

ADMISSION & EXAMINATION BYE-LAWS

FOR

MASTER OF TECHNOLOGY COMPUTER SCIENCE & ENGINEERING with specialization in DATA SCIENCES M.Tech. (CSE-DS)

***CHOICE BASED CREDIT SYSTEM (CBCS)
(W.E.F. 2019-20)***



**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
School of Engineering Sciences & Technology
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ADMISSION & EXAMINATION RULES
for
MASTER OF TECHNOLOGY
(Computer Science & Engineering with *Specialization in Data Sciences*)

M. Tech. (CSE) with specialization in Data Sciences (M. Tech. (CSE) – DS) Program has been offered by the Department of Computer Science & Engineering.

1. PROGRAM OBJECTIVE

To prepare highly skilled professionals with a strong conceptual, theoretical & practical proficiency and research ability in the field of Computer Science & Engineering and related emerging areas; such as Data Sciences, Big Data Analytics, Information Security, and Cyber Forensics.

2. THE PROGRAM

Highlights of the program are described in the following table:

a.	<i>Name of the Program</i>	M. Tech. (CSE) with specialization in <i>Data Sciences</i> <i>M. Tech. (CSE – DS)</i>
b.	<i>Nature</i>	Regular and Full Time
c.	<i>Duration</i>	Two Years (4 Semesters)
d.	<i>Total number of credits</i>	68
e.	<i>Medium of Instruction and English Examinations</i>	English
f.	<i>Eligibility Criteria</i>	Passed B.Tech./BE or equivalent degree in Computer Science/Computer Science & Engineering/Computer Engineering/ Information Technology/Software Engineering/ ICT with atleast 55% marks (or equivalent CGPA) in aggregate (OR) MCA or in M.Sc in IT/Computer Science/Information Science & Technology/Electronics/Software Engineering or equivalent degree with atleast 55 % marks (or equivalent CGPA) in aggregate . (OR) B.Tech. / B.E. or equivalent degree in Electronics & Communication / Electronics Engineering / Electrical Engineering with atleast 55% marks (or

		equivalent CGPA) in aggregate.
g.	<i>Selection procedure</i>	As per the merit of the qualifying examination
h.	<i>Total Seats</i>	30 in each program; inclusive of seats reserved for NRI / sponsored candidates; additional seats are available for Foreign Nationals.
i.	<i>Period of Completion</i>	Not more than 04 years (8 Semesters)
j.	<i>Commencement of the Program</i>	July of the every academic session

3. PROGRAM STRUCTURE

Semester-wise program structures, guidelines for teaching, practical and associated assessments of **M. Tech. CSE-DS** program are described in the following tables:

Program Summary

Course Type	Abbreviation	Credits
Program Core	PC	12
Program Elective	PE	15
Open Elective (OE)	OE	3
Research Methodology & IPR	RMIPR	2
Audit Course	AC	0
Laboratory	LAB	8
Mini Project with Seminar	MPS	2
Dissertation	DISS	26
Total Credits		68

Semester – I

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTDS 101	Mathematical Foundations of Computer Science	PC	25	75	100	3-0-0	3
MTDS 102	Advanced Data Structures	PC	25	75	100	3-0-0	3
	Program Elective – I	PE	25	75	100	3-0-0	3

	Program Elective – II	PE	25	75	100	3-0-0	3
MTDS 103	Research Methodology & IPR	RMIPR	25	75	100	2-0-0	2
	Audit Course – I	AC	25	75	100	2-0-0	0
MTDS 104	Lab– I (Advanced Data Structures)	LAB	25	75	100	0-0-4	2
MTDS 105	Lab – II (Based on Electives)	LAB	25	75	100	0-0-4	2
Total					800	16-0-8	18

L-T-P stands for number of contact hours as Lecture-Tutorial-Practical in a week.

