

Curriculum Structure

Semester I

Course Number	Subject	L	T	P	Credits
PGIT(IS)101	Program Core I- Mathematical foundations of Computer Science	3	0	0	3
PGIT(IS)102	Program Core II- Advanced Data Structures	3	0	0	3
PGIT(IS)103A/ PGIT(IS)103B/ PGIT(IS)103C	Program Elective I- A. Ethical Hacking/ B. Digital Forensic/ C. Intrusion Detection	3	0	0	3
PGIT(IS)104A/ PGIT(IS)104B/ PGIT(IS)104C/ PGIT(IS)104 D	Program Elective II- A. Machine Learning/ B. Cryptography/ C. Security in Cloud Computing D. Secure Coding	3	0	0	3
PGIT(IS)105	Research Methodology and IPR	2	0	0	2
PGIT(IS)106A/B/C/D	Audit Course	2	0	0	0
PGIT(IS)192	Laboratory 1 (Advanced Data Structures)	0	0	4	2
PGIT(IS)193A/B/C	Laboratory 2 (Based on Elective I)	0	0	4	2
PGIT(IS)194A/B/C	Laboratory 3 (Based on Elective II)	0	0	4	2
Total Credits: 20					

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Semester II

Course Number	Subject	L	T	P	Credits
PGIT(IS)201	Program Core III – Advanced Algorithms	3	0	0	3
PGIT(IS)202	Program Core IV – Soft Computing	3	0	0	3
PGIT(IS)203A/ B/C	Program Elective III – A. Data Encryption & Compression/ B. Steganography & Digital Watermarking C. Malware Analysis & Reverse Engineering	3	0	0	3
PGIT(IS)204A/B/C	Program Elective IV – A. Information Theory & Coding/ B. Systems Security/ C. Biometrics Security	3	0	0	3
PGIT(IS)205A/B/C /D	Audit Course	2	0	0	0
PGIT(IS)291	Advanced Algorithms Lab	0	0	4	2
PGIT(IS)292	Soft Computing Lab	0	0	4	2
PGIT(IS)293A/B/C	Lab based on Elective III	0	0	4	2
PGIT(IS)293	Mini Project with Seminar	0	0	4	2
Total Credits: 20					

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Semester III

Course Number	Subject	L	T	P	Credits
PGIT(IS)301A/ PGIT(IS)301B/ PGIT(IS)301C	Program Elective V – A. Data Security and Access Control/ B. Web Search & Information Retrieval/ C. Blockchains and cryptocurency	3	0	0	03
PGIT(IS)302A/ PGIT(IS)302B/ PGIT(IS)302C/ PGIT(IS)302D/ PGIT(IS)302E/ PGIT(IS)302F	Open Elective A. Business Analytics B. Industrial Safety C. Operations Research D. Cost Management of Engineering Projects E. Composite Materials F. Waste to Energy	3	0	0	03
PGIT(IS)391	Dissertation-I /Industrial Project	0	0	20	10
Total Credits: 16					

Semester IV

Course Number	Subject	L	T	P	Credits
PGIT(IS)491	Dissertation II	0	0	3 2	16
Total Credits: 16					

Detailed Syllabus

Semester I

Course Code	PGIT(IS)101
Course Name	Mathematical Foundation of Computer Science
Credits	3
Pre-Requisites	Discrete Mathematics

Total Number of Lectures:48

COURSE OBJECTIVE	
<ul style="list-style-type: none"> To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning. 	
<ul style="list-style-type: none"> To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency. 	
<ul style="list-style-type: none"> To study various sampling and classification problems. 	
LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains	7
Unit 2 Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood,	7
Unit 3 Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over fitting model assessment.	8
Unit 4 Graph Theory: Isomorphism, Planar graphs, graph colouring, hamilton circuits and euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems	11
Unit 5 Information Technology Applications, Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.	10
Unit 6 Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.	5

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> ● To understand the basic notions of discrete and continuous probability.
<ul style="list-style-type: none"> ● To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
<ul style="list-style-type: none"> ● To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

References

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatorics, Wiley.

Course Code	PGIT(IS)102
Course Name	Advanced Data Structures
Credits	3
Pre-Requisites	UG level course in Data Structures

Total Number of Lectures:48

COURSE OBJECTIVE	
<ul style="list-style-type: none"> ● The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem. 	
<ul style="list-style-type: none"> ● Students should be able to understand the necessary mathematical abstraction to solve problems. 	
<ul style="list-style-type: none"> ● To familiarize students with advanced paradigms and data structure used to solve algorithmic problems. 	
<ul style="list-style-type: none"> ● Student should be able to come up with analysis of efficiency and proofs of correctness. 	
LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.	7
Unit 2 Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists	5
Unit 3 Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees	9
Unit 4 Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest	12

Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	
Unit 5 Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadrees, k-D Trees.	10
Unit 6 Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem	5

COURSE OUTCOMES

After completion of course, students would be able to:

- Understand the implementation of symbol table using hashing techniques.
- Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

References:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

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Course Code	PGIT(IS)103A
Course Name	Ethical Hacking
Credits	3

