectives (PEO)

PEO1: Develop expertise in conducting comprehensive digital forensic examinations, including evidence identification, preservation, analysis, and documentation.

PEO2: Acquire proficiency in utilizing advanced forensic tools and methodologies across diverse digital devices and platforms to ensure accurate and reliable evidence collection and analysis.

PEO3: Cultivate strong analytical and critical thinking skills to effectively identify, analyze, and mitigate cyber threats and security incidents through systematic problem-solving approaches.

PEO4: Cultivate interpersonal skills to collaborate effectively within multidisciplinary teams, including legal professionals, law enforcement agencies, corporate stakeholders, and non-technical audiences, to achieve successful outcomes in cyber forensic investigations and incident response.

Program Outcomes (PO)

PO1	To effectively collect, preserve, and analyze digital evidence from various sources, including computers, mobile devices, networks and cloud environments, using forensic tools and methodologies.
PO2	Conduct thorough cybercrime investigations and responding to security incidents by applying systematic forensic techniques, identifying root causes, and implementing appropriate mitigation strategies.
PO3	To develop and validate forensic tools and techniques to enhance the efficiency, accuracy, and reliability of digital forensic investigations, ensuring compliance with industry standards and best practices.

PO4	Graduates will understand and adhere to legal and ethical standards governing the acquisition, handling, and presentation of digital evidence, ensuring the admissibility and integrity of evidence in legal proceedings.
PO5	Graduates will demonstrate effective communication and collaboration skills, including the ability to articulate technical findings, prepare detailed forensic reports, and testify as expert witnesses in legal proceedings, while collaborating with multidisciplinary teams and stakeholders.

Course Category Wise Credit Distribution:

Category	Credits
Program Core	12
Core Labs	4
Electives	15
Electives Labs	4
Audit Course	2
Open Electives	3
Project / Dissertation	28

Semester-I						
S. No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CIL601	Program Core-I Cryptography and Network Security	3	0	0	3
2.	CIL602	Program Core-II Digital Forensics and Cyber Crime Investigation	3	0	0	3
3.	CIL***	Program Elective I	3	0	0	3
4.	CIL***	Program Elective II	3	0	0	3
5.	ACL601	Research Methodology and IPR	2	0	0	2
6.	ACL***	Audit course	2	0	0	0
7.	CIP602	Laboratory-I (Digital Forensics and Cyber Crime Investigation)	0	0	4	2
8.	CIP***	Laboratory-II (Based on Electives)	0	0	4	2
Total credits: 18						
Semester-II						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CIL603	Program Core-III Cyber Law	3	0	0	3

2.	CIL604	Program Core-IV MOBILE AND DIGITAL FORENSIC	3	0	0	3
3.	CIL***	Program Elective III	3	0	0	3
4.	CIL***	Program Elective IV	3	0	0	3
5.	ACL***	Audit Course	2	0	0	0
6.	CIP604	Laboratory-III (MOBILE AND DIGITAL FORENSICS)	2	0	0	2
7.	CIP***	Laboratory-IV (Based on Electives)	0	0	4	2
8.	AID601	Mini Project	2	0	0	2
Total Credits: 18						
Semester-III						
1.	CIL***	Program Elective-V	3	0	0	3
2.	OEL***	Open Elective	3	0	0	3
3.	CID701	Dissertation-I/ Industrial project	0	0	20	10
Total credit: 16						
Semester-IV						
S. No	**Course Code**		**L**	**T**	**P**	**C**
1.	AID702	Dissertation-II	0	0	36	16
Total credit: 16						

Elective Courses						
Sl. No.	**Course code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CIL701	Basics of Forensics Psychology	3	0	0	3
2.	CIL702	Operating System Security	3	0	0	3
3.	CIL703	Mathematics For Information Security and Cyber Forensics	3	0	0	3
4.	CIL704	Security Scripting And Analysis	3	0	0	3
5.	CIL705	Android Security Design and Internals	3	0	0	3
6.	CIL706	Web and Database Security	3	0	0	3
7.	CIL707	Edge Computing	3	0	0	3
8.	CIL708	Information Security Audit	3	0	0	3
9.	CIL709	Data Privacy	3	0	0	3
10.	CIL710	Applied Cryptography	3	0	0	3
11.	CIL711	Malware Analysis	3	0	0	3

12.	CIL712	Image Forensics and Security	3	0	0	3
13.	CIL713	Data Analytics for Fraud Detection	3	0	0	3
14.	CIL714	Mobile And Wireless Security	3	0	0	3
15.	CIL715	Cloud Architectures And Security	3	0	0	3

Audit Course						
Sl. No.	Course code	Course Name	L	T	P	C
1.	ACL601	Research Methodology and IPR	2	0	0	2
2.	ACL701	English for Research Paper Writing	2	0	0	0
3.	ACL702	Disaster Management	2	0	0	0
4.	ACL703	Sanskrit for Technical Knowledge	2	0	0	0
5.	ACL704	Value Education	2	0	0	0
6.	ACL705	Constitution of India	2	0	0	0
7.	ACL706	Pedagogy Studies	2	0	0	0
8.	ACL707	Stress Management by Yoga	2	0	0	0
9.	ACL708	Personality Development through Life Enlightenment Skills.	2	0	0	0

Open Electives						
Sl. No.	**Course code**	**Course Name**	**L**	**T**	**P**	**C**
1.	OEL701	Business Analytics	3	0	0	3
2.	OEL702	Industrial Safety	3	0	0	3
3.	OEL703	Operations Research	3	0	0	3
4.	OEL704	Cost Management of Engineering Projects	3	0	0	3
5.	OEL705	Composite Materials	3	0	0	3
6.	OEL706	Waste to Energy	3	0	0	3

Core Subjects: **SEMESTER-1st**

Program Core-I

Course Code	**CIL601**
Course Name	**Cryptography and Network Security**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• To understand basics of Cryptography and Network Security.
• To be able to secure a message over insecure channel by various means.
• To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
• To understand various protocols for network security to protect against the threats in the networks

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1 INTRODUCTION Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.	10
Unit 2 SYMMETRIC KEY CRYPTOGRAPHY MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures – Modular arithmetic-Euclid? S algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 – Key distribution..	8
Unit 3 PUBLIC KEY CRYPTOGRAPHY MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing –Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography..	10
Unit 4 MESSAGE AUTHENTICATION AND INTEGRITY Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS-Entity Authentication: Biometrics, Passwords, Challenge Response protocols-Authentication applications – Kerberos, X.509.	10
Unit 5 SECURITY PRACTICE AND SYSTEM SECURITY Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	10

COURSE OUTCOMES

• To understand the concepts of Cryptography
• To understand the mathematics of symmetric and public key cryptography
• To understand the concepts associated with Authentication and integrity
• To understand DSS- Entity Authentication: Biometrics, Challenge Response protocols- Authentication applications – Kerberos, X.509.
• To understand Electronic Mail security

