Prof. Ram Meghe Institute Of Technology And Research Badnera -444701

An Autonomus College Affiliated to Sant Gadge Baba Amravati University, Amravati, Maharashtra (India)

PROGRAMME SCHEME & SYLLABI 2023-2024

M. Tech.

(Computer Science and Engineering)

Published By
Principal
Prof. Ram Meghe Institute of Technology And Research, Badnera - Amravati.

Department Vision :

To ensure the world saves time and other delectable resources and free it from complexity by providing efficient computing services.

Department Mission :

1. To create globally competent engineers having knowledge, skills and ability to design, develop, test world class software keeping pace with the latest technological developments.
2. Imparting value based education to enable them to solve complex system by simple algorithms.
3. Contribute significantly to the research and the discovery of innovative methods in computing.
4. To imbibe ethical & social values among students.

Program Educational Objectives :

1. **Preparation**: To prepare students for successful careers in the software industry that meet the needs of Indian and multinational companies or to excel in Higher studies.
2. **Core competence**: To develop the ability among students to synthesize data and technical concepts for software design and development.
3. **Breadth**: To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach and an ability to relate engineering issues to broader social context.
4. **Professionalism**: To provide students with a sound foundation in the mathematical, scientific and computer engineering fundamentals required to solve engineering problems and also pursue higher studies.
5. **Learning Environment**: To promote student with an academic environment aware of excellence, leadership, written ethical codes and guidelines and the life-long learning needed for a successful professional career.

Program Outcomes :

Engineering Graduate will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes :

1. **Foundation of Computer System Development:** Ability to use knowledge of computer systems and design principles in building the hardware and software components, products in the domain of embedded system, artificial intelligence, databases, networking, web technology and mobile computing.
2. **Problem Solving Ability:** Ability to apply knowledge in various problem domains and implement innovative and suitable solutions to cater to needs of industry, business and e-governance by imbibing highest ethical and economical values.

Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati
(An Autonomous Institute)
Two Year Post Graduate Degree Program in Master of Technology
Choice Based Credit System (Semester Pattern)
Branch : Computer Science and Engineering

SEMESTER: I																			
Sr. No.	Course Code	Name of the Course	Teaching Scheme					Examination Scheme											
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL				
										Internal Marks					Max. Marks				
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Max. Marks MSE/ MSIE	Max. Marks TA	Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Int.	Ext.	Total	Min. Passing Marks
Theory																			
1	1SMTK01	Mathematical foundation of Computer Science	3			3	3	3	60	30	10	100	24	50					
2	1SMTK02	Advanced Data Structure	3			3	3	3	60	30	10	100	24	50					
3	1SMTK03	Program Elective I	3			3	3	3	60	30	10	100	24	50					
4	1SMTK04	Program Elective II	3			3	3	3	60	30	10	100	24	50					
5	1SMTK05	Audit Course 1	2			2													
Practical																			
6	1SMTK06	Advanced Data Structure			2	2	1								25	25	50	25	
7	1SMTK07	NLP&ML			2	2	1								25	25	50	25	
8	1SMTK08	Research Methodology & IPR			4	2	2								50		50	25	
9	1SMTK09	Seminar1			2	2	2								25	25	50	25	
		Total	**14**		**10**	**22**	**18**					**500**					**150**		
															Total		**650**		

1SMTK03 : Program Elective I : Data Science/Distributed System/ Natural Language Processing
1SMTK04 Program Elective II : Neural Network & Fuzzy Logic/Machine Learning Technologies/ Cloud Computing
Seminar 1: It will be based on Recent Trends in Technology related to the programme
Audit Course 1 : (i) English for Research Paper Writing (ii) Disaster Management (iii) Constitution of India

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SEMESTER: II																			
Sr. No.	Course Code	Name of the Course	Teaching Scheme					Examination Scheme											
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL				
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks	
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.			
Theory																			
1	2SMTK01	Advance Algorithm	3			3	3	3	60	30	10	100	24	50					
2	2SMTK02	Soft Computing	3			3	3	3	60	30	10	100	24	50					
3	2SMTK03	Program Elective III	3			3	3	3	60	30	10	100	24	50					
4	2SMTK04	Program Elective IV	3			3	3	3	60	30	10	100	24	50					
5	2SMTK05	Audit Course 2	2			2													
Practical																			
7	2SMTK06	Advanced Algorithm and Soft Computing			2	2	1								25	25	50	25	
8	2SMTK07	Big Data and Web Analytics			2	2	1								25	25	50	25	
9	2SMTK08	Mini Project			4	4	6								50	50	100	50	
		Total	**14**		**8**	**22**	**20**					**400**					**250**		
															Total		**650**		

2SMTK03 : Program Elective III : Data Visualization/ Big Data Analytics/Data Warehouse and Data Mining

2SMTK04 : Program Elective IV : Information Security and Privacy/ Web Analytics and Development/Knowledge Discovery

Mini Project : Project should be relevant to current technology and must include innovative element

Audit Course 2 : (i) Value Education (ii) Pedagogy Studies (iii) Personality Development Through Life Enlightenment Skills

Exit option after completion of First year : Student has to earn 8 credits based on internship(s) or On the job training of minimum 120 hours or successful completion of online courses (NPTEL/MOOCS/SWAYAM) as decided by Board of Studies from time to time.

