Course Scheme for M.Tech. in Information Technology

M.Tech Sem-I.

Code	Course Title	Hours per week			Credits
		L	T	P	
PGIT-101	Program Core I- Mathematical foundations of Computer Science	3	0	0	3
PGIT-102	Program Core II- Advanced Data Structures	3	0	0	3
PGIT-103A/103B/103C	Program Elective I- Advanced Web Technology/ Data Science/Mobile Communication	3	0	0	3
PGIT-104A/104B/104C/104D	Program Elective II- Internet of Things/ Machine Learning/Social Network Analysis/Information Security	3	0	0	3
PGIT-105	Research Methodology and IPR	2	0	0	2
PGIT-106A/106B/106C/106D	Audit Course	2	0	0	0
PGIT-192	Laboratory 1 (Advanced Data Structures)	0	0	4	2
PGIT-193A/193B/193C	Laboratory 2 (Based on Elective 1)	0	0	4	2
PGIT-194A/194B/194C	Laboratory 3 (Based on Elective II)	0	0	4	2
Total Credits: 20					

M.Tech Sem- II

Code	Course Title	Hours per week			Credits
		L	T	P	
PGIT-201	Program Core III – Advanced Computer Architecture	3	0	0	3

PGIT-202	Program Core IV – Advanced Operating System	3	0	0	3

PGIT-203A/203B/203C/203D/203E	Program Elective III – Cloud Computing/ Image Processing/ Soft Computing/Data Warehousing and Data Mining/Wireless and Sensor Networks	3	0	0	3
PGIT-204A/204B/204C	Program Elective IV– Distributed Systems / Big Data Analytics / Information Theory and Coding/ Pattern Recognition	3	0	0	3
PGIT-205A/B/C/D	Audit Course-2	2	0	0	0
PGIT-291	Laboratory 1 (Advanced Computer Architecture)	0	0	4	2
PGIT-292	Laboratory 2 (Advanced Operating System)	0	0	4	2
PGIT-293A/B/C/D	Laboratory 3 (Based on Elective III)	0	0	4	2
PGIT-293	Term Paper with Seminar	0	0	4	2
Total Credits: 20					

***Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.**

M.Tech III Sem*

Code	Course Title	Hours per week			Credits
		L	T	P	
PGIT-301A/301B/301C/301D	Program Elective V – Bio-informatics/ Remote Sensing and GIS / Distributed Databases/	3	0	0	03
PGIT-302	**Open Elective** A. Business Analytics B. Project Management & Entrepreneurship C. Industrial Safety D. Operations Research E. Cost Management of Engineering Projects F. Composite Materials G. Waste to Energy	3	0	0	03
PGIT-393	Dissertation-I /Industrial Project	0	0	20	10
Total Credits: 16					

***Students going for Industrial Project/Thesis will complete these courses through MOOCs.**

M.TechSem-IV

	Course Title	Hours per week	Credits

		L	T	P	
PGIT-491	Dissertation II	0	0	32	16
Total Credits: 16					

Mathematics for Computer Science (PGIT-101)
Credits 3
Total Number of Lectures: 48

COURSE OBJECTIVE
● 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.
● 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.
● 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 overfitting 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 **Computer science and engineering applications**	10

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-102
Course Name	Advanced Data Structures
Credits	3
Pre-Requisites	UG level course in Data Structures

Total Number of Lectures: 48

COURSE OBJECTIVE	
● The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.	
● Students should be able to understand the necessary mathematical abstraction to solve problems.	
● To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.	
● 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 Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	12
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, Quadtrees, k-D Trees.	10
Unit 6 Recent Trands in Hashing, Trees, and various computational geometry methods for effeciently 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.

Advanced Web Technology(PGIT-103A)

Credit: 3

Total No. of Lectures:40

Internet and World Wide Web:

Overview, Computer Network, Intranet, Extranet and Internet. Types of Networks (LAN, MAN, WAN), Network Topologies. Definition of Internet, Internet organization. Growth of Internet, Internet Application.

Review of TCP/IP (2L):

OSI Reference model, TCP/IP Model, IP addressing, Classful and Classless Addressing, Subnetting, Features and services of TCP/IP, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram. Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail- POP3, SMTP.

World Wide Web (2L):

Evolution of distributed computing. Core distributed computing technologies – Client/Server Architecture & its Characteristics, JAVA RMI.

Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).

Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

Web Server Concept and Architecture.

Definition of DNS (Domain Name System).

Domain and Sub domain, Address Resolution, FTP & its usage, Telnet Concepts, Remote Logging, HTTP & HTTPs.

Course Code	PGIT-103B
Course Name	Data Science
Credits	3
Pre-Requisites	

Total Number of Lectures:48

COURSE OBJECTIVE
● Provide you with the knowledge and expertise to become a proficient data scientist.

• Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
• Produce Python code to statistically analyse a dataset;
• Critically evaluate data visualisations based on their design and use for communicating stories from data;

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: Introduction to core concepts and technologies: Introduction, Terminology, data	6
science process, data science toolkit, Types of data, Example applications.	
Unit 2: Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources	7
Unit 3: Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	10
Unit 4: Data visualisation: Introduction, Types of data visualisation,Data for visualisation:Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.	11
Unit 5: Applications of Data Science,Technologies for visualisation, Bokeh (Python)	7
Unit 6: Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.	7
COURSE OUTCOMES	
On completion of the course the student should be able to	
• Explain how data is collected, managed and stored for data science;	
• Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;	
• Implement data collection and management scripts using MongoDB	

References:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Mobile Communication (PGIT-103C)
Credit:3
Total No. of Lectures: 42

Fundamentals of Cellular Communications [8L]

Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Teletraffic Engineering, Radio Propagation and Propagation Path-Loss Models, Cellular Geometry, Interference in Cellular Systems, Frequency Management and Channel Assignment Issues, Multiple Access Techniques, GSM Logical Channels and Frame Structure, Privacy and Security in GSM, Mobility Management in Cellular Networks. Wireless

Transmission Fundamentals [8L]

Spread Spectrum (SS) and CDMA Systems, Wireless Medium Access Control, IEEE 802.11 Architecture and Protocols, Issues in Ad Hoc Wireless Networks (Medium Access Scheme), Routing, Multicasting, Transport Layer Protocols, QoS Provisioning, Energy Management and Energy Consumption Models, Traffic Integration in Personal, Local, and Geographical Wireless Networks, Bluetooth, Technologies for High-Speed WLANs, Third-Generation Cellular Systems: UMTS.

Mobile Adhoc Networks [8L]

Introductory Concepts. Different models of operation, Various applications of MANET, Destination-Sequenced Distance Vector protocol - overview, Route Advertisement, Extending Base Station Coverage, Properties of DSDV protocol, Dynamic Source Routing protocol - overview and properties, DSR Route Discovery, Route Maintenance, Support for Heterogeneous Networks and Mobile IP, Multicast routing with DSR, Ad Hoc On-Demand Distance-Vector protocol - properties, Unicast Route Establishment, Multicast Route Establishment, Broadcast Optimizations and Enhancements, Link Reversal Routing - Gafni-Bertsekas Algorithm, lightweight mobile routing algorithm, Temporally Ordered Routing Algorithm, Preserving battery life of mobile nodes - Associativity Based Routing, Effects of beaconing on battery life.

Wireless Sensor Networks [8L]

Sensor networks overview: introduction, applications, design issues, requirements, Sensor node architecture, Network architecture: optimization goals, evaluation metrics, network design principles, Sensor network operating systems and brief introduction to sensor network Programming, Network protocols: MAC protocols and energy efficiency, Routing protocols: data centric, hierarchical, location-based, energy efficient routing etc, Sensor deployment, scheduling and coverage issues, Self Configuration and Topology Control, Querying, data collection and processing, collaborative The New unified Syllabus for both CSe & IT are to be compulsorily followed from the session 2013-14.Details of some electives are yet to be received for approval by BoS. These electives can only be offered after the details are approved by BoS & uploaded on the University website. No electives other than those listed & detailed are to be offered. information processing and group connectivity, Target tracking, localization and identity management, Power management, Security and privacy.

Topology Control and Clustering in Adhoc Networks [5L] Algorithms for Graphs Modeling Wireless Ad Hoc Networks, Clustering and Network Backbone, Dominating-SetBased Routing in Ad Hoc Wireless Networks, Formation of a Connected Dominating Set, Backbone-Formation Heuristics.

Mobile, Distributed and Pervasive Computing [5L]

Pervasive Computing Applications, Architecture of Pervasive Computing Software, Indoor Wireless Environments, Challenges for the Future: Nomadic Computing.

Text Books:

a) Sivaram Murthy, Manoj, “Adhoc Wireless and Sensor Networks: Architecture and Protocols”, Pearson.

b) Vijay Garg, “Wireless Communications and Networking”, Morgan Kaufmann Publishers
c) Gast,” 802.11 Wireless Networks”, Oreilly-SPD
d) Theodore Rappaport, “Wireless Communications: Principles and Practice” TMH.
e) J. Schiller, Pearson Education, “Mobile Communications”, TMH.
f) William C.Y Lee Cellular Mobile Telecommunications, TMH
g) Garg and Wilkes, Principles and Applications of GSM, Pearson. .