Semester – II

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTDS 201	Advanced Algorithms	PC	25	75	100	3-0-0	3
MTDS 202	Soft Computing	PC	25	75	100	3-0-0	3
	Program Elective – III	PE	25	75	100	3-0-0	3
	Program Elective – IV	PE	25	75	100	3-0-0	3
	Audit Course – II	AC	25	75	100	2-0-0	0

MTDS 203	Lab – III (Based on Core)	LAB	25	75	100	0-0-4	2
MTDS 204	Lab – IV (Based on Electives)	LAB	25	75	100	0-0-4	2
MTDS 205	Mini Project with Seminar@#	MPS	25	75	100	2-0-0	2
Total					800	16-0-8	18

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

Semester – III

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
	Program Elective – V	PE	25	75	100	3-0-0	3
	Open Elective	OE	25	75	100	3-0-0	3
MTDS 301	Dissertation – I//Industrial Project @ #	DISS	200	100	300	0-0-20	10
Total					500	6-0-20	16

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

Semester – IV

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTDS 401	Dissertation – II@# \$	DISS	300	200	500	0-0-32	16

Grand Total of Credits = 68

@ *Dissertation/Mini Project shall be based on latest research topics in the broad area of research from the domain of Data Sciences.*

Students are required to get approval of their title of Dissertation/Mini Project by Dissertation Assessment & Evaluation committee constituted by HOD. Supervisor of respective students must be member of the above committee. Students are required to give at least three presentations/seminars for progress monitoring & assessment purpose to their respective supervisors. Viva-voce will be held only after the submission of completion report duly signed by the supervisor of the respective student. A plagiarism report duly signed by the students are mandatory to submit in compliance with UGC (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2017 (or any such regulations notified time to time) by competent authority.

\$ *Students are required to publish at least one article related to their work of Dissertation in SCI/SCIE/Scopus indexed or UGC approved International Refereed Journal/International Conference. Acceptance of paper is a must for viva voce to be held, but the degree will be awarded only on proof of publication verified by the supervisor In any case consent of the Supervisor is mandatory for publication. Before submitting the paper Student **MUST** take the consent of their respective supervisor.*

PROGRAM OUTCOMES

At the end of the program a student is expected to have:

1. An understanding of the theoretical foundations and the limits of computing.
2. An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems.
3. An ability to design, develop and evaluate new computer based systems for novel applications which meet the desired needs of industry and society.
4. Understanding and ability to use advanced computing techniques and tools.
5. An ability to undertake original research at the cutting edge of computer science & its related areas.
6. An ability to function effectively individually or as a part of a team to accomplish a stated goal.
7. An understanding of professional and ethical responsibility.
8. An ability to communicate effectively with a wide range of audience.
9. An ability to learn independently and engage in lifelong learning.
10. An understanding of the impact of IT related solutions in an economic, social and environment context.

PROGRAM ELECTIVES (PE) for M.TECH. (CSE-DS) PROGRAM

Course Code	Course Title	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Program Elective – I						
MTDS PE111	Data Science	25	75	100	3-0-0	3
MTDS PE112	Distributed Systems	25	75	100	3-0-0	3
MTDS PE113	Data Preparation & Analysis	25	75	100	3-0-0	3
Program Elective – II						
MTDS PE121	Recommender System	25	75	100	3-0-0	3
MTDS PE122	Machine Learning	25	75	100	3-0-0	3
MTDS PE123	Data Storage Technologies & Networks	25	75	100	3-0-0	3
Program Elective – III						
MTDS PE231	Data Visualization	25	75	100	3-0-0	3
MTDS PE232	Big Data Analytics	25	75	100	3-0-0	3
MTDS PE233	Data Warehousing & Data Mining	25	75	100	3-0-0	3
Program Elective – IV						
MTDS PE241	Data Security & Access Control	25	75	100	3-0-0	3
MTDS PE242	Web Analytics & Development	25	75	100	3-0-0	3

MTDS PE243	Knowledge Discovery	25	75	100	3-0-0	3
Program Elective – V						
MTDS PE351	GPU Computing	25	75	100	3-0-0	3
MTDS PE352	Cloud Computing	25	75	100	3-0-0	3
MTDS PE353	Distributed Database	25	75	100	3-0-0	3

OPEN ELECTIVES (OE) COMMON FOR ALL M.TECH. PROGRAMS

Paper Code	Title of the Paper	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Open Elective						
MTDS OE311	Business Analytics	25	75	100	3-0-0	3
MTDS OE312	Industrial Safety	25	75	100	3-0-0	3
MTDS OE313	Operation Research	25	75	100	3-0-0	3
MTDS OE314	Cost Management of Engineering Projects	25	75	100	3-0-0	3
MTDS OE315	Composite Materials	25	75	100	3-0-0	3
MTDS OE316	Waste to Energy	25	75	100	3-0-0	3