Total Number of Lectures:48

COURSE OBJECTIVE	
<ul style="list-style-type: none"> ● Provide you with the knowledge and expertise to become a proficient ethical hacker. 	
<ul style="list-style-type: none"> ● Provide you the knowledge about vulnerability; 	
<ul style="list-style-type: none"> ● Provide you the knowledge about ethical tools; 	
<ul style="list-style-type: none"> ● Provide you the knowledge about the network security issues based on real time situations ; 	
LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure	6
Unit 2: Penetration Testing and Tools: Using Metasploit, Using Back Track LiveCDLinux Distribution	7
Unit 3: Vulnerability Analysis: Passive Analysis, Advanced Static Analysis with IDAPro, Advanced Reverse Engineering	10
Unit 4: Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit	11
Unit 5: Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware	7
Unit 6: Case study of vulnerability of cloud platforms and mobile platforms & devices.	7
COURSE OUTCOMES	
On completion of the course the student should be able to	
<ul style="list-style-type: none"> ● Understand about network security issues and solutions. 	
<ul style="list-style-type: none"> ● Understand the key concepts of ethical hacking. 	
<ul style="list-style-type: none"> ● Understand the key concepts of vulnerability. 	
<ul style="list-style-type: none"> ● Identify methods to gain access to systems 	
<ul style="list-style-type: none"> ● Analyze social engineering methods 	
<ul style="list-style-type: none"> ● Explain common physical security weaknesses 	

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References:

1. Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, Gray Hat Hacking: The Ethical Hackers' Handbook, TMH Edition
2. Jon Erickson, Hacking: The Art of Exploitation, SPD

Course Code	PGIT(IS)103B
Course Name	Digital Forensic
Credits	3
Pre-Requisites	Computer network

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Overview on digital forensic
<ul style="list-style-type: none"> ● Gain knowledge about digital forensics investigation, including the concept of the chain of evidence.
<ul style="list-style-type: none"> ● Gain the concept of the chain of evidence.
<ul style="list-style-type: none"> ● Gain the knowledge about recovery of digital evidence from various digital devices using a variety of software utilities

LECTURE WITH BREAKUP	NO. OF LECTURES
<p>Unit 1: Digital Forensics Science: Forensics science, computer forensics, and digitalforensics. Computer Crime: Criminalistics as it relates to the investigative process,analysis of cyber-criminalisticsarea, holistic approach to cyber-forensics.</p>	8
<p>Unit 2: Cyber Crime Scene Analysis: Discuss the various court orders etc., methods tosearch and seizure electronic evidence, retrieved and un-retrievedcommunications, Discuss the importance of understanding what courtdocuments would be required for a criminal investigation.</p>	8
<p>Unit 3: Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.</p>	10
<p>Unit 4: Computer Forensics: Prepare a case, Begin an investigation, Understandcomputer forensics workstations and software, Conduct an investigation,Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis,requirements for preservation of network data.</p>	9

Unit 5: Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.	8
Unit 6: Recent trends in mobile forensic technique and methods to search and seizure electronic evidence	5

COURSE OUTCOMES

On completion of the course the student should be able to

- interpret basic terms and characteristics of digital forensics
- Understand digital forensics investigation, including the concept of the chain of evidence.
- Understand the concept of the chain of evidence.
- Understand about recovery of digital evidence from various digital devices using a variety of software utilities

References:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Course Code	PGIT(IS)103C
Course Name	Intrusion Detection
Credits	3
Pre-Requisites	Fundamental knowledge in Operating Systems, and Networks

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
<ul style="list-style-type: none"> ● Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise
<ul style="list-style-type: none"> ● Analyze intrusion detection alerts and logs to distinguish attack types from false alarms

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention-Network and Host-based IDS	8
Unit 2: Classes of attacks - Network layer: scans, denial of service, penetration- Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/sop Hesitated groups-Automated: Drones, Worms, Viruses	8
Unit 3: A General IDS model and taxonomy, Signature-based Solutions, Snort, Snortrules, Evaluation of IDS, Cost sensitive IDS	10
Unit 4: Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology, Payload Anomaly Detection	9
Unit 5: Attack trees and Correlation of alerts-Autopsy of Worms and Botnets-Malware detection-Obfuscation, polymorphism-Document vectors	8
Unit 6: Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zeroday detection-Insider Threat issues-Taxonomy-Masquerade and Impersonation-Traitors, Decoys and Deception-Future: Collaborative Security	5

COURSE OUTCOMES

On completion of the course the student should be able to
<ul style="list-style-type: none"> • Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.
<ul style="list-style-type: none"> • Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.

References:

1. The Art of Computer Virus Research and Defense, Peter Szor, Symantec Press ISBN 0-321-30545-3
2. Crimeware, Understanding New Attacks and Defenses, Markus Jakobsson and Zulfikar Ramzan, Symantec Press, ISBN: 978-0-321-50195-0 2008

Course Code	PGIT(IS)104A
Course Name	Machine learning
Credits	3

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> • To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
<ul style="list-style-type: none"> • To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
<ul style="list-style-type: none"> • Explore supervised and unsupervised learning paradigms of machine learning.
<ul style="list-style-type: none"> • To explore Deep learning technique and various feature extraction strategies.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Supervised Learning (Regression/Classification) <ul style="list-style-type: none"> • Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Nave Bayes • Linear models: Linear Regression, Logistic Regression, Generalized Linear Models • Support Vector Machines, Nonlinearity and Kernel Methods • Beyond Binary Classification: Multi-class/Structured Outputs, Ranking 	10
Unit 2: Unsupervised Learning <ul style="list-style-type: none"> • Clustering: K-means/Kernel K-means • Dimensionality Reduction: PCA and kernel PCA • Matrix Factorization and Matrix Completion • Generative Models (mixture models and latent factor models) 	7
Unit 3 Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random	6

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Forests)	
Unit 4 Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9
Unit 5 Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9
Unit 6: Recent trends classification applications.in various methods for learning techniques IoT applications of machine learning Various models for and IoT	5
COURSE OUTCOMES	
After completion of course, students would be able to:	
<ul style="list-style-type: none"> ● Extract features that can be used for a particular machine learning approach in various applications. 	
<ul style="list-style-type: none"> ● To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach. 	
<ul style="list-style-type: none"> ● To mathematically analyse various machine learning approaches and paradigms. 	