Reference Books

a) Gabrilovska, Prasad, “Adhoc Networking Towards Seamless Communication”, Springer.
b) Azzedine Boukerche, “Handbook of Algorithms for Wireless Networking and Mobile Computing”, Chapman and Hall/CRC, New York.
c) Wagner, Wattenhofer (Eds.), “Algorithms for Adhoc and Sensor Networks: Advanced Lectures”, Springer Lecture Notes in Computer Science.
d) Mukherjee, Bandopadhyay, Saha, “Location Management and Routing in Mobile Wireless Networks”, Artech House, London.
e) Redl, S.M., Weber, M.K., Oliphant, M.W.: An Introduction to GSM. Artech House, London.
f) Mehrotra, A.: GSM System Engineering. Artech House, London.
g) Ivan Stojmenovic, “Handbook of Wireless Networking and Mobile Computing”, Wiley Inc, New York.
h) XiangYang Li, “Wireless Adhoc and Sensor Networks”, Cambridge University Press.

Course Code	PGIT-104A
Course Name	Internet of Things
Credits	3
Pre-Requisites	Wireless Networks

Total Number of Lectures: 48

COURSE OBJECTIVE
• Able to understand the application areas of IOT
• Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
• Able to understand building blocks of Internet of Things and characteristics

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
Unit 2: Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
Unit 3: Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
Unit 4: Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
Unit 5: Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
Unit 6: Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5

COURSE OUTCOMES
On completion of the course the student should be able to
• Understand the vision of IoT from a global context.
• Determine the Market perspective of IoT.
• Use of Devices, Gateways and Data Management in IoT.
• Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
• Building state of the art architecture in IoT.

References:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing

2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

Course Code	PGIT104B
Course Name	Machine learning
Credits	3
Pre-Requisites	

Total Number of Lectures:48

COURSE OBJECTIVE
● To learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
● To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
● Explore supervised and unsupervised learning paradigms of machine learning.
● To explore Deep learning technique and various feature extraction strategies.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **Supervised Learning (Regression/Classification)** ● Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes	10
● Linear models: Linear Regression, Logistic Regression, Generalized Linear Models ● Support Vector Machines, Nonlinearity and Kernel Methods ● Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	
Unit 2: **Unsupervised Learning** ● 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 Forests)	6
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 in various learning techniques of machine learning and classification methods for various applications.	5

COURSE OUTCOMES
After completion of course, students would be able to:

● Extract features that can be used for a particular machine learning approach in various applications.
● 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.
● 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.

Course Code	PGIT-104C
Course Name	Social Network Analysis
Credits	3
Pre-Requisites	

Total Number of Lectures: 48

COURSE OBJECTIVE
● The course explores use of social network analysis to understand growing connectivity and complexity in the world ranging from small groups to WWW.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **Introduction** – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization	10
Unit 2: **Web Analytics tools:** Click Stream Analysis, A/B testing, Online Surveys	8
Unit 3: **Web Search and Retrieval:** Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models	9
Unit 4: **Making Connection**: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity	12
Unit 5: **Connection:** Connection Search, Collapse, Robustness Social involvements and diffusion of innovation	9

Information Security (PGIT-104D)

Introduction to Information Security:

Basics Principles of Confidentiality, Integrity Availability Concepts, Policies, procedures, Guidelines,Standards Administrative Measures and Technical Measures, People, Process, Technology

Current Trends in Information Security

Current Trends in information Security, Cloud Computing: benefits and Issues related to info Sec. Standards available for InfoSec: Cobit, Cadbury, ISO 27001, OWASP, OSSTMM, etc - An Overview, Certifiable Standards

Risk Assessment

Vulnerability, Threat and Risk, Risk Assessment and Mitigation + Quick fixes, Introduction to BCP / DRP / Incident management, Segregation and Separation of Duties & Roles and responsibilities, IT ACT 2000;

Types of assessments for Information Security: 1. VAPT of Networks 2. Web Appln Audits 3. IT assessments or audits 4. Assessment of Network Equipments 5. Assessment of Security Devices (Web Filtering, Firewalls, IDS / IPS, Routers 6. Data Center Assessment 7. Security ofApplication Software 8. SAP Security 9. Desktop Security 10. RDBMS Security 11. BCP / DRP assessments 12. Policy reviews

Security Management

Windows and Linux security, Types of Audits in Windows Environment: Server Security, Active Directory (Group Policy), Anti-Virus, Mails, Malware, End point protection,Shadow Passwords,SUDO users, etc

Web Security

Web Application Security: OWASP, Common Issues in Web Apps, What is XSS, SQLinjection, CSRF, Password Vulnerabilities,SSL, CAPTCHA,Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues, etc.