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SEMESTER: III																			
Sr. No.	Course Code	Name of the Course	Teaching Scheme					Examination Scheme											
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL				
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks	
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.			
Theory																			
01	3SMTK01	Program Elective-V	3			3	3	3	60	30	10	100	24	50					
02	3SMTK02	Open Elective	3			3	3	3	60	30	10	100	24	50					
Practical																			
03	3SMTK03	Seminar 2		2		2	2								25	25	50	25	
04	3SMTK04	Seminar 3		2		2	2								25	25	50	25	
		Total	**6**	**4**		**10**	**10**					**200**					**100**		
															Total		**300**		

3SMTK01: Program Elective (i) V -GPU Computing, (ii) Cloud Computing and Virtulization & (iii) Distributed Databases

3SMTK02: (i) Business Analytics,(ii) Industrial Safety, (iii) Operational Research, (iv) Cost Management of Engineering Projects, (v) Composites Materials & (vi) Waste to Energy

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SEMESTER: IV																				
Sr. No.	Course Code	Name of the Course	Teaching Scheme					Examination Scheme												
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL					
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks		
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.				
Practical																				
01	4SMTK01	Dissertation II			32	32	16								100	200	300	150		
Total					**32**	**32**	**16**										**300**			

The Program offers several elective courses, focusing on different aspects of Computer Science. A student can choose to do any course from the given program elective set.

Audit Course1 &2: (i) English for Research Paper Writing **(ii)** Disaster Management **(iii)** Value Education **(iv)** Constitution of India **(v)** Pedagogy Studies **(vi)** Stress Management by Yoga **(vii)** Sanskrit for Technical Knowledge **(viii)** Personality Development through Life Enlightenment Skills.

Summary of Marks and credits

Year	Sem	Sem Marks	Yearly Marks	Sem Credits	Yrly Credits
First Year	I	650	1300	16	36
	II	650		20	
Second Year	III	300	650	10	26
	IV	300		16	
Total		**1900**		**62**	

M.Tech in Computer Science Engineering Semester I 1SMTK01

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Teching Scheme : 3(L) **Credits: 3**

Course Outcome: After learning the course the students should be able to:

- Use mathematical foundations in many areas of computer science like algorithms, computer networks, cryptography, etc.

Syllabus

UNIT – I LOGIC

Statements Connectives – Truth Tables – Normal forms – Predicate calculus – Inference – Theory for Statement Calculus and Predicate Calculus – automata theorem proving.

UNIT – II COMBINATORICS

Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion - generating function - Recurrence relations.

UNIT – III ALGEBRAIC STRUCTURES

Semigroup - Monoid – Groups (Definition and Examples only) Cyclic group - Permutation group (Sn and Dn) - Substructures - Homomorphism of semigroup, monoid and groups - Cosets and Lagrange Theorem – Normal Subgroups - Rings and Fields (Definition and examples only)

UNIT – IV RECURSIVE FUNCTIONS

Recursive functions - Primitive recursive functions - computable and non - computable functions.

UNIT – V LATTICES

Partial order relation, poset - Lattices, Hasse diagram - Boolean algebra

Unit VI Graph Theory:

Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles.

TEXT BOOK

Gersting J.L., Mathematical Structure for Computer Science, 3rd Edition W.H. Freeman and Co., 1993.

REFERENCES

1. Lidl and pitz., Applied Abstract Algebra, Springer - Verlag, New York, 1984.

2. K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999. 3. http://www.mhhe.com//rosen.

1SMTK02

ADVANCED DATA STRUCTURE

Teaching Scheme : 3(L) **Credits : 3**

Course Outcomes: After learning the course the students should be able to:

1.Understand and implement dynamic list ADTs and planar graphs.

2.Understand different static and dynamic randomization techniques.

3.Understand and analyze tree-based structures using red-black trees, B+-trees and splay trees.

4. Understand and apply dynamic programming to a varied set of problems.

Syllabus

Unit-I Linked Lists: Singly Linked Lists and Operations, Doubly Linked Lists and Operation, Linked Stacks and Linked Queues.

Unit-II Graphs: Classification, Representation, Breadth First Search, Depth First Search, Connected Components, Spanning Trees, Shortest Paths.

Unit-III Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Open Addressing and Separate Chaining, Collision Resolution, Cuckoo Hashing.

Unit–IV Red Black Trees: Height of a Red Black Tree, Red Black Trees Bottom-Up Insertion, Top-Down Red Black Trees, Top-Down Deletion in Red Black Trees. 2-3 Trees: Advantage of 2-3 trees over Binary Search Trees.

Unit–V B+ Trees: Advantage of B+-trees over BSTs, Height of B+-Tree, Search and Update Operations on B+-Trees. Splay Trees: Splaying, Search and Update Operations on Splay Trees.

Unit-VI Dynamic Programming: Basic Strategy, Multistage Graphs, All Pairs Shortest Path, Optimal Binary Search Trees, Travelling Salesman Problem.

Text Books

1. Cormen, Leiserson, Rivest and Stein, Introduction to Algorithm, Third edition, PHI, 2009
2. Horowitz, Sahni and Rajasekaran, Computer Algorithms, Universities Press, 2000.
3. Goodrich and Tamassia, Algorithm Design, Wiley Publishers, 2002.

Reference Books

1.Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition, Pearson Education, 2002.
2. Aho, Hopcroft and Ullman, Data Structures and Algorithms, Pearson Education, 2002.
3.Tanenbaum, Langsam and Augestien, Data Structures using C and C++, Prentice Hall of India, 2002

Program Elective I 1SMTK03-
i DATA SCIENCE

Course Outcomes After learning the course the students should be able to:

- To provide you with the knowledge and expertise to become a proficient data scientist.
- To demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- Produce Python code to statistically analyze a dataset; Critically evaluate data visualizations based on their design and use for communicating stories from data;

Syllabus

Unit-I :-Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications

Unit-II :-Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

Unit-III:- 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.