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

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Course Code	PGIT(IS)104B
Course Name	Cryptography
Credits	3
Pre-Requisites	Computer Networks

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Able to understand the cryptographic algorithm
<ul style="list-style-type: none"> ● Able to realize the public-KeyInfrastructure
<ul style="list-style-type: none"> ● Able to understand security protocols for protecting data on networks

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction of Cryptography, Modular arithmetic, Fermat's little theorem, Euler's theorem, CRT. Different types of attracts.	8
Unit 2: Block ciphers: Pseudorandom functions and permutations (PRFs and PRPs), PRP 5 under chosen plaintext attack and chosen ciphertext attack, Case study: <i>DES, AES, modes of operation.</i>	9
Unit 3: Stream ciphers: RC4 and RC5 Message integrity: Cryptographic hash functions, message authentication code, CBC MAC and its security, Cryptographic hash functions based MACs, Case study: <i>SHA512, SHA3, Merkle trees.</i> Authenticated Encryption-Authenticated encryption ciphers from generic composition,	12
Unit 4: Public key encryption: RSA, Rabin, Knapsack cryptosystems, Diffie-Hellman key exchange protocol, ElGamal encryption.	11
Unit 5: Digital signatures: Generic signature schemes, RSA, ElGamal and Rabin's signature schemes, blind signatures, threshold signature schemes, Signcryption.	8

COURSE OUTCOMES
On completion of the course the student should be able to
<ul style="list-style-type: none"> ● Understand the cryptographic algorithm
<ul style="list-style-type: none"> ● Understand the public-KeyInfrastructure
<ul style="list-style-type: none"> ● Understand security protocols for protecting data on networks

References:

1. 1. A. J. Menezes, P. C. V. Oorschot and S. A. Vanstone, *Handbook of Applied Cryptography*, CRC Press, 1996.
2. O. Goldreich, *Foundations of Cryptography: Vol. 1, Basic Tools*, Cambridge University Press, 2001.
3. O. Goldreich, *Foundations of Cryptography: Vol. 2, Basic Applications*, Cambridge University Press, 2004.
4. J. Katz and Y. Lindell, *Introduction to Modern Cryptography*, Chapman & Hall/CRC, 2007.
5. Abhijit Das and Veni Madhavan C. E., *Public-Key Cryptography: Theory and Practice*, Pearson Education India, 2009.
6. Abijit Das, *Computational Number theory*, CRC Press, 2013.
7. Dan Boneh and Victor Shoup, *A Graduate Course in Applied Cryptography*, V4, 2017

Course Code	PGIT(IS)104C
Course Name	Security in Cloud Computing
Credits	3
Pre-Requisites	Computer Programming, Mathematical Logic

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● To introduce the fundamentals and essentials of Cloud Computing
<ul style="list-style-type: none"> ● To introduce security in cloud computing
<ul style="list-style-type: none"> ● Introduction into cloud offerings.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Fundamentals of cloud computing and types.	6
Unit 2: The trade-offs and differences among cloud offerings such as SaaS, PaaS and IaaS, Key-value stores and their trade-offs against transactional SQL stores, Implementations of classic key-value stores such as Big Table & Dynamo	8
Unit 3: The use of consensus in distributed systems and its implementation in Paxos and Raft, MapReduce and other parallel processing frameworks, Server and network virtualization,	10

Unit 4: Security in the cloud-infrastructure and data, Significant hands-on project experience with a chosen cloud computing framework, Privacy, Side Channel Attack,	14
Unit 5: Insider attack on cloud computing, SAS-70 Certificates HIPAA, Public and Private cloud, Key Management problem for cloud, Homomorphic and Searchable Encryption.	10

COURSE OUTCOMES
On completion of the course the student should be able to
<ul style="list-style-type: none">● Able to understand the fundamentals and essentials of Cloud Computing.
<ul style="list-style-type: none">● Able to understand security in cloud computing.
<ul style="list-style-type: none">● Able to understand cloud offerings.

References:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009

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Course Code	PGIT(IS)104D
Course Name	Secure coding
Credits	3
Pre-Requisites	Computer Programming, Mathematical Logic

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Gain knowledge on how to develop secure software
<ul style="list-style-type: none"> ● Understand the causes of security vulnerabilities and how they are exploited
<ul style="list-style-type: none"> ● Develop skills in using security-oriented software techniques
<ul style="list-style-type: none"> ● Read and analyse scientific papers and synthesize the contents across a subdomain

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction to software security, Managing software security risk, Selecting software development technologies, An open source and closed source, Guiding Principles for software security, Auditing software, Buffer overflows, Access control, Race conditions, Input validation, Password authentication	5
Unit 2: Anti-tampering, Protecting against denial of service attack, Copy protection schemes, Client-side security, Database security, Applied cryptography, Randomness and determinism	7
Unit 3: Buffer Overrun, Format String Problems, Integer Overflow, and Software Security Fundamentals SQL Injection, Command Injection, Failure to Handle Errors, and Security Touchpoints	9
Unit 4: Cross Site Scripting, Magic URLs, Weak Passwords, Failing to Protect Data, Weak random numbers, improper use of cryptography	13

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Unit 5: Information Leakage, Race Conditions, Poor usability, Failing to protect network traffic, improper use of PKI, trusting network name resolution	9
Unit 6: Case study of Cross Site Scripting, Magic URLs, Weak Passwords Buffer Overflows, Access control, Race conditions.	5