REFERENCES BOOKS

1. William Stallings, "Cryptography and Network security Principles and Practices",
2. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
3. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Course Code	**CIL602**
Course Name	**Digital Forensics and Cyber Crime Investigation**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• Understand the languages of digital forensics, and the investigation of digital crime scene
• Learn the basics of computer investigators
• Become knowledgeable in the digital forensics networks and OSI layers

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1 **Introduction:** Computer Forensics Needs, Computer forensics fundamentals, Introduction to Steps of Digital Forensics, Computer Crimes, Types of Digital forensics evidences, Legal Aspects of Digital Forensics.	10
Unit 2 **Hardware and Software:** Understanding Computer components- input and output devices, CPU, Digital Media, System software - Operating System Architecture, Application Software, File Systems, Memory organization concept, Data Storage concepts. Network: Topology, Devices, Protocols and Port, Communication media. IP Address: Types and classes.	8
Unit 3 **Foundations:** Basic Principles and methodologies for digital forensics, Design systems with forensic needs in mind. Phases of Digital Forensics. Introduction to Digital Forensics Tools, Life of a Digital Forensic Investigator. **Data Acquisition:** Principles of Digital Forensic Acquisition, Evidence Handling and Processing Digital Forensic Data.	10
Unit 4 **Evidence Collection:** Rules of Evidence, Jurisdictions, Techniques and standards for Preservation of Data. **Evidence Analysis:** OS /File System Forensics, Application Forensics, Web Forensics, Network Forensics, Mobile Device Forensics.	10
Unit 5 **Investigation:** Computer, Network, System attacks, Attack detection and investigation, Anti forensics. Case studies on File System, Network storage, Web and Mobile.	10

COURSE OUTCOMES
• Understanding the Computer forensics
• Can conduct the investigate and recover the detain Computer forensics
• Applying the knowledge in offending and secure the evidence
• Analyze the knowledge to investigate through the digital evidence
• To Apply network investigation

REFERENCES BOOKS

5. Thomas J Holt , Adam M Bossler, Kathryn C Seigfried-Spellar, Cybercrime and Digital Forensics: An

Introduction, Routledge, 2016

6. Eoghan Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2017
7. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, III Edition, 2016
8. Angus McKenzie Marshall, Digital Forensics: Digital Evidence in Criminal Investigations, Wiley- Blackwell, 2018

SEMESTER 2nd

Program Core-III

Course Code	**CIL603**
Course Name	**Cyber Law**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
The student should be made to: • To enable learner to understand, explore, and acquire practical understanding cyber law.
• Developcompetenciesfordealingwithfraudsanddeceptions(confidencetricks,scams)and other cyber crimes for example, child pornography etc.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1 Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.	10
Unit 2 Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.	8
Unit 3 Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act,	10
Unit 4 Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security.	10
Unit 5 Application area: Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends. Case Study On Cyber Crimes: Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It	10

Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber- Stalking	

COURSE OUTCOMES

- Collect information using network scanning
- Execute a penetration test using standard hacking tools in an ethical manner
- Identify legal and ethical issues related to vulnerability and penetration testing
- Plan a vulnerability assessment and penetration test for a network
- Identify methods to gain access to systems

REFERENCES

1. K. Kumar," Cyber Laws: Intellectual property & ECommerce, Security",1st Edition, Dominant Publisher,2011.
2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007
3. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
4. Information Security policy & implementation Issues, NIIT, PHI.
5. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI, 2003.
6. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, 1stEdition, New Delhi, 2003.
7. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004.
8. Augastine, Paul T., "Cyber Crimes And Legal Issues", Crescent Publishing Corporation, 2007.

Course Code	Course Name	L	T	P	C
CIL604	**MOBILE AND DIGITAL FORENSICS**	3	0	0	3
	Total Number of Lectures:48				

PURPOSE

The use of Mobile phones and digital devices across the globe has increased dramatically. These devices are more susceptible to information security attacks and thus they also possess huge evidences which shall be used during crime scene investigation. This makes the course on mobile and digital forensics an inevitable one for the security professionals. This course on mobile and digital forensics will provide a better understanding for the course participants on different forms of evidences in many digital devices, collection and interpretation of the same.

INSTRUCTIONAL OBJECTIVES

1.	Understand the basics of wireless technologies and security.
2.	Become knowledgeable in mobile phone forensics and android forensics.
3.	Learn the methods of investigation using digital forensic techniques.

LECTURE WITH BREAKUP	NO. OF LECTURES
UNIT- I Overview of wireless technologies and security: Personal Area Networks, Wireless Local Area Networks, Metropolitan Area Networks, Wide Area Networks. Wireless threats, vulnerabilities and security: Wireless LANs, War Driving, War Chalking, War Flying, Common Wi-Fi security recommendations, PDA Security, Cell Phones and Security, Wireless DoS attacks, GPS Jamming, Identity theft.	10
UNIT - II CIA triad in mobile phones-Voice, SMS and Identification data interception in GSM: Introduction, practical setup and tools, implementation- Software and Hardware Mobile phone tricks: Net monitor, GSM network service codes, mobile phone codes, catalog tricks and AT command set- SMS security issues	8
UNIT - III Mobile phone forensics: crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques	10
UNIT - IV Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination-	10
UNIT - V Digital forensics examination principles: Previewing, imaging, continuity, hashing and evidence locations- Seven element security model- developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context	10

1. Gregory Kipper, "*Wireless Crime and Forensic Investigation"*, Auerbach Publications, 2007
2. IosifI.Androulidakis,*"Mobilephonesecurityandforensics:Apractical approach",* Springer publications, 2012
3. AndrewHoog,*"AndroidForensics:Investigation,AnalysisandMobileSecurity for Google Android"*, Elsevier publications, 2011

4. AngusM.Marshall,*"Digitalforensics:Digitalevidenceincriminalinvestigation"*, John–WileyandSons,2008

Elective Courses

Course Code	**CIL701**
Course Name	**Basics of Forensics Psychology**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• To learn the basic psychology
• Analyze the behavior of biology and its structure
• Evaluate the learning process
• Identify the concepts of Psychologists and investigation
• To Discuss the Risks
• To Identify the Interrogation and confessions