Unit IV: Data visualisation: Introduction, Types of data visualisation, Data for visualisation, Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings

Unit V: - Applications of Data Science, Technologies for visualisation, Bokeh (Python)

Unit VI: - Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data science.

Books Recommended:

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

1SMTK03-ii DISTRIBUTED SYSTEM

Course Outcomes: After learning the course the students should be able to:

- Understand the design principles in distributed systems and the architectures for distributed systems
- Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting etc.

Unit I: Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and The Web, Challenges, System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects.

Unit II: Inter process Communication: Introduction, The API for the Internet Protocols- The Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication.

Unit III: Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI.

Unit IV: Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads

Unit V: Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

Unit VI: Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication. Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed DeadLocks, Transaction Recovery.

Text Books:

1.George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication

Reference Books:

1. Ajay D Kshemkalyani, Mukesh Sighal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge

2. Andrew S Tanenbaum, Maarten Van Steen: "Distributed Systems- Principles and Paradigms", Pearson Publication

3. Bredan Burns,"Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services", Kindle eTextbook store.

1SMTK03- iii NATURAL LANGUAGE PROCESSING

- **Course Outcomes:** After learning the course the students should be able to:
- Will be able to understand the wide spectrum of problem statements, tasks, and solution approaches within NLP
- Will be able to implement and evaluate different NLP applications and apply machine learning and deep learning methods for this process.

Syllabus

Unit I: Introduction to NLP: Computational Models of Language, Organization of NLP Systems, Natural Language Generation.

Unit-II: Syntax: Linguistic Background, Elements of Simple Sentences, Parsing Techniques, Features and Augmented Grammars, Deterministic Parsing.

Unit- III: Semantic: Logical Form, Case Relations, Semantic Networks.

Unit-IV: Context & World Knowledge: Knowledge Representation, Question, Answering Systems: Natural Language Generation, Typical NLP Systems and their Architectures, Cognitive Aspects of Natural Languages

Unit V: Indian Language Processing: Techniques of Machine Translation, Approaches to Machine Translation, Typical Case Studies in Indian Language Context

Unit VI: Introduction to Speech Processing: Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition, Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Indian language case studies

Text Book:

1. James Allen, "Natural Language Understanding", Pearson Education.

2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Prentice-Hall

Reference Books:

1. Christopher Manning "Foundations of Statistical Natural Language Processing", MIT Press, Cambridge.

2. Akshar Bharathi, Vineet Chaitanya, Rajeev Sangal, "Natural Language Processing – A Paninian Perspective", Prentice Hall

3. Tom Mitchell, "Machine Learning", McGraw Hill

4. Ronald Hausser, "Foundations of Computational Linguistics", Springer-Verlog,

5. Winograd, "Language as a cognitive process- syntax", Addison Wesley.

6. Popov, "Talking with computer in Natural language", Springer Verlog,

Program Elective II
1SMTK04-i NEURAL NETWORK & FUZZY LOGIC

Course Outcomes: After learning the course the students should be able to:

1. To Expose the students to the concepts of feed forward neural networks.
2. To provide adequate knowledge about feedback networks.
3. To teach about the concept of fuzziness involved in various systems. To provide adequate knowledge about fuzzy set theory.
4. To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithms.

UNIT– I: Fuzzy Set Theory and Fuzzy Logic Control: Basic concepts of fuzzy sets- Operations on fuzzy sets- Fuzzy relation equations- Fuzzy logic control Fuzzification –Defuzzification- Knowledge base- Decision making logic- Membership functions – Rule base.

UNIT–II:Adaptive Fuzzy Systems: Performance index- Modification of rule base0- Modification of membership functions- Simultaneous modification of rule base and membership functions- Genetic Algorithms- Adaptive fuzzy system Neuro fuzzy systems.

UNIT –III:Artificial Neural Networks: Introduction- History of neural networks- multilayer perceptions- Back propagation algorithm and its Variants- Different types of learning, examples.

UNIT-IV: Mapping and Recurrent Networks: Counter propagation –Self organization Map- Congnitron and Neocognitron- Hopfield Net- Kohonnen Nets- Grossberg Nets- Art-I, Art-II reinforcement learning

UNIT-V:Case Studies: Application of fuzzy logic and neural networks to Measurement- Control- Adaptive Neural Controllers – Signal Processing and Image Processing

TEXT BOOK:

1. Vallum B.R And Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB Publications, New Delhi, 1996

REFERENCE BOOKS:

1. Fuzzy logic & Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
2. Neural Networks for control, Millon W. T, Sutton R.S and Werbos P. J, MIT Press 1992
3. Fuzzy sets Fuzzy logic, Klir, G. J anfd Yuan B.B Prentice Hall oif India Pvt. Ltd.,, New Delhi
4. Neural Networks and Fuzzy systems, Kosko.. Prentice hall of India Pvt. Ltd.,, New Delhi 1994
5. Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996
6. Introduction to Artificial Neural systems, Zurada J. M Jaico Publishing House, New Delhi 1994

Program Elective II

1SMTK04-ii MACHINE LEARNING TECHNIQUES

Course Outcomes: After learning the course the students should be able to:

- Understand the features of machine learning to apply to real world problems.
- Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning

UNIT I Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance. Linear Regression: Introduction, Linear regression,

UNIT II Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT III Python exercise on Decision Tree. Instance based Learning: K nearest neighbor, the Curse of Dimensionality, Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Feature reduction (Principal Component Analysis).

UNIT IV Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression. Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem.

UNIT V Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm,

UNIT VI Ensembles: Introduction, Bagging and boosting, Random forest, Discussion on some research papers. Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering.