COURSE OUTCOMES

On completion of the course the student should be able to

- Understand secure software
- Develop the knowledge about causes of security vulnerabilities and how they are exploited
- Develop skills in using security-oriented software techniques

References:

1. J. Viega, M. Messier. Secure Programming Cookbook, O'Reilly.
2. M. Howard, D. LeBlanc. Writing Secure Code, Microsoft
3. J. Viega, G. McGraw. Building Secure Software, Addison Wesley

Course Code	PGIT(IS)105
Course Name	Research Methodology and IPR
Credits	2

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Understand research problem formulation. ● Analyze research related information ● Follow research ethics ● Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity. ● Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular. ● Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

- StuartMelville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

- Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
- Mayall, “Industrial Design”, McGraw Hill, 1992.
- Niebel, “Product Design”, McGraw Hill, 1974.
- Asimov, “Introduction to Design”, Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
- T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Course Code	PGIT(IS)106A
Course Name	English for research paper writing
Credits	0

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 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’sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht

Heidelberg London, 2011.

Course Code	PGIT(IS)106B
Course Name	Disaster management
Credits	0

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, Pardeep Et. 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.

Course Code	PGIT(IS)106C
Course Name	Sanskrit for technical knowledge
Credits	0

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	<ul style="list-style-type: none"> ● Alphabets in Sanskrit, ● Past/Present/Future Tense, ● Simple Sentences 	8
2	<ul style="list-style-type: none"> ● Order ● Introduction of roots ● Technical information about Sanskrit Literature 	8
3	<ul style="list-style-type: none"> ● Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics 	8

Suggested reading

1. “Abhyasa Pustakam” – Dr. Vishwas, Samskrita-Bharati Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumba Sastry, Rashtriya Sanskrit Sansthan, 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

Course Code	PGIT(IS)106D
Course Name	Value education
Credits	0

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

Unit	Content	Hours
1	<ul style="list-style-type: none"> ● Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. ● Moral and non- moral valuation. Standards and principles. Value judgements 	4
2	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● 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 labour. ● 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	<ul style="list-style-type: none">● 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
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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

Advanced Data Structures Lab PGIT (IS)192

Assignments are based on theory of PGIT (IS) 102

Lab based on Elective I: PGIT (IS) 193A/B/C

Assignments are based on theory of PGIT (IS) 103A/B/C

Lab based on Elective II: PGIT (IS) 194A/B/C

Assignments are based on theory of PGIT (IS) 104A/B/C

Semester II

Course Code	PGIT(IS)201
Course Name	Advanced Algorithms
Credits	3
Pre-Requisites	UG level course in Algorithm Design and Analysis

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Introduce students to the advanced methods of designing and analyzing algorithms.
<ul style="list-style-type: none"> ● The student should be able to choose appropriate algorithms and use it for a specific problem.
<ul style="list-style-type: none"> ● To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
<ul style="list-style-type: none"> ● Students should be able to understand different classes of problems concerning their computation difficulties.
<ul style="list-style-type: none"> ● To introduce the students to recent developments in the area of algorithmic design.

LECTURE WITH BREAKUP	NO. OF LECTURES
<p>Unit1 Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.</p>	6
<p>Unit 2 Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.</p>	8
<p>Unit 3 Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.</p>	9
<p>Unit 4 Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm</p>	10

Unit 5 Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	10
Unit 6 Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5

COURSE OUTCOMES

After completion of course, students would be able to:

- Analyze the complexity/performance of different algorithms.
- Determine the appropriate data structure for solving a particular set of problems.
- Categorize the different problems in various classes according to their complexity.
- Students should have an insight of recent activities in the field of the advanced data structure.

References:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

Course Code	PGIT(IS)202
Course Name	Soft Computing
Credits	3
Pre-Requisites	Basic knowledge of mathematics

Total Number of Lectures:48

COURSE OBJECTIVE

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide studentan hand-on experience on MATLAB to implement various strategies.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics	7
Unit 2 FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems,	8

Fuzzy Expert Systems, Fuzzy Decision Making.	
Unit 3 NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks	10
Unit 4 GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.	5
Unit 5 Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic	13
Unit 6 Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	5
COURSE OUTCOMES	
After completion of course, students would be able to:	
<ul style="list-style-type: none"> ● Identify and describe soft computing techniques and their roles in building intelligent machines 	
<ul style="list-style-type: none"> ● Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems. 	
<ul style="list-style-type: none"> ● Apply genetic algorithms to combinatorial optimization problems. 	
<ul style="list-style-type: none"> ● Evaluate and compare solutions by various soft computing approaches for a given problem. 	

References

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, Eiji Mizutani, Neuro:Fuzzy and Soft Computing®, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications®, Prentice Hall, 1995.
3. MATLAB Toolkit Manual

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Course Code	PGIT(IS)203A
Course Name	Data Encryption & Compression
Credits	3
Pre-Requisites	Wireless Networks

Total Number of Lectures:45

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● The course gives an overview of various topics related to security
<ul style="list-style-type: none"> ● The course covers topics with types of attack experienced, encryption and authentication for deal with attacks
<ul style="list-style-type: none"> ● Able to understand data compression, need and techniques of data compression