COURSE OUTCOMES
After completion of course, students would be:
● Become familiar with core research communities, publications, focused on web and social media analytics and research questions engaged in

References:

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks-book/
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

Research Methodology and IPR	
Teaching Scheme Lectures: 1hrs/week	
Course Outcomes: At the end of this course, students will be able to ● 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:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Audit course 1 (PGIT-106)

A. English for Research Paper Writing
B. Disaster Management
C. Sanskrit for Technical Knowledge
D. Value Education

Audit Course 2 (PGIT-205)

B. Constitution of India
C. Pedagogy Studies
D. Stress Management by Yoga
E. Personality Development through Life Enlightenment Skill

AUDIT COURSE (PGIT-106A/B/C/D) ENGLISH FOR RESEARCH PAPER WRITING

6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

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

AUDIT COURSE: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

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

Syllabus

Units	CONTENTS	Hours
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4

5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, 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.

AUDIT COURSE: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

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

Syllabus

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

Suggested reading

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

Course Output

Students will be able to

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

AUDIT COURSE: VALUE EDUCATION

Course Objectives

Students will be able to

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

Syllabus

Unit	*Content*	*Hours*
1	● Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. ● Moral and non- moral valuation. Standards and principles. ● Value judgements	4
2	● Importance of cultivation of values. ● Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. ● Honesty, Humanity. Power of faith, National Unity. ● Patriotism.Love for nature ,Discipline	6
3	● Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. ● Punctuality, Love and Kindness. ● Avoid fault Thinking. ● Free from anger, Dignity of 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	● Character and Competence –Holy books vs Blind faith. ● Self-management and Good health. ● Science of reincarnation. ● Equality, Nonviolence ,Humility, Role of Women. ● All religions and same message. ● Mind your Mind, Self-control. ● Honesty, Studying effectively	6

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi ***Course outcomes*** Students will be able to

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

Laboratory 1 (Advanced Data Structures) - PGIT-192

Contact Hours: 4/week

Credit: 2

Assignments based on theory of PGIT-102

Laboratory 2 (Based on Elective 1)- PGIT- 193A/193B/193C

Contact Hours: 4/week

Credit: 2

Assignments based on theory of PGIT- 103A/103B/103C

Laboratory 3 (Based on Elective II)- PGIT- 194A/194B/194C

Contact Hours: 4/week

Credit: 2

Assignments based on theory of PGIT- 104A/104B/104C

M.Tech Semester-II

Course Code	PGIT-201
Course Name	Advanced Computer Architecture
Credits	3
Pre-Requisites	UG level course in Computer Architecture

Total Number of Lectures:48

COURSE OBJECTIVE

- Understand the micro-architectural design of processors
- Learn about the various techniques used to obtain performance improvement and power savings in current processors

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **FUNDAMENTALS OF COMPUTER DESIGN** Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis (3L) Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models (3L) Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow (3L)	9

Unit 2: **INSTRUCTION LEVEL PARALLELISM** Network topologies-Static, Dynamic, Types of Networks (3L) RISC vs. CISC, Memory Hierarchy, Virtual Memory (4L) Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. (4L)	11
Unit 3: **DATA-LEVEL PARALLELISM I** Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message-passing (4L) Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining (4L) Array Processors- Structure, Algorithms (3L)	11
Unit 4: **DATA-LEVEL PARALLELISM II** Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations (4L) Parallel Programming Models, Languages, Compilers (4L)	8

Advanced Operating System (PGIT-202)

Module I

Operating System Introduction, Structures - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating-System services, System Calls, Virtual Machines, System Design and Implementation. [~4L]

Process and CPU Scheduling - Process concepts and scheduling, Operation on processes, Cooperating Processes, Threads, and Interposes Communication Scheduling Criteria, Scheduling Algorithm, Multiple - Processor Scheduling, Real-Time Scheduling. [~5L]

Module 2

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging. Demand Paging, Performance of Demanding Paging, Page Replacement, Page Replacement Algorithm, Allocation of Frames, Thrashing. [~6L]

File System Interface and Implementation -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management, Directory Management, Directory Implementation, Efficiency and Performance. [~6L]

Module 3
Deadlocks - System Model, Dead locks Characterization, Methods for Handling Dead locks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock. [~4L] Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors. [~5L]

Module 4
Operating System Security Issues- Introduction to the topic of Security in Operating Systems, Principles of Information Security, Access Control Fundamentals, Generalized Security Architectures. [~5L]

Module 5:

Introduction to Distributed systems: Goals of distributed system, hardware and software Concepts, design

issues. [~2L]
Elementary introduction to the terminologies within Modern Oss: Parallel, Distributed, Embedded & Real Time, Mobile, Cloud and Other Operating System Models. [~3L]

Course Code	PGIT-203A
Course Name	Cloud Computing
Credits	3
Pre-Requisites	

Total Number of Lectures: 48

COURSE OBJECTIVE
• The student will also learn how to apply trust-based security model to real-world security problems.
• An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
• Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **Introduction to Cloud Computing** Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing	4
Unit 2: **Cloud Computing Architecture** Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model **Cloud Deployment Models** Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	11
Unit 3: **Security Issues in Cloud Computing** Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security **Identity and Access Management** Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management	10