AUDIT COURSE (AC) COMMON FOR ALL M.TECH. PROGRAMS

Paper Code	Title of the Paper	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Audit Course – I						
MTDSAC111	English for Research Paper Writing	25	75	100	2-0-0	0
MTDS AC112	Disaster Management	25	75	100	2-0-0	0
MTDS AC113	Pedagogy Studies	25	75	100	2-0-0	0
Audit Course – II						
MTDS AC221	Constitution of India	25	75	100	2-0-0	0
MTDS AC222	Value Education	25	75	100	2-0-0	0
MTDS AC223	Personality Development through Life Enlightenment Skills	25	75	100	2-0-0	0

4. MODE OF CURRICULUM DELIVERY

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

5. ATTENDANCE

- a. All students are supposed to attend every lecture and practical classes. However, the attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.
- b. Each one-period teaching shall account for one attendance unit.
- c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.
- d. Attendance on account of participation (with prior permission from the Head of the Department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.
- e. Attendance records displayed on the Notice Board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.
- f. In case a student is found to be continuously absent from the classes without information for a period of 30 days, the concerned teacher shall report it to the Head of the Department.
- g. Head of the Department may recommend for striking off the name of a student from rolls, after ensuring 'one month continuous absence', from all the concerned teachers.
- h. A student, whose name has been struck off on account of long absence may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.
- i. A student with less than 75% attendance in a subject shall not be allowed to appear in that subject in the semester examination. The Head of the Department shall recommend all such cases to the Dean of the School.
- j. The Dean, on the recommendation of the Head of the Department, may consider the relaxation of attendance up to 10% on account of sickness and /or any other valid reason. No application for relaxation of attendance (duly certified by a Registered Medical Practitioner/Public hospital or a competent authority) will be entertained after 15 days from the recovery from illness etc.

6. INTERNAL ASSESSMENT

- a. Internal assessment, to be made by concerned teachers, will be based on unit tests, quizzes, presentation, programming test, demonstrations and assignments.
- b. There will be three (3) Internal Assessment (Unit Tests) with a total of 20 marks ,and the best two (2) performances out of the three Unit tests of Internal Assessment will be counted. Other modes of assessment shall account for remaining 5 marks.
- c. Dates for unit tests will be announced at the beginning of the semester, by the examination coordinator.

- d. The teacher concerned shall maintain a regular record of the marks obtained by students in minor tests and display the same in due course.
- e. The concerned teachers shall submit the compiled internal assessment marks to the Head of the Department, on the conclusion of teaching of the current semester.
- f. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.
- g. A promoted candidate, who has to reappear in the examination of a paper, will retain internal assessment marks.
- h. In the case of re-admission, the candidates shall have to go through the internal assessment process afresh and shall retain nothing of the previous year.

7. SEMESTER EXAMINATIONS

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the conclusion of each of the semesters, are presented in the following table:

S.N.	Classification	Theory	Lab
1.	Mode	Written Only	Written, Demo, Programming and viva- voce etc.
2.	Duration	03 Hours	04 Hours
3.	Total Marks	75 (Seventy Five Only)	75 (Seventy Five Only)

8. DISSERTATION

- a. Each student of the final semester will have to go for a Research based Dissertation work either in the industry or in the Department under the guidance of one or two faculty members.
- b. Dissertation shall be based on latest research topics. In case of Specialization in Data Sciences, the broad area of research shall be from the domain of Data Sciences.
- c. Students are required to get approval of their title of Dissertation by Dissertation Assessment & Evaluation committee constituted by HOD. Supervisor of respective students must be member of the above committee. Students are required to give atleast three presentations for progress monitoring & assessment purpose to their respective supervisors. Viva-voce will be held only after the submission of