LECTURE WITH BREAKUP	NO. OF LECTURES
<p>Unit 1: Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks.</p> <p>Encryption Techniques: Plaintext, Cipher text, Substitution & Transposition Techniques, Encryption & Decryption, Types of attacks, Key range & Size.</p>	8
<p>Unit 2: Symmetric & Asymmetric Key Cryptography: Algorithm types & Modes,DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric &Asymmetric key together, Digital signature, Knapsack algorithm.User Authentication Mechanism: Authentication basics, Passwords,Authentication tokens, Certificate based & Biometric authentication, Firewall.</p>	9
<p>Unit 3: Case Studies Of Cryptography: Denial of service attacks, IP spoofing attacks,Secure inter branch payment transactions, Conventional Encryption and Message Confidentiality, Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management</p>	9
<p>Unit 4: Introduction: Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio,Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Loss less & Lossy</p>	10
<p>Unit 5: Entropy encoding-- Repetitive character encoding, Run length encoding,Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic &</p>	7

Lempel-Ziv Coding; Source encoding-- Vector quantization (Simple vector quantization &with error term); Differential encoding—Predictive coding, Differential pulse code modulation, Delta modulation, Adaptive differential pulse code modulation; Transform based coding :Discrete cosine transform & JPEGstandards; Fractal compression	
Unit 6: Recent trends in encryption and data compression techniques.	5

COURSE OUTCOMES

On completion of the course the student should be able to

- Understand the basics of data encryption
- Analysis various Symmetric Key based encryption
- Understand Asymmetric Key based encryption,
- Understand lossy and lossless compression
- Solve problem Shannon – Fano, Huffman coding , LZ-77, LZ-78, LZW
- Apply various video and audio compression

References:

1. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
2. The Data Compression Book by Nelson, BPB.
3. Cryptography & Network Security by Atul Kahate, TMH.

Course Code	PGIT(IS)203B
Course Name	Steganography and Digital Watermarking
Credits	3
Pre-Requisites	Computer Graphics, Image Processing

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> • Make students familiar about Digital watermarking and steganography.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Steganalysis: Active and Malicious Attackers, Active and passive steganalysis,	8
Unit 2: Frameworks for secret communication (pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive),	8
Unit 3: Steganography techniques: Substitution systems, Spatial Domain, Transformdomain techniques, Spread spectrum, Statistical steganography, CoverGeneration and cover selection, Tools: EzStego, FFEncode, Hide 4 PGP, Hideand Seek, S Tools etc.)	10
Unit 4: Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based	11
Unit 5: Digital Watermarking: Introduction, Difference between Watermarking and Steganography, History, Classification (Characteristics and Applications), Types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Attacks and Tools (Attacks by Filtering, Remodulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication.	7
Unit 6: Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.	4

COURSE OUTCOMES

On completion of the course the student should be able to
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| <ul style="list-style-type: none">● Students should be able to understand how Digital Watermarking and Steganography works and how they can be used in Applications for making it more secure. |
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References:

1. Peter Wayner, “Disappearing Cryptography–Information Hiding: Steganography & Watermarking”, Morgan Kaufmann Publishers, New York, 2002.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, “Digital Watermarking and Steganography”, Margan Kaufmann Publishers, New York, 2008.
3. Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, ZoranDuric, SushilJajodia

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Course Code	PGIT(IS)203C
Course Name	Malware Analysis and Reverse Engineering
Credits	3
Pre-Requisites	Computer Networks

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> Understand how malware hides its execution, including process injection, process replacement and user-space rootkits
<ul style="list-style-type: none"> Grasp how shellcode works, including position independence, symbol resolution and decoders
<ul style="list-style-type: none"> Understand how to combat anti-debugging, including bypassing timing checks, Windows debugger detection and debugger vulnerabilities

LECTURE WITH BREAKUP	NO. OF LECTURES
<p>Unit 1: Fundamentals of Malware Analysis (MA), Reverse Engineering Malware (REM) Methodology, Brief Overview of Malware analysis lab setup and configuration, Introduction to key MA tools and techniques, Behavioral Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining ClamAV Signatures, Creating Custom ClamAV Databases, Using YARA to Detect Malware Capabilities, Creating a Controlled and Isolated Laboratory, Introduction to MA Sandboxes, Ubuntu, Zeltser's REMnux, SANS SIFT, Sandbox Setup and Configuration New Course Form, Routing TCP/IP Connections, Capturing and Analyzing Network Traffic, Internet simulation using INetSim, Using Deep Freeze to Preserve Physical Systems, Using FOG for Cloning and Imaging Disks, Using MySQL Database to Automate FOG Tasks, Introduction to Python, Introduction to x86 Intel assembly language, Scanners: Virus Total, Jotti, and NoVirus Thanks, Analyzers: Threat Expert, CWSandbox, Anubis, Joebox, Dynamic Analysis Tools: Process Monitor, Regshot, HandleDiff, Analysis Automation Tools: Virtual Box, VM Ware, Python, Other Analysis Tools</p>	9
<p>Unit 2: Malware Forensics Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries, Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plugins, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.</p>	9

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<p>Unit 3: Malware Forensics Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries , Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plugins:, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.</p>	9
<p>Unit 4: Memory Forensics and Volatility Memory Dumping with MoonSols Windows Memory Toolkit, Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA.</p>	8
<p>Unit 5: Researching and Mapping Source Domains/Ips Using WHOIS to Research Domains, DNS Hostname Resolution, Querying Passive DNS, Checking DNS Records, Reverse IP Search New Course Form, Creating Static Maps, Creating Interactive Maps.</p>	8
<p>Unit 6: Case study of Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA</p>	5

COURSE OUTCOMES

On completion of the course the student should be able to

- Understand process injection, process replacement and user-space rootkits
- Understand how malware hides its execution, including shellcode works, including position independence, symbol resolution and decoders
- Understand combat anti-debugging, including bypassing timing checks, Windows debugger detection and debugger vulnerabilities