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1 **The Science of psychology:** The history of psychology, issues of psychology, modern perspectives, the scientific methodology, issues in psychology, ethics of psychological research. The biological perspective: Neurons and nerves, an overview of the nervous system, distant connection, looking inside living brain, from the bottom up. Sensation and perception: The ABCs of sensation, the science of seeing, the Hearing sense, chemical sense so esthetics sense, The ABCs perception. Consciousness: sleep, dreams effects o f hypnosis, influence of psychoactive drugs.	10
Unit 2 **Learning:** Classical conditioning, operant conditioning, cognitive leaning theory, observational learning. Memory: three memory system, retrieval of long term memories, reconstructive nature of long term memory retrieval, neuroscience of memory, health and memory.	8
Unit 3 Forensic psychology, forensic psychologists, psychology and law enforcement, techniques of criminal investigation.	10
Unit 4 Insanity and competency, From dangerousness to risk assessment, Syndrome evidence, child sexual abuse, child custody and related decisions, improving eyewitness identification procedures.	10
Unit 5 Performance Metrics- General issues- Partitioning the patterns for training, testing, and validation-Cross validation - Fitness and fitness functions - Parametric and nonparametric statistics, Evolutionary algorithm effectiveness metrics, Receiver operating characteristic curves, Computational intelligence tools for explanation facilities, Case Studies for implementation of practical applications in computational intelligence.	10

COURSE OUTCOMES
Students completing this course were able to • Understanding the psychology of historical roots
• To know about the structure of biology and its behaviours
• Assess the investigation
• To assess the Risks
• Understanding the various Interrogations

REFERENCES

1. Psychology, by Saundra K. Ciccarelli Gulf Coast State College J. Noland White Georgia College 4th edition. (unit 1 &2)
2. Forensic Psychology, bySolomonM.Fulero&LawrenceS.Wrightsman3rd edition.(unit 3,4,5)

Course Code	**CIL702**
Course Name	**Operating System Security**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• Understanding the concepts of Operating System Security
• Have depth knowledge about Security kernels
• To Analyze the different types of commercial OS
• To understand Secure Virtual Machine Systems

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 **Introduction**-Secure Operating Systems-Security Goals-Trust Model- Threat Model. Access Control Fundamentals-Protection System-Reference Monitor-Secure Operating Definition. Multics- Multics System-Multics Security- Multics Vulnerability Analysis	10
Unit 2 Security in OS & Goals System Histories-UNIX Security- Windows Security-Information Flow-Information Flow Secrecy Models, Information flow integrity models- Covert Channels.	8
Unit 3 Security Kernels & Securing Commercial OS Secure Communications Processor- Architecture, Hardware, Trusted Operating Program, Kernel Interface Package, Applications, Gemini Secure Operating System-Retrofitting Security into a Commercial OS- History of Retrofitting Commercial OS-Commercial Era-Microkernel Era-Unix Era	10
Unit 4 Secure Virtual Machine Systems Separation Kernels-VAX VMM Security Kernel- VAX VMM Design-VAX VMM Evaluation-VAX VMM Result-Security in other virtual Machine Systems-System Assurance.	10
Unit 5 **CASE STUDY:** Solaris Trusted Extensions-Trusted Extensions Access Control- Solaris Compatibility-Trusted Extensions Mediation – Process Rights Management-Role Based Access	10

Control–Trusted Extensions Networking-Multilevel Services-Administration-Linux Security Modules-Security Enhanced Linux.	

COURSE OUTCOMES
Students completing the course were able to • Understand and analyze operating systems Security
• Analyze Security Kernels
• Apply the concept of commercial OS
• Analyze secure Virtual Machine Systems
• Apply the functionalities in Solaris

REFERENCES

1. Mukesh Singhal, Niranjan G Shivratri, "Advanced Concepts in Operating Systems", McGraw Hill International, 1994.
2. Pradeep Kumar Sinha, "DistributedOperatingSystems:ConceptsandDesign",PHI,2002.

Course Code	**CIL703**
Course Name	**Mathematics For Information Security and Cyber Forensics**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• To define algebra for constructing and writing mathematical proofs.
• To illustrate the limitations of predicate logic.
• To recognize the patterns that arises in graph problems and uses this knowledge for constructing the trees and spanning trees.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1INTRODUCTION TO ABSTRACT ALGEBRA Groups (Definition and Examples) – Subgroups– Permutation groups – Homomorphism – Kernel – Cosets– Lagrange's theorem– Rings – Fields (Definition and Examples).	10
Unit 2 COMBINATORICS Mathematical Induction – Pigeon Hole Principle – Principle of Inclusion and Exclusion – Recurrence Relations – Generating Functions.	8
Unit 3 MATHEMATICAL LOGIC Statements–TruthTable–Connectives–NormalForms–PredicateCalculus–InferenceTheory.	10
Unit 4 DISCRETE STRUCTURES I Basic concepts of Graphs – Subgraphs– Paths and Circuits – Matrix representation of Graphs – Graph Isomorphism – Connected graphs and Components – Euler and Hamiltonian paths – Travelling salesman problem.	10
Unit 5 DISCRETE STRUCTURES II Basic concepts of Trees– Properties – Pendant vertices –Rooted and Binary trees – Spanning trees –Fundamental circuits–Finding all spanning trees of a graph – Spanning trees in a weighted graph.	10

COURSE OUTCOMES
• To understand the concepts of Algebraic Structures
• To understand the concepts of Combinatorics
• To understand the concepts associated with Mathematical Logic and Predicate calculus
• To determine if a given graph is simple or a multi graph, directed or undirected, Eulerian and HamiltonianGraphs,Shortestpathalgorithmanddeterminetheconnectivityofagraph
• ToconstructaminimalspanningtreebyusingKruskal'sandPrim'salgorithminorderto obtain a solution for a real-time problem

REFERENCES BOOKS

1) Tremblay J.P.,Manohar R., *Discrete Mathematical structures with applications to Computer science*, Tata McGraw Hill Publishing Co., (2004).
2) Kenneth Rosen, *Discrete Mathematics and its applications (SIE)*, Tata Mc Graw Hill Publishing Co.,(2007).

3) John C. Martin, *Introduction to languages and the theory of computation (3rd ed.)*, Mcgraw Hill, (2003).
4) Hop croft J.E., Ullman J. D., *Introduction to Automata theory, Languages and Computation*, Narosa Publishing house, (2002).
5) Nar singh Deo, *Graph theory with applications to Engineering and Computer Science*, Prentice Hall of India, (2004).
6) RobinJ.Wilson, *Introduction to Graph theory (4th ed.)*,Pearson, (2002).

Course Code	**ACL601**
Course Name	**Research Methodology and IPR**
Credits	**2**

Total Number ofLectures:

COURSE OBJECTIVE

- To give an overview of the research methodology and explain the technique of defining a research problem
- To explain the functions of the literature review in research.
- To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- To explain various research designs and their characteristics.
- To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.
- To explain several parametric tests of hypotheses and Chi-square test.
- To explain the art of interpretation and the art of writing research reports.
- To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment.
- To discuss leading International Instruments concerning Intellectual Property Rights

UNIT-I	**No of Lectures**
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.	10
UNIT-II	
Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.	8
UNIT-III	

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	10
UNIT-IV	
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.	10
UNIT-V	
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992,Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organization (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.	10

REFERENCES BOOKS

1. Trochim, Research Methods: the concise knowledge base, Atomic Dog Publishing, 2005
2. Fink A, Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 2009

CIL704	SECURITYSCRIPTINGAND ANALYSIS	L	T	P	C
	Total Contact Hours–75	3	0	2	4

This course will help the students to gain mastery over scripting and its application to problems in computer and network security. This course is ideal for penetration testers, security enthusiasts, Packet analyzers and networkadministratorswhowanttolearntoautomatetasksorgobeyondjust using readymade tools.