- completion report duly signed by the supervisor of the respective student. A plagiarism report duly signed by the students are mandatory to submit in compliance with UGC (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2017 (or any such regulations notified time to time) by competent authority.
- d. *Students are required to publish atleast one article related to their work of Dissertation in UGC approved International Refereed Journal/International Conference. Before submitting the paper Student **MUST** take the consent of their respective supervisor.*
 - e. A supervisor will be allocated to every student for dissertation work as decided by the Dissertation Committee of the Department.
 - f. All the students, who are pursuing the Dissertation work, shall be continuously in touch with the internal supervisor.
 - g. **There shall be three presentations by the students for evaluation of the progress** and the internal supervisors will conduct it. However, an internal supervisor may ask the student to submit a confidential progress-report from the external supervisor (*if any*).
 - h. All the candidates shall submit **Three (03)** hard copies of the project reports that are duly approved and signed by internal as well as external (*if applicable*) supervisors.
 - i. An external examiner, appointed for the purpose, shall evaluate the project report.
 - j. The Head of the Department shall fix a date and time for viva-voce examinations, on receipt of the evaluation-report of the project reports from the external examiner.
 - k. Head of the Department shall forward the compiled total marks (awarded in internal assessment, project Report and Viva-voce Examination), in the project-semester of each of the candidate, to the Controller of Examination.

9. EXAMINATION

- a. The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/ tutorials, quizzes/ viva voce and attendance. The end semester examination shall be comprised of written papers, practical and viva voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.
- b. The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.
- c. The minimum pass marks in each subject including sessional marks (Theory, Practical or Project etc.) shall be 40%.

10. PROMOTION SCHEME

- a. A student will be required to clear minimum **40% of his/her papers** (including Labs; excluding non-credit papers) in a semester/annual examination to be eligible **for promotion to the next semester/year**. A student may appear in the supplementary examination after each semester/annual examination and

can have a choice to appear in the backlog papers in the supplementary examination or in the subsequent regular semester/annual examination with a prescribed fee. A student detained due to shortage of attendance will repeat his/her paper in the subsequent semester concerned (even/odd).

- b. A **detained** student is not allowed to re-appear in the internal assessment (Unit test). His/her old internal assessment marks will remain same.

A student who cleared all the papers of a semester/annual examination of a programme/course will be eligible for improvement examination as per university rule.

After having passed all the FOUR semesters, the students shall be eligible for the award of M. Tech. Computer Science & Engineering with Specialization in Data Sciences degree of JAMIA HAMDARD.

11. THE GRADING SYSTEM

As per University Rule

12. CALCULATION OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

As per University Rule

After having passed all the FOUR semesters successfully, the students shall be eligible for the award of **Master of Technology (Computer Science & Engineering with Specialization in Data Sciences)** degree of JAMIA HAMDARD based on their enrollment in the respective program.

13. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **Master of Technology (Computer Science & Engineering with Specialization in Data Sciences), M. Tech. (CSE) – DS** shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rule).

Course Outline and Detailed Curriculum for Program Core Mathematical Foundations of Computer Science

Course Code: MTDS 101

L-T-P: 3-0-0

Course Prerequisite: Discrete Mathematics

Total Teaching Hours: 48 hours

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.

Unit wise Syllabus

Unit – I: Probability Functions and Distributions

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.

Unit – II: Random Sample Distribution

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.

Unit – III: Statistical Models

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over-fitting model assessment.

Unit – IV: Graph Theory

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

Unit – V: Computer Science & Engineering Applications

Computer science and engineering applications: Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

Unit – VI: Recent Trends in Various Distribution Functions

Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatic, soft computing, and computer vision.

Learning Outcome:

After completion of course, students would be able to:

- To understand the basic notions of discrete and continuous probability.
- To understand the methods of statistical inference, and the role that sampling distributions play in those methods.

- To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

Text/ Reference Books:

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

**Course Outline and Detailed Curriculum for
Advanced Data Structures**

Course Code: MTDS 102

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite: UG level course in Data Structures

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.

Unit wise Syllabus

Unit – I: Dictionaries & Hashing

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.

Unit – II: Skip Lists

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Unit – III: Trees

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Unit – IV: Text Processing

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.

Unit – V: Computational Geometry

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.

Unit – VI: Recent Trends in Hashing, Trees & Computational Geometry

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

Course Outcome:

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.

Text/ Reference Books:

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

**Course Outline and Detailed Curriculum for
Research Methodology and IPR**

Course Code: MTDS 103

L-T-P: 2-0-0

Total Teaching hours: 48

Course Prerequisite:

Course Objective:

Unit wise Syllabus

Unit – I: Research Problem, Scope & Objectives

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

Effective literature studies approaches, analysis Plagiarism, Research ethics

Unit – III: Effective Technical Writing

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

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 – V: Patent Rights

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

Unit – VI: New Developments in IPR

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.