Unit 4: **Security Management in the Cloud** Security Management Standards, Security Management in the Cloud,	11
Availability Management: SaaS, PaaS, IaaS **Privacy Issues** Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations	
Unit 5: **Audit and Compliance** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud	8
Unit 6: **ADVANCED TOPICS** Recent devlopments in hybrid cloud and cloud security .	4

COURSE OUTCOMES
After completion of course, students would be able to:
● Identify security aspects of each cloud model
● Develop a risk-management strategy for moving to the Cloud
● Implement a public cloud instance using a public cloud service provider
● Apply trust-based security model to different layer

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

Image Processing (PGIT-203B)
Total No. of Lectures: 40

Introduction [5L]

Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation [6L]

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries [7L]

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures,

Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

Image Enhancement [8L]

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Image Restoration [7L]

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation – Spatial Transformation, Gray Level Interpolation.

Image Segmentation [7L]

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Books: 1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis,Chanda & Majumder,PHI
4. Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS

Course Code	PGIT-203C
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, Fuzzy Expert Systems, Fuzzy Decision Making.	8
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 Trands in deep learning, various classifiers, neural networks and genetic algorithm.	5
Implementation of recently proposed soft computing techniques.	
COURSE OUTCOMES	
After completion of course, students would be able to:	
● Identify and describe soft computing techniques and their roles in building intelligent machines	
● Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.	
● Apply genetic algorithms to combinatorial optimization problems.	
● Evaluate and compare solutions by various soft computing approaches for a given problem.	

References:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, 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.
   MATLAB Toolkit Manual

Course Code	PGIT-203D
Course Name	Data Warehousing and Data Mining
Credits	3
Pre-Requisites	Databases, Probability

Total Number of Lectures: 48

COURSE OBJECTIVE

- The objective of this course is to introduce data warehousing and mining techniques. Application of data mining in web mining, pattern matching and cluster analysis is included to aware students of broad data mining areas.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;	7
Unit 2: Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,	8
Unit 3: Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;	8
Unit 4: Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;	11
Unit 5: Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.	9
Unit 6: Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	5

COURSE OUTCOMES
After completion of course, students would be:
● Study of different sequential pattern algorithms
● Study the technique to extract patterns from time series data and it application in real world.
● Can extend the Graph mining algorithms to Web mining
● Help in identifying the computing framework for Big Data

References:

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.
3. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

Course Code	PGIT(202
Course Name	Wireless and Sensor Networks
Credits	3

Total Number of Lectures: 40

COURSE OBJECTIVE
● students should be able to list various applications of wireless sensor networks, describe the concepts, protocols, and differences underlying the design
● Implementation, and use of wireless sensor networks. Also implement and evaluate new ideas for solving wireless sensor network design issues.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **Sensor networks overview:** Introduction, Applications of WSN, Range of Applications, Designissues	4
Unit 2: **Basic Wireless Sensor Technology:** Sensor node architecture, Hardware and Software, Sensor Taxonomy, WSN Operating Environment, Trend	5
Unit 3: **Wireless Transmission Technology and Systems:** Introduction, Radio Technology Primer, Propagation & Propagation Impairments, Available Wireless Technologies	4

Unit 4: **Fundamentals of MAC Protocols:** Performance Requirements, Common Protocols, MAC Protocols for WSNs, Schedule-Based Protocols, Random Access-Based Protocols, Sensor-MAC Case Study, Protocol Overview, Periodic Listen and Sleep Operations, Schedule Selection and Coordination, Schedule Synchronization, Adaptive Listening, Access Control and Data Exchange.	5
Unit 5: **Routing Protocols for Wireless Sensor Networks:** Routing Challenges and Design Issues in Wireless, Sensor Networks, Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks, WSN Routing Techniques Flooding and its Variants, Sensor Protocols for Information via Negotiation, LowEnergy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Directed Diffusion, Geographical Routing.	5
Unit 6: **Transport Control Protocols for Wireless Sensor Networks:** Transport Protocol Design Issues, Examples of Existing TransportControl Protocols, CODA (Congestion Detection and Avoidance), ESRT (Event-to-Sink Reliable Transport), RMST (Reliable Multisegment Transport), PSFQ (Pump Slowly, Fetch Quickly), GARUDA, ATP (Ad Hoc Transport Protocol), Problems with Transport Control Protocols, Performance of Transport Control Protocols, Congestion, Packet Loss Recovery.	5