INSTRUCTIONALOBJECTIVES

1	Understand the system and network security programming.

2	Acquire knowledge on developing web servers and clients
3	Understand various exploitation techniques.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
UNIT I - Introduction To Programming Language Types and styles (8 hours) Introduction to Interpreted Languages - Data Types and variables - Operators and Expressions - Program Structure and Control - Functions and Functional Programming - Classes, Objects and other OOPS concepts. I/O stream- File and Directory Access - Multithreading and Concurrency - Inter Process Communication (IPC) - Permissions and Controls	10
UNIT II - NETWORK SECURITY PROGRAMMING Raw Socket basics -Socket Libraries and Functionality - Programming Servers and Clients - Asynchronous socket channels, Multithreaded server - Programming Wired and Wireless Sniffers - Programming arbitrary packet injectors - Symmetric and Asymmetric encryption client/server	8
UNIT III - WEB APPLICATION SECURITY Web Servers and Client scripting - Web Application Fuzzers - Scraping Web Applications – HTML and XML file analysis - Web Browser Emulation - Attacking Web Services - Application Proxies and Data Mangling - Attacking Session Management - Attacking Access Controls	10
UNIT IV - EXPLOITATION TECHNIQUES Exploit Development techniques - Immunity Debuggers and Libs - Writing plug ins - Binary data analysis - Exploit analysis Automation- Finding Vulnerabilities in Source Code - Automating Customized Attacks	10
UNIT V - Mastering Packet Analysis Capturing methodologies, Capture filters, Display filters, Searching for packets using the Find dialog, Create new Wire shark profiles, Graphs-(I/O,TCP, Flow), Inspecting Application Layer protocols - DNS,FTP, HTTP, SMTP. Analyzing Transport Layer Protocol, Analyzing Traffic in thin Air Network Security Analysis.	10

REFERENCES

1. Mike Dawson,"*More Python programming for Absolute Beginner*", Cengage Learning PTR; 3rd edition, ISBN-10: 1435455002, ISBN-13: 978- 14354550092, 2010.
2. The Web Application Hacker's Handbook, 2nd Edition, Wiley Publication, Dafydd Stuttard, Marcus Pinto
3. Learning Network Programming with Java, PACKT Publishing, By Richard MReese,December2015
4. MasteringWireshark,PACKTPublishing,ByCharitMishra,March2016
5. MarkLutz,"*PythonPocketreference",* O'ReillyMedia; 4thedition, ISBN- 10:0596158084, ISBN-13:978-0596158088, 2009.

CIL705	**Android Security Design and Internals**	L	T	P	C
	Total Contact Hours: 48	3	0	2	4
PURPOSE					
The purpose is to understand the working of Android and learning about its architecture and security related issues					
INSTRUCTIONAL OBJECTIVES					
1	To study about the basic architecture of Android and its features				
2	To learn the various natures of permission in Android Platform				
3	To implement a simple Android APK following Secure coding principles				
4	To understand and implement the various services provided through Android platform				
5	To build and secure custom Android ROM.				

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit-I Android Security Model Linux Kernel- Native User space – Dalvik VM- Java Run Time Libraries- System Services- IPC- Binder's- Framework Libraries- Applications- Sandboxing- Code Signing and Platform Key- SE Linux- System Updates- Verified Boot.	10
Unit-II Permissions Nature of Permission- Request for permission- Management- Protecting Levels- Assignment- Enforcement- System Permission- Shared User ID- Custom Permission – Broadcast Permissions- Content Provider Permission- Pending Intents.	8
Unit- III Introduction to Secure Coding Building a Secure Smartphone Society - Developer's Context- Steps to Install Sample Codes into Android Studio- Android Application Security- Handling Input Data Carefully and Securely.	10
Unit-IV Application Development Creating/Using Activities- Receiving/Sending Broadcasts.-Creating/Using Content Providers- Creating/Using Services- Using SQLite- Handling Files- Using Intent- Outputting Log to - Using Web View- Using Notifications.	10
Unit-V – Secure Functions Building custom Android ROM- Steps and Tools, Creating Password Input Screens- Permission and Protection Level- Add In-house Accounts to Account Manager- Communicating via HTTPS- Handling privacy data- Using Cryptography- Using fingerprint authentication features- Risk of Information Leakage from Clipboard	10

Reference Books

1. Nikolay Elenkov, "Android Security Internals: An In-Depth Guide to Android's Security ", ISBN-13: 978-1-59327-581-5, reprint, No Starch Press, 2014.
2. Japan Smartphone Security Association, "Android Application Secure Design/Secure Coding Guidebook", JSSEC-TECA-SC-GD20170201BE, Secure Coding Working Group, February 1, 2017 Edition.
3. Jeff Six, "Application Security for the Android Platform", ISBN-13: 9781449322274, O'Reilly Media, Inc., 2011.

Course Code	**CIL706**
Course Name	**Web and Database Security**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• To give an Over view of information security
• To Give an over view of Access control of relational databases To reveal the underlying in web application
• To identify future trends in database publishing

• To understand the security re-engineering for databases
• To give an Over view of information security

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 The Web Security, The Web Security Problem, Risk Analysis and Best Practices Cryptography and the Web : Cryptography and Web Security, Working Cryptographic Systems and Protocols , Legal Restrictions on Cryptography ,Digital Identification	10
Unit 2 The Web's War on Your Privacy, Privacy-Protecting Techniques , Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications	8
Unit 3 Database Security : Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems	10
Unit 4 Security Re-engineering for Databases: Concepts and Techniques , Database Watermarking for Copyright Protection , Trustworthy Records Retention , Damage Quarantine and Recovery in Data Processing Systems , Hippocratic Databases: Current Capabilities	10
Unit 5 Future Trends Privacy in Database Publishing: A Bayesian Perspective, Privacy-enhanced Location-based Access Control , Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment	10

COURSE OUTCOMES
• Identify common application vulnerabilities
• Analyze the concepts of quantum cryptography
• Analyze the Web architecture and applications
• Examine, how common mistakes can be bypassed and exploit the application
• Apply client side and service side programming

REFERENCES

1. Web Security, Privacy and Commerce Simson G Arfinkel, Gene Sp afford, O'Reilly.
2. HandbookonDatabasesecurityapplicationsandtrendsMichaelGertz,SushilJajodia

Course Code	**CIL707**
Course Name	**Edge Computing**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
IntroductiontoEdgeComputingisforbeginnerstogainaquickunderstandingoftheedge computingtechnology.Thecoursecoversvarioustopicssuchastheevolutionof computing industry, cloud computing basics and edge computing.