Course Outcome:

- 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 emphasize 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.

Text/ Reference book:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall , "Industrial Design", McGraw Hill, 1992.
- Niebel , "Product Design", McGraw Hill, 1974.
- Asimov , "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outline and Detailed Curriculum for Advanced Algorithms

Course Code: MTDS 201

L-T-P: 3-0-0

Total Teaching hours: 48

Course Prerequisite: Algorithm Design & Analysis

Course Objective:

- Introduce students to the advanced methods of designing and analyzing algorithms.

- The student should be able to choose appropriate algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- Students should be able to understand different classes of problems concerning their computation difficulties.
- To introduce the students to recent developments in the area of algorithmic design.

Unit wise Syllabus

Unit – I: Sorting

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

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

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

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

Unit – V: Linear Programming

Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

Unit – VI: Recent Trends in problem solving

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Course Outcome:

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

Text/ Reference book:

- "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
- "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
- "Algorithm Design" by Kleinberg and Tardos.
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

Course Outline and Detailed Curriculum for Soft Computing

Course Code: MTDS 202

L-T-P: 3-0-0

Total Teaching hours: 48

Course Prerequisite: Basic knowledge of mathematics

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

Unit wise Syllabus

Unit – I: Introduction To Soft Computing And Neural Networks

INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

Unit – II: Fuzzy Logic

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.

Unit – III: Neural Networks

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

Unit – IV: Genetic Algorithms

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition

Unit – V: Matlab/Python Lib

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

Unit – VI: Recent Trends in Deep Learning

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

Course Outcome:

- 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.

Text/ Reference book:

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

**Course Outline and Detailed Curriculum for
Program Elective PE111- Data Science**

Course Code: MTDS PE111

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

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

Unit wise Syllabus

Unit – I: Introduction to Data Science

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

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

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

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

Applications of Data Science, Technologies for visualisation, Bokeh (Python)

Unit – VI: Recent Trends

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Learning Outcome:

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

Text/ Reference Books:

- Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media
- Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media
- Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
- Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Course Outline and Detailed Curriculum for Program Electives PE112- Distributed Systems

Course Code: MTDS PE112

L-T-P: 3-0-0

Course Prerequisite: Database Management Systems

Total Teaching Hours: 48 hours

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.

Unit wise Syllabus

Unit – I: Introduction to Distributed DBMS Architecture

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

Unit – II: Distributed Database Design

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 – III: Query Optimization, Transaction Management and Concurrency Control

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 – IV: Reliability

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

Unit – V: Parallel Database Systems

Parallel architectures; parallel query processing and optimization; load balancing

Unit – VI: Advanced Topics

Mobile Databases, Distributed Object Management, Multi-databases

Learning Outcome:

After completion of course, students would be:

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

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for Program Electives PE113- Data Preparation & Analysis

Course Code: MTDS PE113

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

Course Objective:

- To prepare the data for analysis and develop meaningful Data Visualizations

Unit wise Syllabus

Unit – I: Data Gathering and Preparation

Data formats, parsing and transformation, Scalability and real-time issues

Unit – II: Data Cleaning

Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation

Unit – III: Exploratory Analysis

Descriptive and comparative statistics, Clustering and association, Hypothesis generation

Unit – IV: Visualization

Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity

Learning Outcome:

After completion of course, students would be:

- Able to extract the data for performing the Analysis.

Text/ Reference Books:

- Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Course Outline and Detailed Curriculum for Program Electives PE121- Recommender System

Course Code: MTDS PE121

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

Course Objective:

- To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering
- To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

Unit wise Syllabus

Unit – I: Introduction

Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Unit – II: Content-based Filtering

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Unit – III: Collaborative Filtering

User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Unit – IV: Hybrid approaches

Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies

Unit – V: Evaluating Recommender System

Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.

Unit – VI: Types of Recommender System

Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

Learning Outcome:

After completion of course, students would be:

- Design recommendation system for a particular application domain.
- Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

Text/ Reference Books:

- Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
- Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st ed.
- Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.
- Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.

Course Outline and Detailed Curriculum for Program Electives PE122 - Machine Learning

Course Code: MTDS PE122

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

Course Objective:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- 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.