TEXTBOOKS

1) Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

Reference Book:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

Program Elective II

1SMTK04 - iii CLOUD COMPUTING

Course Outcomes: After learning the course the students should be able to:

- Provide the students basic understanding about cloud and virtualization along with how one can migrate over it.

Unit – I Introduction: Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing, Introduction to Cloud Computing, Gartner' s Hype Cycle for Emerging Technologies, Comparisons: Cluster, Grid and Cloud, Cloud Computing at a Glance, Vision, A Close Look, The NIST Model, Cloud Cube Model. Cloud Fundamentals: Cloud Definition, Architecture, Characteristics, Applications, Benefits, Disadvantages, Deployment models and Service models.

Unit-II Virtualization: Definition and Understanding of Virtualization. Virtualization Structure/Tools and Mechanisms, Issues with virtualization, virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, introduction to Various Hypervisors, Techniques to design Virtual Machine Monitors, Hardware-assisted CPU virtualization, Full virtualization via dynamic binary translation, Para virtualization, virtualization techniques and types

UNIT-III Cloud issues : Virtual Infrastructures, Dynamic provisioning and resource management, Resource Allocation, Leases: Advance Reservation, Best Effort, Immediate, Deadline Sensitive and Negotiated, Swapping and Backfilling, Resource Allocation Measures.

UNIT-IV Migration and Fault Tolerance: Virtualized Networks and Virtual Clusters. Process Migration and VM Migration. Live Migration, Vendor lock-in, Broad Aspects of Migration into Cloud, Type of migration, Migration of virtual Machines and techniques, live virtual machine migration- types. VM checkpointing and cloning, Containers, Fault Tolerance Mechanisms. Virtualization in Data Centers and Clouds. Cloud OS.

UNIT-V Cloud Security and Storage: Cloud Infrastructure Security, Identity and access management Architecture, IAM practices in the cloud, Cloud Security and Managem
ent, Security and Privacy issues in Cloud. Storage Systems and Storage Virtualization.
UNIT -VI: Cloud Programming Model: Parallel and Distributed Programming Paradigms, Study of different Cloud computing Systems, Deployment of Web Services from Inside and Outside a Cloud Architecture.

Text Books

1.Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012
2."Cloud Computing Principles and Paradigms", Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publishers.2011.

Reference Books

1.Jim Smith, Ravi Nair. Virtual Machines: Versatile Platforms for Systems and Processes. Morgan Kaufmann. 2005
2. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
3. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance", O' Reilly 2009
4. Cloud Computing: A Practical Approach, Toby Velte, Anthony TVelte, Robert Elsenpeter, McGraw Hill,2009
5.Technical research papers from major journals and major conferences on cloud computing.

1SMTK08 Research Methodology and IPR

Teaching Scheme : 4(P) **Credits: --**

Course Outcomes: After learning the course the students should be able to:

- Formulate research problem
- Analyze literature review and find research gaps to finalize research objectives.
- Identify the need of ethics in research
- Identify the need of IPR of research projects

UNIT-I 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-II Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT-III 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-IV Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario. Procedure for grants of patents, Patenting under PCT. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems.

References:

1.Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science 2. & engineering students'" 3.

2.Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" 4. 3.Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

4.Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. 6. 5. Mayall , "Industrial Design", McGraw Hill, 1992. 7.

1SMTK05-i ENGLISH FOR RESEARCH PAPER WRITING

Teaching Scheme : 2(L) **Credits: --**

Course outcomes: After learning the course the students should be able to:

- Understand how to improve writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title

Syllabus

UNIT I Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT II Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT III Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

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

UNIT V Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

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

1SMTK05-ii DISASTER MANAGEMENT

Teaching Scheme : 2(L) **Credits: --**

Course outcomes: After learning the course the students should be able to:

- Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- 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 PGPA

Syllabus

UNIT-I Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

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

UNIT-III 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.

UNIT-IV 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.

UNIT-V 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.

References:

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

2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L., Disaster Administration And Management Text And Case Studies" ,Deep & Deep Publication Pvt. Ltd., New Delhi

1SMTK05-iii CONSTITUTION OF INDIA

Teaching Scheme : 2(L) **Credits: --**

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

- The growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- The intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- 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.

UNIT I History and philosophy of the Indian Constitution History -Drafting Committee, (Composition & Working) - Preamble - Salient Features

UNIT II 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.

UNIT III Organs of Governance: Parliament – Composition - Qualifications and Disqualifications - Powers and Functions, Executive President – Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

UNIT IV Local Administration: District's Administration Head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati raj.

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

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3.M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

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

2SMTK05-i VALUE EDUCATION

Teaching Scheme : 2(L) **Credits: --**

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

- Acquire the knowledge of self-development
- Learn the importance of Human values
- Develop the overall personality

Syllabus

UNIT I Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles.

UNIT II 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

UNIT III Personality - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking. Free from anger, Dignity of labour.

UNIT IV Behavior Development, 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

UNIT V Character and Competence, Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

References: 1 Chakraborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

2SMTK05-ii PEDAGOGY STUDIES

Teaching Scheme : 2(L) **Credits: --**

Course Outcomes: After learning the course the students should be able to:

- The pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
- The evidence on the effectiveness of these pedagogical practices
- Learns how teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

UNIT I 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.

UNIT II Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III 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.

UNIT IV 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

UNIT V Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

References:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare.

2 245-261. 2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies

(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.

2SMTK05- iii PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Teaching Scheme : 2(L) **Credits: --**

Syllabus

UNIT-I Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue)

UNIT II Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT III Approach to day to day work and duties. Shrimad Bhagwat 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.

UNIT IV Statements of basic knowledge. Shrimad Bhagwat Geeta: Chapter2-Verses 56, 62, 68 - Chapter 12 - Verses 13, 14, 15, 16,17, 18 UNIT V 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.