LECTURE WITH BREAKUP	**NO. OF LECTURES**

Unit 1 IntroductiontoEdgeComputingScenario'sandUsecases-Edgecomputingpurposeanddefinition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M	10
Unit 2 A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment,	8
Unit 3 Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout and Pinouts, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Web server, Pi Camera, Image & Video Processing using Pi.	10
Unit 4 Implementation of Microcomputer Raspberry Pi and device Interfacing, Edge to Cloud Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT3.1.1working example	10
Unit 5 Edge computing with Raspberry Pi, Industrial and Commercial IoT and Edge, Edge computing and solutions, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.	10

COURSE OUTCOMES
• This course will explore research, frameworks, and applications in Edge Computing
• The class will begin with are view of current IoT Applications
• Explore frameworks for computing using Raspberry Pi
• Apply the Interfacing edge to cloud applications
• Analyze edge computing with others

REFERENCES

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, SatishNarayanaSrirama, wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, “Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE

Course Code	**CIL708**
Course Name	**Information Security Audit**
Credits	**3**
Pre-Requisites	**Network Security**

Total Number of Lectures:48

COURSE OBJECTIVE
• Tointroducethefundamentalconceptsandtechniquesincomputerandnetworksecurity, giving students an overview of information security and auditing.
• Toexposestudentstothelatesttrendofcomputerattackanddefense.Otheradvancedtopics on information security such as mobile computing security, security and privacy of cloud computing, as well as secure information

system development will also be discussed.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 A model for Internetwork security, Conventional Encryption Principles & Algorithms (DES, AES, RC4, Blowfish), Block Cipher Modes of Operation, Location of Encryption Devices, Key Distribution. Public key cryptography principles, public key cryptography algorithms (RSA, Diffie- Hellman, ECC), public Key Distribution.	10
Unit 2 Approaches of Message Authentication - Secure Hash Functions (SHA-512, MD5) and HMAC, Digital Signatures, Kerberos, X.509 Directory Authentication Service, Email Security: Pretty Good Privacy (PGP) IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.	8
Unit 3 Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Firewalls: Firewall Design principles, Trusted Systems, Intrusion Detection Systems	10
Unit 4 Auditing For Security: Introduction, Basic Terms Related to Audits, Security audits, The Need for Security Audits in Organization, Organizational Roles and Responsibilities for Security Audit, Auditors Responsibility In Security Audits, Types Of Security Audits.	10
Unit 5 Information Security Assessments: Vulnerability Assessment, Classification, Types of Vulnerability Assessment, Vulnerability Assessment Phases, Vulnerability Analysis Stages, Characteristics of a Good Vulnerability Assessment Solutions &Considerations, Vulnerability Assessment Reports – Tools and choosing a right Tool, Information Security Risk Assessment, Risk Treatment, Residual Risk, Risk Acceptance, Risk Management Feedback Loops etc.	10

COURSE OUTCOMES
• Discussed various algorithms and Distributions
• Understanding the approaches of message authentication
• Analyze the security principles and its requirements
• Apply the roles and procedures for audit
• Analyze the approaches to audits during the system development

REFERENCES

1. Information Security by Mark Stamp, Wiley–INDIA, 2006.
2. Fundamentals of Computer Security, Springer.

3. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G. T. Gangemi Sr., SPD O'REILLY 2006.
5. Modern Cryptography by Wenbo Mao, Pearson Education2007.
6. Principles of Information Security, Whitman, Thomson.

Course Code	**CIL709**
Course Name	**Data Privacy**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• To introduce the fundamentals of statistics, data privacy & polices.
• To Study the mathematical model and computing practices
• To learn the protection models and surveys
• To study the computation system
• Aware of policies and practices of technology

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 **Data Privacy and its Importance**- Need for Sharing Data, Methods of Protecting Data, Importance of Balancing Data Privacy and Utility, Disclosure, Tabular Data, Micro data, Approaches to Statistical disclosure control, Ethics, principles, guidelines and regulations.	10
Unit 2 **Micro data**-Disclosure, Disclosure risk, Estimating re-identification risk, Non-perturbative micro data masking, Perturbative micro data masking, Information loss in micro data.	8
Unit 3 **Static Data Anonymization on Multidimensional Data -**Privacy Preserving Methods, Classification of Data in a Multidimensional Data Set, Group- Based Anonymization, k-Anonymity, l-Diversity, t- closeness.	10
Unit 4 **Static Data Anonymization on Complex Data Structures -**Privacy Preserving Graph Data, Privacy Preserving Time Series Data, Time Series Data Protection Methods, Privacy Preservation of Longitudinal Data, Privacy Preservation of Trans- action Data.	10
Unit 5 **Data Anonymization Threats**-Threats to Anonymized Data, Threats to Data Structures, Threats by Anonymization Techniques, Randomization, k- Anonymization, l-Diversity, t-Closeness. Dynamic Data Protection: Tokenization, Understanding Tokenization, Use Cases for Dynamic Data Protection, Benefits of Tokenization Compared to Other Methods, Components for Tokenization.	10

COURSE OUTCOMES
• Learning and applying the concepts of statistics and policies
• Describe the mathematical models and computations
• Capable to protect the models through techniques
• To protect the system through computation
• Implement the policies and practices in the system

REFERENCES

1. George T. Duncan. Mark Elliot, Juan-Jose Salazar-GonZalez, Statistical Confidentiality: Principle and Practice. Springer, 2011. (ISBN No.: 978-1-44-197801-1).
2. Aggarwal, Charu C., Yu, Philip S., Privacy-Preserving Data Mining: Models and Algorithms, Springer, 2010. (ISBN No.: 978-0-38-770991-8). Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Course Code	**CIL710**
Course Name	**Applied Cryptography**
Credits	**3**
Pre-Requisites	**Network Security**

Total Number of Lectures:48

COURSE OBJECTIVE
• Acquire fundamental knowledge on the concepts of infinite fields and number theory
• Identify the various cryptographic protocols
• Identify the intermediate protocols
• Describe the principles of public key cryptosystems, hash functions and digital signature.
• Understand various block cipher and stream cipher models