Unit 7: **Middleware for Wireless Sensor Networks:** Introduction, Network Management Requirements, Traditional Network Management Models, Simple Network Management Protocol, Telecom Operation Map, Network Management Design Issues, Example of Management Architecture: MANNA, Other Issues Related to Network Management, Naming, Localization.	4
Unit 8: **Performance and Traffic Management:** WSN Design Issues, MAC Protocols, Routing Protocols, Transport Protocols, Performance Modeling of WSNs, Performance Metrics, Basic Models, Network Models.	4
Unit 9: **Operating Systems for Wireless Sensor Networks:** Operating System Design Issues, Examples of MANTIS, SenOS, MagnetOS	4

COURSE OUTCOMES
After completion of course, students would be able to:
· To list various applications of wireless sensor networks, describe the concepts, protocols, and differences underlying the design, implementation, and use of wireless sensor networks,
· Propose, implement, and evaluate new ideas for solving wireless sensor network design issues

TEXT BOOK:

[1] Wireless Sensor Network by KazemSohraby, Daniel Minoli, TaiebZnati Pub: Wiley.

[2] Wireless Sensor Networks Signal Processing andCommunications by Ananthram Swami, Qing Zhao, YaoWin Hong, Lang Tong Pub: John Wiley & Sons.

[3] Ad Hoc Wireless Networks: Architectures And Protocols By Murthy Pub: Pearson Education

[4] Wireless sensor networks Edited by C. S. Raghavendra Pub: Springer

[5] Fundamentals of Sensor Network Programming: Applications and Technology By Sridhar S.Iyengar, NandanParameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, Wiley

Pre-Requisites	Computer Architecture , Networking
Course Code	PGIT-204A
Course Name	Distributed Systems
Credits	3
Pre-Requisites	Database Management Systems

Total Number of Lectures: 48

COURSE OBJECTIVE
● To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: **INTRODUCTION** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts **DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	8
Unit 2: **DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control **QUERY PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	11
Unit 3: **DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms **TRANSACTION MANAGEMENT** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models **CONCURRENCY CONTROL** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	11
Unit 4:	8
RELIABILITY Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols	
Unit 5: **PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing and optimization; load balancing	6
Unit 6: **ADVANCED TOPICS** Mobile Databases, Distributed Object Management, Multi-databases	4

COURSE OUTCOMES
After completion of course, students would be:
● Design trends in distributed systems.
● Apply network virtualization.
● Apply remote method invocation and objects.

References:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Course Code	PGIT-204B
Course Name	Big Data Analytics
Credits	3
Pre-Requisites	Data Structure, Computer Architecture and Organization

Total Number of Lectures: 48

COURSE OBJECTIVE
• Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
Unit 2: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
Unit 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9
Unit 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map- reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
Unit 5: Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	7
Unit 6: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6

COURSE OUTCOMES
After completion of course, students would be:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

References:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010. Alan

Gates, "Programming Pig", O'Reilley, 2011.

Course Code	PGIT-204C
Course Name	Information Theory and Coding
Credits	3
Pre-Requisites	Probability Theory, Computer Networks

Total Number of Lectures: 48

COURSE OBJECTIVE
• The objective of this course is to provide an insight to information coding techniques, error correction mechanism. Various compression techniques for text, video and image are covered for thorough knowledge of efficient information conveying systems.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: Information and entropy information measures, Shannon's concept c	8
Unit 2: Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes,	9
Unit 3: Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques,	8

Unit 4: Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1- DCompression, CCITT group 3 2D compression, CCITT group 4 2DCompression.	10

Unit 5: Convolutional codes, sequential decoding. Video image Compression: CITT H 261 Video coding algorithm, audio (speech) Compression. Cryptography and cipher.										9
Unit 6: Case study compression.	of	CCITT	group	3	1-DCompression,	CCITT	group	3	2D	4

COURSE OUTCOMES
After completion of course, students would be:
● The aim of this course is to introduce the principles and applications of information theory.
● The course will study how information is measured in terms of probability and entropy.
● The students learn coding schemes, including error correcting codes, The Fourier perspective; and extensions to wavelets, complexity, compression, and efficient coding of audio-visual information.

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.

AUDIT COURSE 2(PGIT-205A/B/C/D)

CONSTITUTION OF INDIA

3	● **Contours of Constitutional Rights & Duties:** ● Fundamental Rights ● Right to Equality ● Right to Freedom ● Right against Exploitation ● Right to Freedom of Religion ● Cultural and Educational Rights ● Right to Constitutional Remedies ● Directive Principles of State Policy ● Fundamental Duties.	4
4	● **Organs of Governance:** ● Parliament ● Composition ● Qualifications and Disqualifications ● Powers and Functions • Executive ● President ● Governor ● Council of Ministers ● Judiciary, Appointment and Transfer of Judges, Qualifications ● Powers and Functions	4
5	● **Local Administration:** ● District's Administration head: Role and Importance, ● Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation. ● Pachayati raj: Introduction, PRI: Zila Pachayat. ● Elected officials and their roles, CEO Zila Pachayat: Position and role. ● Block level: Organizational Hierarchy (Different departments), ● Village level: Role of Elected and Appointed officials, ● Importance of grass root democracy	4
6	● **Election Commission:** ● Election Commission: Role and Functioning.	4
	• Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	

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.

PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

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

Syllabus

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

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?

STRESS MANAGEMENT BY YOGA

Course Objectives

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

Syllabus

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

Suggested reading

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

Course Outcomes:

Students will be able to:

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

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

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

Syllabus

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

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

Suggested reading

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

Course Outcomes

Students will be able to

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

Advanced Operating System Lab (PGIT-292)

CONTACT HOURS: 4/WEEK

CREDIT: 2

Assignments based on theory of PGIT-292

Cloud Computing Lab / Image Processing Lab / Soft Computing Lab /Data Mining and Data Warehousing Lab (PGIT- 203A/203B/203C/203D)

CONTACT HOURS: 4/WEEK

CREDIT: 2

Assignments based on theory of PGIT- 203A/203B/203C/203D

Mini Project with Seminar (PGIT-293)

CONTACT HOURS: 4/WEEK

CREDIT: 2

Students will do projects on application areas of latest technologies and current topics of societal relevance.

Course Code	PGIT301A
Course Name	Bio-informatics
Credits	3
Pre-Requisites	Biology, Programming knowledge, Statistics

LECTURE WITH BREAKUP	NO. OF LECTURES
Module 1: Definition and application bioinformatics to biological research and a general view about application relating biological research. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;. A brief introduction of gene prediction: Prediction of ORF, Promoter.	
Module 2: Sequence analysis: Introduction to sequence analysis, local and global alignment, pair wise and multiple alignment, sequence alignment algorithm: Needleman and Wunsch algorithm, Smith-Waterman, BLAST, FASTA. Substitution Matrix :PAM and BLOSUM.	
Module 3: Programming with bioinformatics applications Introduction to the idea about phylogenetics analysis through multiple sequence alignment: CLUSTALW.	
Module 4: Protein Secondary and tertiary structure prediction : Chou Fasman method, Hidden markov model and neural network, Homology Modelling, Motif identification- Pfam, Prosite. Structure visualization methods (eg: RASMOL, CHIME) Introduction to energy minimization ,QSAR and their relation in drug design.	

Textbook:

1. Xiong.J, Essential Bioinformatics, Cambridge University Press
2. Ghosh and Mallick, Bioinformatics-Principles and applications Oxford University Press.
3. James Tisdall, Beginning Perl for Bioinformatics, SPD

Reference books:

1. Cynthia Gibas and Per Jambeck, Introduction to Bioinformatics computer Skills, 2001 SPD
2. Atwood, Introduction to Bioinformatics, Person Education
3 Smith, D.W, Biocomputing : informatics and Genome Project,.,1994, Academic Press, NY.
4. Baxevanis, A.D, Quellette. B.F.F, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, , John Wiely & Sons.
5. Andrew Leach, Molecular Modelling: Principles and Applications,Pearson Education.

Course Code	PGIT301B
Course Name	Remote Sensing
Credits	3
Pre-Requisites	Statistics, Image Processing

Course Outcomes:

- Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles;

- Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

LECTURE WITH BREAKUP	NO. OF LECTURES
Module 1 Physics Of Remote Sensing:Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.	
Module 2 Data Acquisition:Types of Platforms–different types of aircrafts-Manned and Unmanned space crafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRDetc.	
Scattering System: Microwave scatterometry,types of RADAR –SLAR –resolution –rangeand azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave imagestopographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.	
Thermal And Hyper Spectral Remote Sensing:Sensors characteristics-principle of spectroscopy-imaging spectroscopy–fieldconditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.	
Data Analysis:Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basicprinciples of data processing –Radiometric correction–Image enhancement–Imageclassification–Principles of LiDAR, Aerial Laser Terrain Mapping.	

References:

- Lillesand. T.M. and Kiefer. R.W,"Remote Sensing and Image interpretation", 6th Edition, John Wiley & Sons, 2000.
- John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective", 2nd Edition, Prentice Hall,1995.
- Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis",5th Edition, Springer-Verlag Berlin Heidelberg, 2013.
- Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.
- Charles Elachi, Jakob J. van Zyl, "Introduction to The Physicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie, 2006.
- Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W.H.Freeman& Co, 1978

Principles & Applications of GIS (301C)
Contact Hours: 3hours/week
CREDIT:3

COURSE OBJECTIVE

- To teach the principles and applications of remote sensing, GPS and GIS in the context of water resources. At the end of the course, the student will appreciate the importance of remote sensing and GIS in solving the spatial problems in water resources.