References Book:

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

Semester II

2SMTK01 ADVANCE ALGORITHM

Teaching Scheme : 3(L) **Credits: 3**

Course Outcomes:After learning the course the students should be able to:

- Students should develop a sound theoretical understanding of advanced algorithms and practical problem solving skills using them.
- Students should develop basic knowledge of a wide range of advanced algorithm design techniques including dynamic programming, linear programming, approximation algorithms, and randomized algorithms.
- Students should develop basic advanced algorithm analysis skills for analyzing the approximation ratio of approximation algorithms and the probability of randomized algorithms
- Students should gain a good understanding on a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.

Unit-I: Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Unit II Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path

Unit-III Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition

Unit-IV Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming Modulo Representation of integers/polynomials: Chinese Theorem, Conversion between base-representation and modulo-representation Extension to polynomials. Application: Interpolation problem

Unit V Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm Linear Programming: Geometry of the feasibility region and Simplex algorithm NPcompleteness: Examples, proof of NP-hardness and NP-completeness.

UNIT VI Computational complexity. Introduction. Information-theoretic arguments. Adversary arguments. Linear reduction, Introduction to NP-completeness. Heuristic algorithms. Approximate algorithms. NP-hard approximation problems. Approximation scheme

Text Book

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.

2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman."Algorithm Design" by Kleinberg and Tardos.

References Book

1. G. Brassard, P.Bratley, “Fundamentals of Algorithmics”, (PHI).

2SMTK02 SOFT COMPUTING

Teaching Scheme : 3(L) **Credits: 3**

Course Outcomes: After learning the course the students should 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

Syllabus

Unit-I: Introduction to soft computing, hard computing versus soft computing, constituents of soft computing, fuzzy logic, artificial neural networks, evolutionary computing, machine learning

Unit-II: CRISP and fuzzy sets, classical or crisp set theory, crisp relations and operations, fuzzy set theory, important concepts of fuzzy set: Alpha cut

Unit-III: fuzzy logic and inference rules, classical logic, multi valued logic, fuzzy logic, fuzzy propositions, inference rules for fuzzy propositions

Unit-IV: Single layer feedforward neural network, artificial neural networks, artificial neural network model, learning process, applications of artificial neural network

Unit-V: Multilayer feed forward neural network, introduction, architecture, learning methods, back propagation methods, Design issues of artificial neural networks, applications of feedforward networks

Unit-VI: Introduction to evolutionary computing, genetic algorithm processes, swarm intelligence, introduction to machine learning, applications of machine learning, MATLAB implementation of machine learning

Textbook:

1. Soft computing: fundamentals, techniques and applications, Saroj Kaushik, Sunita Tiwari McGraw hill education.

2SMTK03 – (i) PROGRAM ELECTIVE III DATA VISUALIZATION

Teaching Scheme : 3(L) **Credits: 3**

Course Outcome: After learning the course the students should be able to:

- Explore various data visualization techniques in order to provide new insight.
- Apply appropriate data visualization techniques to provide trends/insights for the given dataset
- Apply visualization tools / techniques for various data analysis tasks
- Given the application context for given data set, Design the information Dashboard for access information based on user criteria.

Unit 1: Introduction to Data Visualization: Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization (Control of Presentation, Faster and Better JavaScript processing, Rise of HTML5, Lowering the implementation Bar)

Unit 2: Basics of Data Visualization – Tables: Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content Outputting Basic Table Data (Building a table, Using Semantic Table, Configuring the columns),

Unit 3: Visualizing data Programmatically: Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).

Unit 4: Introduction to D3.js: Getting setup with D3, Making selections, changing selection's attribute, Loading and filtering External data : Building a graphic that uses all of the population distribution data, Data formats you can use with D3, Creating a server to upload your data, D3's function for loading data.

Unit 5: Advanced Data Visualization: Making charts interactive and Animated: Data joins, updates and exits, interactive buttons, updating charts, adding transactions, using keys Adding a Play Button: wrapping the update phase in a function.

Unit 6: Information Dashboard Design: Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard-visual perception, Achieving eloquence, Advantages of Graphics _Library of Graphs, Designing Bullet Graphs.

Text Book:

1."Data Analysis and Visualization", Jon Raasch, Graham Murray, Vadim Ogievetsky, Joseph Lowery,

Reference Books:

1. Ritchie S. King, Visual story telling with D3" Pearson
2. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
3. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Relly
4. Andy Kirk, Data Visualization: A Successful Design Process, PAKT
5. Scott Murray, Interactive Data Visualization for Web, O'Relly
6. Nathan Yau, "Data Points: Visualization that means something", Wiley,2013.
7. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014.

2SMTK03 – (ii) BIG DATA ANALYTICS

Course Outcomes: After learning the course the students should be able to:

- To gain knowledge about working of Hadoop File System.
- Ability to analyze Big Data using different tools.
- To gain knowledge about working of fuzzy System.
- To gain knowledge about working of fuzzy soft set System.
- To gain knowledge about working of Hadoop distributed File System.

Unit-1 Introduction to Big Data:

What is Big Data? Why Big Data is Important. Meet Hadoop Data, Data Storage and Analysis, Comparison with other systems, Grid Computing. A brief history of Hadoop. Apache hadoop and the Hadoop Ecosystem. Linux refresher, VM Ware Installation of Hadoop

Unit-II The design of HDFS:

HDFS concepts. Command line interface to HDFS. Hadoop File systems. Interfaces. Java Interface to Hadoop. Anatomy of a file read. Anatomy of a file writes. Replica placement and Coherency Model. Parallel copying with distcp, keeping an HDFS cluster balanced

Unit-III Introduction:

Analyzing data with unix tools. Analyzing data with hadoop. Java Map Reduce classes (new API). Data flow, combiner functions, Running a distributed Map Reduce Job. Configuration API. Setting up the development environment.