Unit wise Syllabus

Unit – I: Supervised Learning

Supervised Learning (Regression/Classification) - Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes - Linear models: Linear Regression, Logistic Regression, Generalized Linear Models; Support Vector Machines, Nonlinearity and Kernel Methods; Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

Unit – II: Clustering

Clustering: K-means/Kernel K-means; Dimensionality Reduction: PCA and kernel PCA; Matrix Factorization and Matrix Completion; Generative Models

Unit – III: Evaluating Machine Learning

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

Unit – IV: Sparse Modeling & Estimation

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Unit – V: Scalable Machine Learning

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.

Unit – VI: Recent Trends in various learning technique

Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

Learning Outcome:

After completion of course, students would be able to:

- Extract features that can be used for a particular machine learning approach in various IOT 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.

Text/ Reference Books:

- Tom M. Michell, Machine Learning, McGraw Hills
- Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Publications
- Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
- Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
- Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

**Course Outline and Detailed Curriculum for
Program Electives PE123 - Data Storage Technologies & Networks**

Course Code: MTDS PE123

L-T-P: 3-0-0

Course Prerequisite: Basic knowledge of Computer Architecture, Operating Systems, and Computer Networking is required.

Total Teaching Hours: 48 hours

Course Objective:

- To provide learners with a basic understanding of Enterprise Data Storage and Management Technologies

Unit wise Syllabus

Unit – I: Storage Media and Technologies

Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.

Unit – II: Usage and Access

Positioning in the Memory Hierarchy, Hardware and Software Design for Access, Performance issues.

Unit – III: Large Storages

Hard Disks, Networked Attached Storage, Scalability issues, Networking issues.

Unit – IV: Storage Architecture

Storage Partitioning, Storage System Design, Caching, Legacy Systems.

Unit – V: Storage Area Networks and QoS

Hardware and Software Components, Storage Clusters/Grids.

Storage QoS– Performance, Reliability and Security issues.

Unit – VI: Recent Trends

Recent Trends related to Copy data management, Erasure coding, and Software defined storage appliances.

Learning Outcome:

After completion of course, students would be:

- Learn Storage System Architecture
- Overview of Virtualization Technologies, Storage Area Network

Text/ Reference Books:

- The Complete Guide to Data Storage Technologies for Network-centric Computing Paperback– Import, Mar 1998 by Computer Technology Research Corporation
- 2. Data Storage Networking: Real World Skills for the Comp TIA Storage by Nigel Poulton

Course Outline and Detailed Curriculum for Program Electives PE231 - Data Visualization

Course Code: MTDS PE231

L-T-P: 3-0-0

Course Prerequisite: Computer Graphics, Image Processing

Total Teaching Hours: 48 hours

Course Objective:

- familiarize students with the basic and advanced techniques of information visualization and scientific visualization
- to learn key techniques of the visualization process
- a detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

Unit wise Syllabus

Unit – I: Introduction to Visual Perception

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

Unit – II: Visual Representation

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Unit – III: Classification of Visualization Systems

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Unit – IV: Visualization of Structures

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

Unit – V: Visualization of Volumetric Data

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations

Unit – VI: Recent Trends

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Learning Outcome:

On completion of the course the student should be able to

- be familiar with the design process to develop visualization methods and visualization systems, and methods for their evaluation.
- preparation and processing of data, visual mapping and the visualization
- have an understanding of large-scale abstract data

Text/ Reference Books:

- WARD, GRINSTEIN, KEIM, .Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.
- E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

Course Outline and Detailed Curriculum for Program Electives PE232- Big Data Analytics

Course Code: MTDS PE232

L-T-P: 3-0-0

Course Prerequisite: Data Structure, Computer Architecture and Organization

Total Teaching Hours: 48 hours

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

Unit wise Syllabus

Unit – I: Introduction to Big Data

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.

Unit – II: Introduction to NoSQL

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less 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.

Unit – III: Data Format

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

Unit – IV: MapReduce

Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats

Unit – V: Hbase

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Unit – VI: Data Models

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.

Learning Outcome:

- 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

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for Program Electives PE233 - Data Warehousing & Data Mining

Course Code: MTDS PE233

L-T-P: 3-0-0

Course Prerequisite: Databases, Probability

Total Teaching Hours: 48 hours

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.

Unit wise Syllabus

Unit – I: Introduction to Data Warehousing

Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods

Unit – II: Classification and Prediction

Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns.

Unit – III: Data Mining

Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis

Unit – IV: Data Streams

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

Unit – V: Web Mining

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.