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 MATHEMATICALFOUNDATION Number theory: Fermat's and Euler's theorem-Chinese remainder theorem-Euclidean algorithm- Test for primality-Discrete logarithms, Information theory: entropy, Uncertainty-Complexity theory: pseudo random number generation and generators.	10
Unit 2CRYPTOGRAPHICPROTOCOLS Protocol Building Blocks-Basic Protocols: key Exchange-Authentication-Authentication and Key exchange: Wide-mouth frog, Yahalom, Kerberos-Formal Analysis of Authentication and Key Exchange Protocols-Multiple Key Public Key Cryptography-Secret Splitting-Secret Sharing: Secret Sharing with Cheaters-Cryptographic protection of Databases.	8
Unit 3 INTERMEDIATEPROTOCOLS Time stamping services, Linking protocol, Distributed Protocol-Undeniable digital signatures-Proxy Signatures-Group Signatures-Fail-stop signatures-computing with encrypting data-bit commitment- Fair coin flips-one-way accumulators.	10
Unit 4 ADVANCED PROTOCOLS Zero knowledge proof, Parallel Zero Knowledge Proof, Zero Knowledge proof of identity: Chess Grandmaster Problem-Blind Signatures-Simultaneous Contract Signing-Digital certified Mail- Simultaneous Exchange of Secrets-Esoteric protocols: Secure Elections-Secure Multiparty Computation.- Digital cash	10
Unit 5 CRYPTOGRAPHICTECHNIQUESANDALGORITHMS Key Length: Symmetric key Length, Public Key length-Algorithm types and Modes: Electronic Code Book Mode, Block Replay, Cipher Block Chaining Mode-Using Algorithms: Choosing an Algorithm, Public Key Cryptography vs Symmetric Cryptography, Encrypting Communication Channels- Public Key Algorithms: RSA, Pohlig-Hellman, Rabin, Elliptic Curve Cryptosystems - Public Key Digital Signature Algorithms: Ghost Digital Signature Algorithm, Discrete Logarithm Signature schemes. Real World approach: IBM secret key management protocol- MITRENET,ISDN, SESAME.	10

COURSE OUTCOMES
• Understand the fundamentals of number theory and algorithms
• Analyze, design and implement different cryptography protocols
• Apply the intermediate protocols for linking and distributing
• Understand various Security practices and System security standards
• ApplythevariousAuthenticationschemestosimulatedifferentapplications

REFERENCES

1. AppliedCryptography:Protocols,AlgorithmsandsourcecodeinC,Wiley,SecondEdition- Bruce Schneier (OCT 18, 1996)

2. CryptographyandNetworkSecurityPrinciplesandpractices-WilliamStallings(Jan24,2010)
3. **FoundationsofCryptography:Volume1,BasicToolsbyOdedGoldreich(Jan18,2007)**
4. Encryption: High-impact Strategies- What You Need to Know: Definitions, Adoptions, Impact, Benefits, Maturity... by Kevin Roebuck, Emereopty Limited, 2011.
5. **Foundations of Cryptography: Volume2, Basic Applications by Oded Gold reich (Sep17,2009)**

Course Code	**CIL711**
Course Name	**Malware Analysis**
Credits	**3**

Pre-Requisites	Network Security

Total Number of Lectures:48

COURSE OBJECTIVE
• Exhibitknowledgetosecurecorruptedsystems,protectpersonaldata,andsecurecomputer networks in an Organization
• Practicewithanexpertiseinacademicstodesignandimplementsecuritysolutions
• Understand key terms and concepts in Cryptography, Governance and Compliance.
• Understandprinciplesofwebsecurityandtoguaranteeasecurenetworkbymonitoringand analyzing the nature of attacks through cyber/computer forensics software/tools.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 MATHEMATICALFOUNDATION Malware Analysis and Reverse Engineering, Types of Malware Analysis, Purpose of Malware Analysis Limitations of Malware Analysis, The Malware Analysis Process , Malware Classes Infectors,NetworkWorms,TrojanHorseBackdoors,Remote-AccessTrojan,InformationStealers .	10
Unit 2CRYPTOGRAPHICPROTOCOLS Malware Infection Vectors, Speed, Stealth, Coverage, Shelf Life, Types of Malware Infection Vectors, Physical Media, E-mails. Instant Messaging and Chat, Social Networking, URL Links, File Shares, Software Vulnerabilities- **Protective Mechanisms-** The Two States of Malware, Static Malware, Dynamic Malware, Protective Mechanisms, Static Malware Protective Mechanisms, Dynamic Malware Protective Mechanisms	8
Unit 3 INTERMEDIATEPROTOCOLS Dependency Types, Environment Dependencies, Program Dependencies, Timing Dependencies, Event Dependencies, **Malware Collection-** Your Own Backyard, Scan for Malicious Files, Look forActiveRootkits,InspectStartupPrograms,InspectRunningProcesses,ExtractSuspiciousFiles, **The Portable Executable File-**The Windows Portable Executable File, The PE File Format, Relative Virtual Address, PE Import Functions.	10
Unit 4 ADVANCED PROTOCOLS **The Proper Way to Handle Files-** File's Analysis Life Cycle, Transfer, Analysis, Storage, **Inspecting Static Malware-** Static Analysis Techniques, File Type Identification, Antivirus Detection, Protective Mechanisms Identification, PE Structure Verification	10
Unit 5 CRYPTOGRAPHICTECHNIQUESANDALGORITHMS **Inspecting Static Malware-**Static Analysis Techniques, ID Assignment-File Type Identification, Antivirus Detection, Protective Mechanisms Identification, PE Structure Verification, Dynamic Analysis-Analyzing Host Behavior, Analyzing Network Behavior	10

COURSE OUTCOMES
• Understand the purpose of malware analysis
• Analyzevariousmalwaresandunderstandthebehaviorofmalwaresinrealworldapplications
• Implement different malware analysis techniques
• Identify the various tools formal ware analysis
• Analyze the malware be having windows and android

REFERENCES

1. CameronH.Malin,EoghanCasey,JamesM.AquilinaandCurtisW.Rose,Malware Forensics Field Guide for

Windows Systems, Syngress, Elsevier, 2014
2. KenDunham,SaeedAbu-Nimeh,MichaelBecherandSethFogie,MobileMalware Attacks and Defense, Syngress, Elsevier, 2009
3. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides by Cameron H. Malin, Eoghan Casey, James M. Aquiline1 st Edition.
4. TheArtofMemoryForensics:DetectingMalwareandThreatsinWindows,Linux,and Mac Memory by Michael Hale Ligh, Kindle Edition

Course Code	**CIL712**
Course Name	**Image Forensics and Security**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• To understand the concepts of Image Forensics and Security
• Emphasize the fundamentals and importance of image security techniques
• Presents the Digital Image Processing, Digital Image Formation, Image Forensics, Pixel Based, Statistical-

Based, Camera-Based, Video Forensics, Image Hiding, Image Coding, Image security techniques: visual cryptography, stenography, water marking