References:

1. . Michael Sikorski, Andrew Honig "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" publisher William Pollock

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Course Code	PGIT(IS)204A
Course Name	Information Theory and Coding
Credits	3
Pre-Requisites	Digital electronics

Total Number of Lectures: 48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Understand the basics of information theory and coding theories.
<ul style="list-style-type: none"> ● Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them
<ul style="list-style-type: none"> ● Introduce the concept of amount of information, entropy, channel capacity, error-detection and error-correction codes, block coding, convolution coding, and Viterbi decoding algorithm.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Information and entropy information measures, Shannon's concept of Information. Channel coding, channel mutual information capacity (BW),	8
Unit 2: Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes,	8
Unit 3: Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques,	9
Unit 4: Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1-D Compression, CCITT group 3 2D compression, CCITT group 4 2D Compression.	10
Unit 5: Convolutional codes, sequential decoding. Video image Compression: CITT H261 Video coding algorithm, audio (speech) Compression. Cryptography and cipher.	7
Unit 6: Case study of CCITT group 3 1-D Compression, CCITT group 3 2D compression.	6

COURSE OUTCOMES
After completion of course, students would be:

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<ul style="list-style-type: none">• Able to understand the basics of information theory and coding theories.
<ul style="list-style-type: none">• Able to understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them
<ul style="list-style-type: none">• Inspect error detection and correction in linear block codes and Develop encoding circuits for cyclic codes
<ul style="list-style-type: none">• Analysis various Lossy and lossless Coding
<ul style="list-style-type: none">• Construct Convolutional codes, sequential decoding and Video image Compression, understand cryptography and cipher
<ul style="list-style-type: none">• Case study compression and D-compression

References:

1. Fundamentals in information theory and coding, Monica Borda, Springer.
2. Communication Systems: Analog and digital, Singh and Sapre, TataMcGraw Hill.
3. Multimedia Communications Fred Halsall.
4. Information Theory, Coding and Cryptography R Bose.
5. Multimedia system Design Prabhat K Andleigh and Kiran Thakrar.

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Course Code	PGIT(IS)204B
Course Name	Systems Security
Credits	3
Pre-Requisites	Computer Networks

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● To learn the basics of security and various types of security issues. ● To study different cryptography techniques available and various security attacks. ● Explore network security and how they are implemented in real world. ● To get an insight of various issues of Web security and biometric authentication.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Data security: Review of cryptography. Examples RSA, DES, ECC.	6
Unit 2: Authentication, non-repudiation and message integrity. Digital signatures and certificates. Protocols using cryptography (example Kerberos). Attacks on protocols	9
Unit 3 Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec. Security Goals, Secure Design Principles, Authentication, Linux Password scheme, Password Security, Privilege Escalation Attacks, Assembly Primer, Shellcoding, ELF File Format,	9
Unit 4 Web security – SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access Control, firewalls and host/network intrusion detection.	11
Unit 5 Other topics: Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.	8
Unit 6: Memory Exploits – Buffer Overflow, Off by one overflow, Format String Attacks, Integer Overflow, Return to Libc, Heap Overflow, Case Study of Local and Remote Attacks, Exploit Development with Metasploit, Web Security – HTML/DOM Refresher, JavaScript, Browser Security Model, Authentication and Session Management, Cookies, Same Origin Policy,	5

Security Policy for Windows and Frames, Web Vulnerabilities - Cookie protocol problems, SQL Injection, XSS, CSRF, SSL/TLS Vulnerabilities, Session Hijacking, Guninski Attack, Defenses, Understanding Threats - Classification, Rootkits, Virus, Worm, Clickjacking, Phishing, Pharming, Exploit kits, Botnets, Defenses- ASLR, DEP, Stack Canaries, Secure Coding Techniques for C Programs, Trusted Execution Environment- Case Study on TrustZone, Security Vulnerability Tools , Static and Dynamic Analysis overview	
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COURSE OUTCOMES

After completion of course, students would be able to:
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| <ul style="list-style-type: none"> ● To have an understanding of basics of security and issues related to it. ● Understanding of biometric techniques available and how they are used in today’s world. ● Security issues in web and how to tackle them. ● Learn mechanisms for transport and network security |
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References:

1. W. R. Cheswick and S. M. Bellovin. Firewalls and Internet Security. Addison Wesley, 1994.
2. W. Stallings. Cryptography and Network Security. Prentice Hall, 1999.
3. B. Schneier. Applied Cryptography. Wiley, 1999.
4. Neil Daswani, Christopher Kern, Anita Kesavan, “*Foundations of Security, What Every Programmer*
Needs to Know”, Apress, 2007
5. James C. Foster and Vincent T. Liu, “*Writing Security Tools and Exploits*”, Syngress Publishing
6. Gary McGraw, John Viega, “*Building Secure Software*”, Addison-Wesley Professional, 2001.
7. Jon Ericson, “*Hacking: The Art of Exploitation*”, Second Edition, No Starch Press, 2008, ISBN 978-1593271442
8. Chris Anley, John Heasman, Felix Linder, Gerardo Richarte, The Shellcoder’s Handbook :
Discovering and Exploiting Security Holes, Second Edition, Addison-Wiley, ISBN 978-0470080238

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Course Code	PGIT(IS)204C
Course Name	Biometrics Security
Credits	3
Pre-Requisites	Computer networks, Fundamental knowledge in Biometrics