Unit – VI: Recent Trends

Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

Learning Outcome:

After completion of course, students would be:

- Study of different sequential pattern algorithms
- Study the technique to extract patterns from time series data and its application in real world.
- Can extend the Graph mining algorithms to Web mining
- Help in identifying the computing framework for Big Data

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for Program Electives PE241 - Data Security & Access Control

Course Code: MTDS PE241

L-T-P: 3-0-0

Course Prerequisite: Database Management

Total Teaching Hours: 48 hours

Course Objective:

- The objective of the course is to provide fundamentals of database security. Various access control techniques mechanisms were introduced along with application areas of access control techniques.

Unit wise Syllabus

Unit – I: Access Control

Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.

Unit – II: Roles and Policies

Role- Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC Comparing RBAC to DAC and MAC Access control policy.

Unit – III: Integrity Model

Biba's integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC.

Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi line Insurance Company

Unit – IV: Smart Card

Smart Card based Information Security, Smart card operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.

Unit – V: Recent Trends in Database Security

Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems

Unit – VI: Recent Trends in Data Security Management

Recent Trends related to data security management, vulnerabilities in different DBMS.

Learning Outcome:

After completion of course, students would be:

- In this course, the students will be enabled to understand and implement classical models and algorithms
- They will learn how to analyse the data, identify the problems, and choose the relevant models and algorithms to apply.

- They will further be able to assess the strengths and weaknesses of various access control model and to analyse their behaviour.

Text/ Reference Books:

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

**Course Outline and Detailed Curriculum for
Program Electives PE242 - Web Analytics & Development**

Course Code: MTDS PE242

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

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.

Unit wise Syllabus

Unit – I: Introduction

Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization

Unit – II: Web Analytics tools

Click Stream Analysis, A/B testing, Online Surveys

Unit – III: Web Search and Retrieval

Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models

Unit – IV: Making Connection

Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity

Unit – V: Connection

Connection Search, Collapse, Robustness Social involvements and diffusion of innovation

Learning Outcome:

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

Text/ Reference Books:

- Hansen, Derek, Ben Shneiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
- AvinashKaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.

- 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/>
- 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.

Course Outline and Detailed Curriculum for Program Electives PE243 - Knowledge Discovery

Course Code: MTDS PE243

L-T-P: 3-0-0

Course Prerequisite: Data structures, Basic Statistics

Total Teaching Hours: 48 hours

Course Objective:

- Conduct case studies on real data mining examples

Unit wise Syllabus

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

Unit – VI: Artificial Neural Networks

Perceptrons, Multilayer Networks, The Backpropagation Algorithm

Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm

Learning Outcome:

After completion of course, students would be:

- Able to have knowledge of various knowledge representation methods.

Text/ Reference Books:

- Data mining and knowledge discovery handbook by Maimon, Oded (et al.)
- Data Cleansing: A Prelude to Knowledge Discovery

Course Outline and Detailed Curriculum for Program Electives PE351 - GPU Computing

Course Code: MTDS PE351

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

Course Objective:

- To learn parallel programming with Graphics Processing Units (GPUs).

Unit wise Syllabus

Unit – I: Introduction

History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs

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 **Functions:** Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

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

Learning Outcome:

After completion of course, students would be:

- Students would learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.

Text/ Reference Books:

- Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, WenmeiHwu; Morgan Kaufman; 2010 (ISBN: 978-0123814722)
- CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Course Outline and Detailed Curriculum for Program Electives PE352 - Cloud Computing

Course Code: MTDS PE352

L-T-P: 3-0-0

Course Prerequisite:

Total Teaching Hours: 48 hours

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.

Unit wise Syllabus

Unit – I: Introduction to Cloud Computing

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

Unit – II: 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

Unit – III: 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

Unit – IV: Security Management in the Cloud

Security Management Standards, Security Management in the Cloud, 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 – V: 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

Unit – VI: Advanced Topics

Recent developments in hybrid cloud and cloud security.

Learning Outcome:

After completion of course, students would be:

- 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

Text/ Reference Books:

- 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

**Course Outline and Detailed Curriculum for
Program Electives PE353- Distributed Database**

Course Code: MTDS PE353

L-T-P: 3-0-0

Course Prerequisite: Distributed Systems

Total Teaching Hours: 48 hours

Course Objective:

- The objective of course is to provide insight to distributed database, normalization techniques and integrity rules. It also includes parallel database systems along with object oriented models

Unit wise Syllabus

Unit – I: Introduction

Distributed Data processing, Distributed database system (DDBMS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS

Unit – II: Distributed DBMS Architecture

DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control.