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 INTRODUCTION Introduction to Image Processing, Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing- Image Acquisition, Storage, Processing, Communication, Display.	10
Unit 2DIGITAL IMAGE FORMATION Image formation, image compression, point processing, neighbourhood operations, image analysis. Morphological Image Processing : Dilation and Erosion, Opening and Closing, Extensions to gray level images, hit or miss transformation, basic morphologic algorithms	8
Unit 3 IMAGE FORENSICS Format-Based Forensics- Fourier Transform-Smoothing and Sharpening, frequency domain filters- Ideal, Butterworth and Gaussian Filters, Homomorphic filtering, JPEG, Camera-Based Forensics. Pixel-Based Forensics: Resampling, Cloning, Thumbnails.	10
Unit 4 STATISTICAL-BASED FORENSICS Principal Component Analysis, Linear Discriminant Analysis, Quadratic Discriminant Analysis and Logistic Regression, Computer Generated or Photographic: Perception.	10
Unit 5 VIDEO FORENSICS & IMAGE SECURITY TECHNIQUES Motion, Re-Projected,Projectile,Enhancement Physics-BasedForensics:2-DLighting,LeeHarvey Oswald (case study). Image Hiding, Image Coding. Image file Forensics, Video Surveillance, RFID and Vehicular tracking (GPS) devices, Image security techniques: visual cryptography, Stenography, water marking.	10

COURSE OUTCOMES
Students completing this course were able to • Upon successful completionofthiscourse,thestudentswillgetanin-depthknowledgeinimageandvideo forensics and its security techniques
• Helps students to learn various types of image formation Techniques
• Students will earn the Fourier Transform and Forensic image analysis
• Students will gain the knowledge of statistical based forensics
• StudentslearntoconductaVideoForensics&ImageSecurityTechniquesinan organized and systematic way

REFERENCES

1. N.Efford,DigitalImageProcessing,AddisonWesley2000,ISBN0-201-59623-7
2. M Sonka, VHlavac and RBoyle, Image Processing, Analysis and Machine Vision, PWS 1999,ISBN0-534-95393
3. Pratt.W.K., Digital Image Processing, JohnWileyandSons,NewYork,1978

Course Code	**CIL713**
Course Name	**Data Analytics for Fraud Detection**
Credits	**3**

Total Number of Lectures:48

COURSE OBJECTIVE
• Discuss the overall process of how data analytics is applied
• Discuss how data analytics can be used to better address and identify risks
• Help mitigate risks from fraud and waste for our clients and organizations

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 Introduction: Defining Fraud, Anomalies versus ,Fraud, Types of Fraud, Assess the Risk of Fraud, Fraud Detection : Recognizing Fraud, Data Mining versus Data Analysis and Analytics, Data Analytical Software, Anomalies versus Fraud within Data, Fraudulent Data Inclusions and Deletions	10
Unit 2 The Data Analysis Cycle: Evaluation and Analysis, Obtaining Data Files, Performing the Audit, File Format Types, Preparation for Data Analysis, Arranging and Organizing Data, Statistics and Sampling: Descriptive Statistics, Inferential Statistics, Measure of Centre, Dispersion, Variability, Sampling.	8
Unit 3 Data Analytical Tests : Benford's Law, Number Duplication Test , Z-Score, Relative Size Factor Test, Same-Same-Same Test , Same-Same-Different Test	10
Unit 4 Advanced Data Analytical Tests: Correlation, Trend Analysis, , GEL-1 and GEL-2 , Skimming and Cash Larceny, Billing schemes : and Data Familiarization, Benford's Law Tests, Relative Size Factor Test , Match Employee Address to Supplier data, Gap Detection of Check Number Sequences	10
Unit 5 Payroll Fraud: Data and Data Familiarization, Analysis , The Payroll Register, Expense Reimbursement Schemes , Register disbursement schemes , No cash Misappropriations	10

COURSE OUTCOMES
Students completing this course were able to • Formulate reasons for using data analysis to detect fraud
• Clarifycharacteristicsandcomponentsofthedataandassessitscompleteness
• Identifyknownfraudsymptomsandusedigitalanalysistoidentifyunknownfraud symptoms
• Automate the detection process
• Prove results and understand how to prosecute fraud

COURSE CODE	COURSE NAME	L	T	P	C
CIL714	**MOBILE AND WIRELESS SECURITY**	**3**	**0**	**0**	**3**
	Total Contact Hours – 45				
	Prerequisite				
	TCP/IP, Principles of Network Security				

PURPOSE

The course deals with the security and privacy problems in the realm of wireless networks and mobile computing. The subject is useful to researchers working in thefields of mobile and wireless security and privacy and to graduate students seeking new areas to perform research.

INSTRUCTIONAL OBJECTIVES

1.	Gain in-depth knowledge on wireless and mobile network security and its relation to the new security based protocols.
2.	Apply proactive and defensive measures to counter potential threats, attacks and intrusions.
3.	Design secured wireless and mobile networks that optimize accessibility whilst minimizing vulnerability to security risks.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
UNIT I - WIRELESS NETWORK SECURITY THREATS AND VULNERABILITIES Introduction to wireless technologies, Design Factors, security threats and vulnerabilities present at the different protocol layers, family of security protocols and algorithms used in the existing wireless networks (Bluetooth, Wi-Fi, Wi MAX and LTE standards)	7
UNIT II – 4G MOBILE SECURITY Introduction To Mobile Network Techs, Vulnerabilities Threats And Attack Entry Points. Categorization Of Attacks In Mobile Networks, Signaling Attacks. Threats And Attacks In 4g Networks- Attacks Against Security And Confidentiality, Ip-Based Attacks, Gtp-Based Attacks, Volte Sip-Based Attacks, Diameter-Based Attacks	8
UNIT III - SECURINGPHYSICAL LAYER Emerging physical layer security in wireless communications. Class of information-Theoretic security, artificial-noise-aided security, security-oriented beam forming, security-oriented diversity, and physical-layer secret key generation techniques. Review on various wireless jammers, open challenges in wireless security	10
UNIT IV - ADHOC NETWORK SECURITY Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management in Adhoc Wireless Networks, Secure Routing in Adhoc Wireless Networks	10
UNIT V - RFID SECURITY Introduction, RFID Security and privacy, RFID chips Techniques and Protocols, RFID anti-counterfeiting, Man-in-the-middle attacks on RFID systems, Digital Signature Transponder, Combining Physics and Cryptography to Enhance Privacy in RFID Systems, Scalability Issues in Large-Scale Applications, An Efficient and Secure RFID Security Method with Ownership Transfer, Policy-based Dynamic Privacy Protection Framework leveraging Globally Mobile RFIDs, User-Centric Security for RFID based Distributed Systems, Optimizing RFID protocols for Low Information Leakage, RFID: an anti-counterfeiting tool.	10