Unit-IV Classic Map reduce:

Job submission. Job Initialization. Task Assignment. Task execution. Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side. Configuration tuning. Map Reduce Types. Input formats. Output cormats. Sorting. Map side and Reduce side joins.

Unit-V Automatic Text Transformations:

Text transformations, Automatic writing Aids, Automatic abstracting systems, Automatic Text Generation, Automatic Translation. Paperless Information Systems- Paperless Processing, Processing Complex Documents, Graphics Processing, Speech Processing, Electronic Mail and Messages.

Text Books:

1. Tom White, Hadoop, "The Definitive Guide", O'Reilly Publications
2. Bernard Marr, Big Data in Practice: How 45 Successful Companies Used Big Data Analytics to Deliver Extraordinary Results

References:

1. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data TMH
2. Bart Baesens ,Analytics in a Big Data World: The Essential Guide to Data Science and Its Applications
3. Bernard Marr, Big Data in Practice: How 45 Successful Companies Used Big Data Analytics to Deliver Extraordinary Results

2SMTK03 – (iii) DATA WAREHOUSING AND DATA MINING

Course Outcomes: After learning the course the students should be able to:

- the functionality of the various data mining and data warehousing component.
- Appreciate the strengths and limitations of various data mining and data warehousing models.
- Explain the analyzing techniques of various data.
- Describe different methodologies used in data mining and data ware housing.

Unit-I Data Mining: Introduction – Information and production factor – Data mining Vs Query tools – Data and machine learning- Machine learning and statistics-Data Mining in marketing – Data Mining and ethics- Nuggets and data mining.

Unit-II Knowledge Discovery Process : Knowledge discovery process – Data selection – Cleaning – Enrichment – Coding – Preliminary analysis of the data set using traditional query tools – Visualization techniques – Knowledge representation- Decision trees – Classification rules- Association rules –Rules with exceptions- rules involving relations.

Unit-III Data warehouse – Architecture: Data warehouse Architecture – System Process – Process Architecture – Design – Database Schema – Partitioning Strategy – Aggregations – Data Marting – Meta Data – System and Data Warehouse Process Managers.

Unit-IV Hardware and Operational Design: Hardware and operational design of Data Warehouse – Hardware Architecture – Physical Layout – Security – Backup and Recovery – Service – Level Agreement – Operating the Warehouse.

Unit-V Planning- Tuning and Testing: Capacity planning – Tuning the Data Warehouse – Testing Warehouses – Data Warehouse Features. T

Text Books:

Pieter Adriaans, Dolf zantinge, "Data Mining", Pearson Education, 2007.
Sam Anahory, Dennis Murray, "Data Warehousing in the real world – A Practical Guide for Building Decision Support Systems", Pearson Education, 2006.

Reference Books:

1. Ian.H.Witten & Eibe Frank, "Data Mining – Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publishers, 2006.
2. Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques" Morgan Kaufmann Publishers, 2000.
3. Hanand J and M. Kamber, "Data Mining: Concepts and Techniques", Second Edition, Morgan Kaufman, 2006.

2SMTK04 -(i) INFORMATION SECURITY AND PRIVACY

Course outcomes: After learning the course the students should be able to:

- appreciate the value of information to the modern organisation.
- understand the CIA triad of Confidentiality, Integrity and Availability
- appreciate the difficulties that arise when valuable information needs to be shared
- identify the five leading-edge resources that have up-to-date information on information security.

Syllabus

Unit I Passwords, security questions, challenge-response, Cryptographic hash functions, Biometrics, Phishing

Unit II Web security model, Web authentication and session management, Cross-site request forgery, SQL injection, cross-site scripting, Logic flaws in Web applications, Clickjacking

Unit III Online tracking, Symmetric encryption, Kerberos, Memory corruption attacks and defenses, Viruses and rootkits.

Unit IV Spam, Attacks on TCP/IP, DNS, BGP. Denial of service, Worms and botnets, Advance Persistent Threats

Unit-V Firewall and intrusion detection, Public Key Cryptography, SSL and certificates, Anonymity networks, Side channel attacks: acoustics and reflections

Textbook

- Network Security (2nd edition) by Kaufman, Perlman, and Speciner

RefernceBooks:

- Security Engineering by Anderson
- The Art of Intrusion by Mitnick and Simon
- The Shellcoder's Handbook by Koziol et al.
- Secure Programming for Unix and Linux HOWTO by Wheeler
- Network Security Essentials by Stallings

2SMTK04 –(ii) **Web Analytics and Development**

Teaching Scheme : 3(L) **Credits : 3**

Course Outcomes: After learning the course the students should be able to:

- Able to perform web analyasis.
- Web Analytics helps in identifying online/offline patterns and trends of web traffic.
- able collect, measure, report, and analyze website data.
- Web analytics tracks key metrics and analyze visitors' activity and traffic flow.

Unit I

Introduction: Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web;

Unit II

Data Collection: Clickstream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data.

Unit III

Web Analytic fundamentals: Capturing data: Web logs or Java Scripts tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding clickstream data quality, Identifying unique page definition, Using cookies, Link coding issues.

Unit IV

Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization(e-commerce, non e-commerce sites):

Unit V

Web analytics 2.0: Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.

Unit VI

Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues. Relevant technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hyper Text Transfer Protocol), Server Log Files & Cookies, Web Bugs.