COURSE OUTCOME

- Introduce the technology and principles of Satellite Imaging
- Theoretical explanations on Image processing and information extraction from Satellite Data Products
- Functional elucidation of GIS integrating Satellite Data Products into the GIS platform for Decision making
- Potential of remote sensing and GIS is solving problems in water resources through case studies.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit I: Introduction, Geographical concepts and Terminology, Difference between Image Processing system and GIS, Utility of GIS.	
Unit II: Various GIS packages and their salient features, Essentials components of GIS, Data acquisition through scanners and digitizers	
Unit III: Raster and Vector Data: Introduction, Descriptions: Raster and Vector data, Raster Versus Vector, Raster to Vector conversion, Remote Sensing Data in GIS, Topology and Spatial Relationships, Data storage verification and editing	
Unit IV: Data preprocessing, Georeferencing, Data compression and reduction techniques, Runlength encoding, Interpolation of data, Database Construction, GIS and the GPS, Data Output Database structure, Hierarchical data, Network systems, Relational database, Database management, Data manipulation and analysis	
Unit V: Spatial and mathematical operations in GIS, Overlay, Query based, Measurement and statistical modelling, Buffers, Spatial Analysis, Statistical Reporting and Graphing	
Unit VI: Programming languauges in GIS, Virtual GIS, Web GIS	
Unit VII: Application of GIS to various natural resources mapping and monitoring and engineering problems	

References:

- Burrough, P.A. and Mc Donnel, R.A., "Principles of Geographic Information System", Oxford University Press. 2000
- Chrisman, Nicholas R., "Exploring Geographic Information Systems", John Wiley. 2002
- Demers, Michael N., "Fundamentals of Geographic Information System", 2nd Ed. Wiley.2008
- Ghosh, S.K. and Chandra, A.M., "Remote Sensing and GIS", Narosa Publishing House. 2008
- Lo, C.P. and Young, A.K.W., "Concepts and Techniques of Geographical Information System", Prentice Hall India. 2002
- Longley, Paul A, Goodchild, Michael F., Maguire, David J. and Rhind, David W., "Geographic Information Systems and Science", Wiley. 2001

Distributed Databases(PGIT 301D)
CONTACT HOURS:3HOURS /WEEK
CREDIT:3

Total Number of Lectures: 48

COURSE OBJECTIVE
• To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **INTRODUCTION** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts **DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE** Transparencies in adistributed DBMS; Distributed DBMS architecture; Globaldirectory issues	8
Unit 2: **DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control **QUERY PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	11
Unit 3: **DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms **TRANSACTION MANAGEMENT** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models **CONCURRENCY CONTROL** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	11
Unit 4:	8

RELIABILITY Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols	
Unit 5: **PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing and optimization; load balancing	6
Unit 6: **ADVANCED TOPICS** Mobile Databases, Distributed Object Management, Multi-databases	4

COURSE OUTCOMES
After completion of course, students would be:
• Design trends in distributed systems.
• Apply network virtualization.
• Apply remote method invocation and objects.

References:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell

and J. Grimson, Addison-Wesley, 1992.

OPEN ELECTIVES

Business Analytics

Course Code	PGIT302A
Course Name	**Business Analytics**
Credits	3

Total Number of Lectures: 48

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

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling,	9

Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	
Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	8
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

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

Reference:

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

Name of the Course:	Project Management and Entrepreneurship	
Course Code	PGIT-302B	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: 1hr		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

MODULE I: ENTREPRENEURSHIP

1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]
2. 2. Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L]
3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L]
4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L]
5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L]
6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]
7. Applications and Project Reports Preparation [4L]

8. PROJECT MANAGEMENT : Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]

9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]

10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]

12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Suggested Readings:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Text book and Reference books:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP. 4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
4. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
5. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Industrial Safety (PGIT-302C)

Teaching Scheme Lecture: - 3 h/week

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

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

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

principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision 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 PGIT302D

Teaching Scheme

Lectures: 3 hrs/week

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

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

Syllabus Contents:

Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2

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

Unit 3:

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

Unit 4

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

Unit 5

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

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

Open Elective

Cost Management of Engineering Projects PGIT302E

Teaching

scheme

Lecture: - 3

h/week

Introduction and Overview of the Strategic Cost Management Process

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

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and 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:

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

Open Elective

Composite Materials PGIT302F
Lecture: - 3

h/week

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

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

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

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

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

TEXT BOOKS:

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

References:

1. Hand Book of Composite Materials-ed-Lubin.

2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Open Elective

Waste to Energy PGIT302G
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.

(Dissertation) Dissertation Phase – I (PGIT-393) **and Phase – II(**PGIT-491)		
Teaching Scheme Lab work : 20 and 32 hrs/week for phase I and II respectively		

Course Outcomes:

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

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Ability to present the findings of their technical solution in a written report. • Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various

domain The student should complete the following:

- Literature survey Problem Definition • Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred

literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.
- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work