Total Number of Lectures:48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.
<ul style="list-style-type: none"> ● Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
<ul style="list-style-type: none"> ● Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
<ul style="list-style-type: none"> ● Understand various Biometric security issues.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction and Definitions of bio-metrics, Traditional authenticated methods and technologies.	8
Unit 2: Bio-metric technologies: Fingerprint, Face, Iris, Hand Geometry, Gait Recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.	8
Unit 3: The Law and the use of multi bio-metrics systems.	8
Unit 4: Statistical measurement of Bio-metric. Bio-metrics in Government Sector and Commercial Sector.	10
Unit 5: Case Studies of bio-metric system, Bio-metric Transaction. Bio-metric System Vulnerabilities	9
Unit 6: Recent trends in Bio-metric technologies and applications in various domains. Case study of 3D face recognition and DNA matching.	5

COURSE OUTCOMES
On completion of the course the student should be able to understand
<ul style="list-style-type: none"> ● Biometric systems at the component level and be able to analyze and

design basic biometric system applications.
<ul style="list-style-type: none"> • Basic physical and biological science and engineering principles underlying biometric systems.
<ul style="list-style-type: none"> • Sociological and acceptance issues associated with the design and implementation of biometric systems.
<ul style="list-style-type: none"> • Various Biometric security issues.

References:

1. Biometrics for network security, Paul Reid, Hand book of Pearson
2. D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Handbook of Fingerprint Recognition, Springer Verlag, 2003.
3. A. K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in Networked Society, Kluwer Academic Publishers, 1999.
4. 4. J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology, Design and Performance Evaluation, Springer, 2004.
5. Anil Jain, Arun A. Ross, Karthik Nanda kumar, Introduction to biometric, Springer, 2011.
6. Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D. Maltoni, and D. Maio

Course Code	PGIT(IS)205A
Course Name	Constitution of India
Credits	0

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	<ul style="list-style-type: none"> • History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working) 	4
2	<ul style="list-style-type: none"> • Philosophy of the Indian Constitution: Preamble Salient Features 	4

3	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● Local Administration: ● District's Administration head: Role and Importance, ● Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation. ● Pachayati raj: Introduction, PRI: ZilaPachayat. ● Elected officials and their roles, CEO ZilaPachayat: Position and role. ● Block level: Organizational Hierarchy (Different departments), ● Village level: Role of Elected and Appointed officials, ● Importance of grass root democracy 	4
6	<ul style="list-style-type: none"> ● 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.

Course Code	PGIT(IS)205B
Course Name	Pedagogy Studies
Credits	0

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	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. ● Curriculum, Teacher education. 	2
3	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● Professional development: alignment with classroom practices and follow-up support ● Peer support ● Support from the head teacher and the community. ● Curriculum and assessment 	4

	<ul style="list-style-type: none"> ● Barriers to learning: limited resources and large class sizes 	
5	<ul style="list-style-type: none"> ● Research gaps and future directions ● Research design ● Contexts 	2

	<ul style="list-style-type: none"> ● Pedagogy ● Teacher education ● Curriculum and assessment ● Dissemination and research impact. 	
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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?

Course Code	PGIT(IS)205C
Course Name	Stress management by Yoga
Credits	0

Course Objectives

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

Syllabus

Unit	Content	Hours
1	<ul style="list-style-type: none"> ● Definitions of Eight parts of yog. (Ashtanga) 	8
2	<ul style="list-style-type: none"> ● Yam and Niyam. Do`s and Don`t`s in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan 	8
3	<ul style="list-style-type: none"> ● 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, AdvaitaAshrama (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

Course Code	PGIT(IS)205D
Course Name	Personality development through life enlightenment skills
Credits	0

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 <ul style="list-style-type: none"> • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (don't's) • Verses- 71,73,75,78 (do's) 	8
2	<ul style="list-style-type: none"> • Approach to day to day work and duties. • Shrimad BhagwadGeeta : 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	<ul style="list-style-type: none"> • Statements of basic knowledge. • Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad BhagwadGeeta: 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 Department), Kolkata
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.

Advanced Algorithms Lab : PGIT (IS)291

Assignments are based on theory of PGIT (IS) 201

Soft Computing Lab: PGIT (IS) 292

Assignments are based on theory of PGIT (IS) 202

Lab based on Elective III: PGIT (IS) 293A/B/C

Assignments are based on theory of PGIT (IS) 203A/B/C

Semester-III

Course Code	PGIT(IS)301A
Course Name	Data Security and Access Control
Credits	3
Pre-Requisites	Database Management

Total Number of Lectures: 48

COURSE OBJECTIVE
<ul style="list-style-type: none"> ● To understand and implement classical models and Algorithms
<ul style="list-style-type: none"> ● To analyse the data, identify the problems, and choose the relevant models and algorithms to apply
<ul style="list-style-type: none"> ● To assess the strengths and weaknesses of various access control models and to analyse their behaviour.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.	9
Unit 2: Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.	8

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Unit 3: Biba'sintrigity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi line Insurance Company	10
Unit 4: Smart Card based Information Security, Smart card operating system- fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.	10
Unit 5: Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.	7
Unit 6: Recent Trends related to data security management, vulnerabilities in different DBMS.	4

COURSE OUTCOMES
After completion of course, students would be able to:
<ul style="list-style-type: none"> ● Demonstrate knowledge of the basic of data security
<ul style="list-style-type: none"> ● To understand and implement classical models and Algorithms
<ul style="list-style-type: none"> ● To analyses the data, identify the problems, and choose the relevant models and algorithms to apply
<ul style="list-style-type: none"> ● To assess the strengths and weaknesses of various access control models and to analyses their behavior
<ul style="list-style-type: none"> ● Analysis Smart Card based Security techniques
<ul style="list-style-type: none"> ● Identifies of vulnerabilities in different DBMS and do Case study

References:

1. David F. Ferraiolo, D.Richard Kuhn, RamaswamyChandra mouli, Role Based Access Control.
2. <http://www.smartcard.co.uk/tutorials/sct-itsc.pdf> : Smart Card Tutorial.