Text Book:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. (2010), 2nd ed.
2. Kaushik A., Web Analytics 2.0 The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. (2010),1st ed.
3. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons (2002),1sted

Program Elective IV
2SMTK04 –(iii) Knowledge Discovery

Teaching Scheme : 3(L) **Credits : 3**

Course Outcomes:

- Able to have knowledge of various knowledge representation method

Unit I Introduction KDD and Data Mining - Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics

Unit II Knowledge Representation - Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters

Unit III Decision Trees - Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, The C4.5 Algorithm Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation

Unit IV Classification Rules - Inferring Rudimentary Rules, Covering Algorithms for Rule Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency

Unit V Numeric Predictions - Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees, Evaluating Numeric Predictions Artificial Neural Networks – Perceptrons, Multilayer Networks, The Backpropagation Algorithm Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm

References:

1. Data mining and knowledge discovery handbook by Maimon, oded(et al.)
2. Data Cleansing: A Prelude to knowledge Discovery

Semester III
Program Elective V
3SMTK01 –(i) GPU COMPUTING

Course Outcomes: After learning the course the students should be able to:

- Define terminology commonly used in parallel computing, such as efficiency and speedup.
- Describe common GPU architectures and programming models.
- Implement efficient algorithms for common application kernels, such as matrix multiplication.
- Given a problem, develop an efficient parallel algorithm to solve it.
- Given a problem, implement an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining the achievements.

UNIT – I: Introduction: History, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming, CUDA OpenCL / Open ACC, Kernels Launch parameters, Thread hierarchy, Warps/Wave fronts, Thread blocks/Workgroups, Streaming m

UNIT – II: Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

UNIT – III: Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU.

UNIT – IV: Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects.

Streams: Asynchronous processing, tasks, Task-dependence, overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based Synchronization - Overlapping data transfer and kernel execution, pitfalls.

UNIT – V : Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning

UNIT – VI : Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing

TEXT BOOK:

1. David Kirk and Wen-mei Hwu, Programming Massively Parallel Processors: A Hands-On Approach, 2nd Edition, Publisher: Morgan Kaufman, 2012, ISBN: 9780124159921.
2. Shane Cook, CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Semester III

Program Elective V

3SMTK01 –(ii) CLOUD COMPUTING AND VIRTUALIZATION

Course Outcomes: After learning the course the students should be able to:

- Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost,and then study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.

Unit I

Introduction: Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Virtualization: Virtualization of Computing, Storage and Resources. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS

Unit II

Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure as a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. Platform As a service (PaaS):

Unit III

Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

Unit IV

Cloud Infrastructure and Cloud Resource Management: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products.

Unit V

Security: Security Overview, Cloud Security Challenges and Risks, Software-as-a Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security,

UnitVI

computing, Secure Execution Environments and Communications, Identity Management and Access control Identity management, Access control, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds. 6 Cloud Middleware: OpenStack, Eucaluptus, Windows Azure, CloudSim, EyeOs, Aneka, Google App Engine

Text Books:

1.Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Cloud Computing: Principles and Paradigms,Wiley publication.

Reference Books:

1.Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media.

2.George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication.

3. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press

Semester III

Program Elective V

3SMTK01 –(iii) DISTRIBUTED DATABASES

Course Outcomes: After learning the course the students should be able to:

- Design trends in distributed systems. Apply network virtualization.
- Apply remote method invocation and objects.

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

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

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

UNIT 4: 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

Unit 6: ADVANCED TOPICS Mobile Databases, Distributed Object Management, Multi-databases

References:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, PrenticeHall, 1991.

2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Open Elective

3SMTK02 –(i) BUSINESS ANALYTICS

Teaching Scheme : 3(L) **Credits: 3**

Course outcomes: After learning the course the students should be able to:

- To provide the knowledge of data analytics.
- To think critically in making decisions based on data and deep analytics.
- Ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

UNIT I Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT II 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.

UNIT III Organization Structures of Business analytics, Team management, Management Issues, designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear optimization.

UNIT IV 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.

UNIT V: Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT VI Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

References:

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

OPEN ELECTIVE
3SMTK02 –(ii) INDUSTRIAL SAFETY

Teaching Scheme : 3(L) **Credits : 3**

Course outcomes : After learning the course the students should be able to:

- Understand the preventive steps for industrial safety
- Apply the corrosion prevention methods find the causes and tracking of faults in machine tools and equipment
- Understand the periodic and preventive maintenance of mechanical and electrical equipment.

Syllabus :

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

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

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

UNIT IV Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in achine 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.

UNIT-VI 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 39

References :

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 ELECTIVE
3SMTK02 –(iii) OPERATIONAL RESEARCH

Teaching Scheme : 3(L) **Credits : 3**

Syllabus

UNIT I: Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP.

UNIT II: Transportation Problem. Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method.

UNIT III: Assignment model. Formulation. Hungarian method for optimal solution. Solving unbalanced problems. Traveling salesman problem.

UNIT IV: Sequencing models. Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

UNIT V: Dynamic programming. Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting.
UNIT VI: Games Theory. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game.

TEXT BOOKS:

1. P. Sankara Iyer," Operations Research", Tata McGraw-Hill, 2008.

REFERENCE BOOKS:

1. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005.
2. J K Sharma., "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.
3. P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007.
4. J K Sharma., "Operations Research, Problems and Solutions, 3e", Macmillan India Ltd.
5. N.V.S. Raju, "Operations Research", HI-TECH, 2002.

OPEN ELECTIVE
3SMTK02 –(iv) COST MANAGEMENT OF ENGINEERING PROJECTS

Course Outcomes: After learning the course the students should be able to:

- Understand the costing concepts and their role in decision making.
- Understand the project management concepts and their various aspects in selection.
- Interpret costing concepts with project execution.
- Gain knowledge of costing techniques in the service sector and various budgetary control techniques.
- Become familiar with quantitative techniques in cost management.