REFERENCES

1. Kia Makki, Peter Reiher, “Mobile and Wireless Network Security and Privacy “, Springer, ISBN 978-0-387-71057-0, 2007.
2. Siva Ram Murthy.C, Manoj B.S, “Adhoc Wireless Networks Architectures and By Yulong Zou, Senior Member IEEE, Jia Zhu, Xianbin Wang, Senior Member IEEE, and Lajos Hanzo, Fellow IEEE
3. “A Survey on Wireless Security: Technical Challenges, Recent Advances, and Future Trends” Zou et al.: A Survey on Wireless Security: Technical Challenges, Recent Advances, and Future Trends
4. Noureddine Boudriga, ”Security of Mobile Communications”,
5. ISBN 9780849379413, 2010.
6. Kitsos, Paris; Zhang, Yan, “RFID Security Techniques, Protocols and System-On-Chip Design”, ISBN 978-0-387-76481-8, 2008.
7. Johny Cache, Joshua Wright and Vincent Liu,” Hacking Wireless Exposed: Wireless Security Secrets & Solutions “, second edition, McGraw Hill, ISBN: 978-0-07-166662-6, 2010.

COURSE CODE	COURSE NAME	L	T	P	C
CIL715	**CLOUD ARCHITECTURES AND SECURITY**	2	0	2	3
	Total Contact Hours – 60 (Theory – 30, Practical – 30)				
	Pre-requisite				
	Knowledge of TCP/IP, Cryptography and Network security is preferred				

PURPOSE

Cloud computing has drawn the attention of many business organization and normal users of computers in the recent past. Security aspects of cloud computing have always been subjected to many criticisms. Hence it becomes important for any security professional to possess an understanding of the cloud architecture and methods to secure the same. The afore mentioned fact evident the need for the course.

INSTRUCTIONAL OBJECTIVES

1.	Understand the fundamentals of cloud computing.
2.	Understand the requirements for an application to be deployed in a cloud.
3.	Become knowledgeable in the methods to secure cloud.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
UNIT UNIT- I omputing Fundamental: Cloud computing definition, private, public and hybrid cloud. Cloud aaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of ation in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture.	4
UNIT- II Cloud Applications: Technologies and the processes required when deploying web services-Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages- Development environments for service development; Amazon, Azure, Google App.	6
UNIT-III Security Concepts: Confidentiality, privacy, integrity, authentication, non- repudiation, availability, access control, defence in depth, least privilege- how these concepts apply in the cloud and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud	5
UNIT IV - Multi-tenancy Issues: Isolation of users/VMs from each other- How the cloud provider can provide this- Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security- storage considerations, backup and recovery- Virtualization System Vulnerabilities	7
UNIT V management in the cloud – security management standards- SaaS, PaaS, IaaS availability ment- access control- Data security and storage in cloud	8

REFERENCES

1. GautamShroff, Enterprise Cloud Computing Technology Architecture

Applications [ISBN: 978-0521137355]
2. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach [ISBN: 0071626948]
3. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance [ISBN: 0596802765]
4. Ronald L. Krutz, Russell Dean Vines, Cloud Security [ISBN: 0470589876]

Audit Courses:

ACL701: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

Syllabus

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	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,	4
5	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	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first-time submission	4

Suggested Studies:

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

ACL702: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Syllabus

Units	CONTENTS	Hours
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: 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.	4
3	**Disaster Prone Areas In India** 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	4
4	**Disaster Preparedness And Management** 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.	4
5	**Risk Assessment** 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.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

ACL703: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. huge knowledge from ancient literature

Syllabus

Unit	***Content***	***Hours***
1	• Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	8
2	• Order • Introduction of roots • Technical information about Sanskrit Literature	8
3	• Technical concepts of Engineering-Electrical, Mechanical, • Architecture, Mathematics	8

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

ACL704: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Units	**CONTENTS**	**Hours**
1	• Values and self-development – Social values and individual attitudes. • Work ethics, Indian vision of humanism. • Moral and non-moral valuation. Standards and principles. • Value judgments.	4

2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism. Love for nature, Discipline.	6
3	• Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labor. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	6
4	• Character and Competence – Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence, Humility, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	6

Suggested reading

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course outcomes

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

ACL705: CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus		
Units	**Content**	**Hours**
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	• **Contours of Constitutional Rights & 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.	4
4	• **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	4
5	• **Local Administration:** • District's Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation. • Panchayati raj: Introduction, PRI: Zila Pachayat. • 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	4
6	• **Election Commission:** • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	4

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. Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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.
4. Discuss the passage of the Hindu Code Bill of 1956.

ACL706: PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Syllabus

Units	Content	Hours
1	• **Introduction and Methodology:** • Aims and rationale, Policy background, Conceptual framework and terminology • Theories of learning, Curriculum, Teacher education. • Conceptual framework, Research questions. • Overview of methodology and Searching.	4

2	• Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. • Curriculum, Teacher education.	2
3	• Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	• Professional development: alignment with classroom practices and follow-up support • Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes	4
5	• **Research gaps and future directions** • Research design • Contexts	2
	• Pedagogy • Teacher education • Curriculum and assessment • Dissemination and research impact.	

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

ACL707: STRESS MANAGEMENT by YOGA

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Unit	***Content***	***Hours***
	Definitions of Eight parts of yog. (Ashtanga)	2
2	Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	3
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii) Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata **Course Outcomes:**

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

ACL708: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) • Verses- 71,73,75,78 (do's)	8
2	• Approach to day to day work and duties. • Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, • Chapter 18-Verses 45, 46, 48.	8

3	• Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63	8

Suggested reading

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication
2. Department), Kolkata
3. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
4. Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

Open Elective Subjects:

Business Analytics

Teaching scheme

Lecture: - 3 h/week

Course Code	
Course Name	**Business Analytics**
Credits **Prerequisites**	

Total Number of Lectures: 48

Course objective
1. Understand the role of business analytics within an organization. 2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization. 3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making. 4. To become familiar with processes needed to develop, report, and analyze business data. 5. Use decision-making tools/Operations research techniques. 6. Mange business process using analytical and management tools. 7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive	9
analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	
Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	8
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

COURSE OUTCOMES

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

Industrial Safety

Teaching scheme

Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPEN ELECTIVES

Operations Research

Teaching Scheme

Lectures: 3 hrs/week

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

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

Syllabus Contents:

Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex

Techniques, Sensitivity Analysis, Inventory Control Models **Unit 2**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming **Unit 3**:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4:

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic

Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010

Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Cost Management of Engineering Projects

Teaching scheme

Lecture: - 3 h/week

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance **Project site:** Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting

3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Composite Materials

Teaching scheme

Lecture: - 3 h/week

UNIT–I: INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
   Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Waste to Energy

Teaching scheme

Lecture: - 3 h/week

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
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