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Course Code	PGIT(IS)301B
Course Name	Web Search and Information Retrieval
Credits	3
Pre-Requisites	Wireless Communication and Networks

Total Number of Lectures:48

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Information retrieval model, Information retrieval evaluation, Searching the Web	8
Unit 2: Document Representation, Query languages and query operation, Meta-datasearch,	9
Unit 3: Indexing and searching, Scoring and ranking feature vectors	8
Unit 4: Ontology, domain specific search, parallel and distributed information retrieval,	8
Unit 5: Text and multimedia languages, Social networks. NSR	10
Unit 6: Recent trends in Web search and Information retrieval techniques.	5

COURSE OUTCOMES
On completion of the course the student should be able to
<ul style="list-style-type: none"> ● Demonstrate genesis and diversity of information retrieval
<ul style="list-style-type: none"> ● Describe hands-on experience store, and retrieve information from www semantic approaches.
<ul style="list-style-type: none"> ● Demonstrate the usage of different data/file structures in building
<ul style="list-style-type: none"> ● Analyze the performance of information retrieval using advanced
<ul style="list-style-type: none"> ● Analyze ranked retrieval of a very large number of documents
<ul style="list-style-type: none"> ● Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine

References:

1. 1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at <http://nlp.stanford.edu/IR-book>).
3. 2. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.

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(Effective for 2019-2020 Admission session)

5. 3. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, Addison-
6. Wesley, 2009 (available at <http://ciir.cs.umass.edu/irbook/>).
7. 4. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2nd
8. Edition).

Course Code	PGIT(IS)301C
Course Name	Blockchains and cryptocurency
Credits	3
Pre-Requisites	Computer Networks, Cryptography

Total Number of Lectures:48

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Blockchain Data structure, Hash chain, Distributed database, Index structure	8
Unit 2: Blockchain Architecture -Hashes, Transactions, Asymmetric-Key Cryptography, Addresses and Address Derivation, Private Key Storage, Ledgers, Blocks, Chaining Blocks.	8
Unit 3: Consensus and multiparty agreements - Protocols, Proof of Work, Proof of Stake, Delegated Proof of Stake, Proof of Elapsed Time, Deposit based consensus, Proof of importance,	8
Unit 4: Federated consensus or Federated Byzantine consensus, Reputation-based mechanisms, Practical Byzantine Fault Tolerance. Blockchain implementation, Forking - Soft Fork, Hard Forks, Cryptographic Changes and Forks, Smart contract programing,	12
Unit 5: Blockchain Platforms – Cryptocurrencies (Bitcoin, Litecoin, Ethereum, Ripple), Hyperledger, Ethereum. Blockchain - Outside of Currencies, IPFS protocol and Blockchain,	8
Unit 6: Blockchain Concurrency and scalability, Network models and timing assumptions.	4

COURSE OUTCOMES
On completion of the course the student should be able to
<ul style="list-style-type: none"> ● Describe the basic concepts and technology used for blockchain
<ul style="list-style-type: none"> ● Describe the primitives of the distributed computing and cryptography related to blockchain.
<ul style="list-style-type: none"> ● Illustrate the concepts of Bitcoin and their usage.
<ul style="list-style-type: none"> ● Apply security features in blockchain technologies.

- | |
|---|
| ● Use smart contract in real world applications |
|---|

References:

1. Abhijit Das and Veni Madhavan C. E., *Public-Key Cryptography: Theory and Practice*, Pearson Education India, 2009.
2. Melanie Swan, *Blockchain - Blueprint for a new economy*, O'Reilly Media, Inc., 2015.
3. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*, Princeton University Press, 2016
4. Roger Wattenhofer, CreateSpace, *The Science of the Blockchain*, Independent Publishing Platform, 2016
5. Imran Bashir, *Mastering Blockchain*, 2017.
6. Andreas M. Antonopoulos, *Mastering Bitcoin - Programming the Open Blockchain*, O'Reilly Media, Inc., 2017

OPEN ELECTIVES

Business Analytics

Lecture: - 3 h/week

Course Code	PGIT(IS)302A
Course Name	Business Analytics

Total Number of Lectures: 48

Course objective
<ol style="list-style-type: none">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.

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| <ol style="list-style-type: none"> 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
<p>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.</p>	9
<p>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.</p>	8
<p>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 analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.</p>	9
<p>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.</p>	10
<p>Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of</p>	8

Information, Utility and Decision Making.	
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

COURSE OUTCOMES	
<ol style="list-style-type: none"> 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.

OPEN ELECTIVES
Industrial Safety

CODE: PGIT(IS)302B

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 treeconcept, 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

CODE: PGIT(IS)302C

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

Open Elective

Cost Management of Engineering Projects

CODE: PGIT(IS)302D

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 non-technical 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:

2. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
3. Charles T. Horngren and George Foster, Advanced Management Accounting
4. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
5. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
6. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Open Elective
Composite Materials

CODE: PGIT(IS)302E

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 ply 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.

Open Elective
Waste to Energy

CODE: PGIT(IS)302F

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.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

CODE: PGIT(IS)391 : **Dissertation-I /Industrial Project**

Semester IV

Course Number	Subject
PGIT(IS)491	Dissertation II