Unit I Introduction to costing System
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost.

Unit II Introduction to Project Management
Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as a conglomeration of technical and nontechnical activities.

Unit III Project Execution and Costing Concepts
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing;

Unit IV Costing of Service and Budgetary Control
Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity Based Cost Management, Bench Marking; Balanced ScoreCard and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

Unit V Quantitative Techniques for Cost Management
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TEXT BOOKS:
1. John M. Nicholas, Herman Steyn Project Management for Engineering, Business and Technology, Taylor & Francis, 2 August 2020, ISBN: 9781000092561.
2. Albert Lester, Project Management, Planning and Control, Elsevier/Butterworth- Heinemann, 2007, ISBN: 9780750669566, 075066956X.

REFERENCES:
1. Albert Lester, Project Management, Planning and Control, Elsevier/Butterworth- Heinemann, 2007, ISBN: 9780750669566, 075066956X.
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 1991.
3. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988.
4. Charles T. Horngren et al Cost Accounting a Managerial Emphasis, Prentice Hall of India, New Delhi, 2011.

OPEN ELECTIVE
3SMTK02 –(v) COMPOSITES MATERIALS

Course Outcomes: After learning the course the students should be able to:

- Understand the specifics of mechanical behavior of layered composites compared to isotropic materials.
- Manufacture composite materials using different manufacturing methods.
- Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
- Determine stresses and strains in composites. 5. Understand the behavior of short fiber and longitudinal composites

UNITI: Introduction to Composite Materials: Introduction to Composite Materials, Difference between alloys and composites, reinforcement and matrix, interface and interphase, classification of composites based on types of matrices and reinforcements, Interfaces: wettability and bonding interface in composites, types of bonding at interface, theories of Adhesion at Interfaces, smart composites, self-healing composites.

UNIT II: Manufacturing of Composites: Manufacturing of Polymer Matrix Composites – Hand Lay-up, Compression molding, Vacuum Bag moulding, Pultrusion, Filament winding, RTM; Manufacturing of MMCs – Continuously reinforced MMCs and Discontinuously reinforced MMCs, Manufacturing of CMCs –Powder consolidation, Polymer Infiltration & Pyrolysis, CVD. Analysis of Continuous Fiber Composites.

UNIT-III: Analysis of Continuous Fiber Composites: Derivation for density of composite, Longitudinal and Transverse Stiffnesses of unidirectional composites by mechanics of materials approach, Fraction of load carried by fibers, Longitudinal and Transverse tensile strengths, Critical fiber volume fraction, minimum fiber volume fraction, Failure modes in longitudinal tension, Longitudinal compressive loading, Prediction of Shear modulus, Major and minor Poisson ratio.

UNIT-IV Analysis of Discontinuous Fiber Composites Discontinuous Fiber Composites: Load transfer mechanisms, Derivation for critical fiber length, effective fiber reinforcement, Average fiber stress, longitudinal tensile strength, Single fiber fragmentation test, Failure mode.

UNIT-V: Mechanical Behaviour of Lamina and Laminate Analysis of Unidirectional Lamina: Deformation of Isotropic and Anisotropic Materials, Deformation of Generally orthotropic Material & Specially Orthotropic Material, Stress-strain relations for isotropic lamina, Isotropic lamina in plane stress conditions, Compliance matrix and stiffness matrix, Stress and strain transformations under plane stress conditions, Coordinate Axis in thin lamina.

UNIT-VI: Testing of composite materials: Characterization of constituent materials, physical characterization of composite material, determination of tensile, compressive and shear properties, determination of inter-laminar fracture toughness, bi-axial testing, characterization of composites with stress concentration.

Reference Books :

1. Jones, R M, Mechanics of Composite Materials, 2nd Edition, Taylor & Francis 2018.
2. Krishan K. Chawla, Composite Materials Science and Engineering, 4th Edition, 2019.
3. Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara, Analysis and Performance of Fiber Composites, 3rd Edition, John Wiley & Sons, 2006.
4. P.K. Mallick, Fiber-Reinforced Composites Materials, Manufacturing, and Design, 3rd Edition, Taylor & Francis ,2007.
5. Autar K. Kaw, Mechanics of Composite Materials, 2nd Edition, CRC Press, Taylor & Francis 2005.

OPEN ELECTIVE

3SMTK02 –(vi) WASTE TO ENERGY

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 challahs, 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.

UNIT VI: E-waste

E-waste in the global context – Growth of Electrical and Electronics Industry in India – Environmental concerns and health hazards – Recycling e-waste: a thriving economy of the unorganized sector – Global trade in hazardous waste – impact of hazardous e-waste in India. Management of e-waste: e-waste legislation, Government regulations on e-waste management – International experience – need for stringent health safeguards and environmental protection laws of India.

Books Recommended:

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.

Phase – I Dissertation Instruction

3SMTK03 Seminar 2 and 3SMTK04 Seminar 3 are to conduct in Third Semester

Teaching Scheme : 20(P) **Credits: 10**

Marks: 100 T

The objective of Major Project Phase I Dissertation Work & Dissertation is to enable the student to extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor(Guide) from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

SEMESTER IV

4SMTK01 Project: Phase –II Dissertation Instruction

Teaching Scheme : 32(P) **Credits: 16**
Marks: 100

The objective of Project Work Phase II & Dissertation is to enable the student to extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

The assignment to normally include **:-**

- In depth study of the topic assigned in the view of the Report preparation.
- Review and finalization of the Approach to the Problem relating to the assigned topic.
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department.
- Final Seminar Presentation before a Departmental Committee.