Unit – III: Overview of Query Processing

Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing. Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms.

Unit – IV: Parallel Database Systems

Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Unit – V: Distributed Object Database Management systems

Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing

Unit – VI: Recent Trends

Recent approaches, models and current trends in improving the performance of Distributed Database.

Learning Outcome:

After completion of course, students would be:

- Able to understand relational database management systems, normalization to make efficient retrieval from database and query.

Text/ Reference Books:

- Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez
- Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGraw Hill.

OPEN ELECTIVES

Course Outline and Detailed Curriculum for Business Analytics

Course Code: MTDS OE311

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Manage business process using analytical and management tools.

- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Unit wise Syllabus

Unit – I: Business Analytics

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.

Unit – II: Trendiness & Regression Analysis

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 Analytic Technology.

Unit – III: Business Analytics

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

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.

Unit – V: Decision Analysis

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit – VI: Recent Trends

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Course Outcome:

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

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for Industrial Safety

Course Code: MTDS OE312

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective

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

Unit wise Syllabus

Unit – I: Industrial Safety

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: Maintenance Engineering

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 & Corrosion

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

Unit – V: Periodic & Preventive Maintenance

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

Course Outcome:

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

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for

Operations Research

Course Code: MTDS OE313

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective

At the end of the course, the student should be able to

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

Unit wise Syllabus

Unit – I: Optimization Techniques

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

Unit – II: Formulation of LPP

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

Unit – III: Nonlinear Programming Problem

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

Unit – IV: Scheduling & Sequencing

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

Unit – V: Competitive Models

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

Course Outcome:

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

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for Cost Management of Engineering Projects

Course Code: MTDS OE314

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective

At the end of the course, the student should be able to

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

Unit wise Syllabus

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.

Course Outcome:

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

Text/ Reference Books:

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

Course Outline and Detailed Curriculum for Composite Materials

Course Code: MTDS OE315

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective

At the end of the course, the student should be able to

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

Unit wise Syllabus

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

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

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

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

Course Outcome:

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

Text/ Reference Books:

- Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

- Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
- Hand Book of Composite Materials-ed-Lubin.
- Composite Materials – K.K.Chawla.
- Composite Materials Science and Applications – Deborah D.L. Chung.
- Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Course Outline and Detailed Curriculum for Waste to Energy

Course Code: MTDSOE316

L-T-P: 3-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective

At the end of the course, the student should be able to

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

Unit wise Syllabus

Unit – I: Introduction to Energy from Waste

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

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

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 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

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.

Course Outcome:

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

Text/ Reference Books:

- Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
- Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
- Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
- Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

AUDIT COURSE
Course Outline and Detailed Curriculum
ENGLISH FOR RESEARCH PAPER WRITING

Course Code: MTDS AC111

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a title ensure the good quality of paper at very first-time submission

Unit wise Syllabus

Unit – I: Planning and Preparation

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit – II: Plagiarism

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit – III: Review Study

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

Unit – IV: Writing Skill

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 – V: Writing Skill-II

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 – VI: Quality Assurance

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

Course Outcome:

Text/ Reference Books:

- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
- Sahni, PardeepEt. Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
- Goel S. L., Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi

**Course Outline and Detailed Curriculum for
DISASTER MANAGEMENT**

Course Code: MTDS AC112

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

Students will be able to:

- learn 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 an understanding of 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

Unit wise 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, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit – III: Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post Disaster Diseases And Epidemics

Unit – IV: Disaster Preparedness And Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit – V: Risk Assessment

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 – VI: 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.

Course Outcome:

Text/ Reference Books:

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

**Course Outline and Detailed Curriculum for
CONSTITUTION OF INDIA**

Course Code: MTDS AC221

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit wise Syllabus

Unit – I: History of Making of the Indian Constitution

History, Drafting Committee, (Composition & Working)

Unit – II: Philosophy of the Indian Constitution

Preamble, Salient Features

Unit – III: Contours of Constitutional Rights & Duties

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit – IV: Organs of Governance

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit – V: Local Administration

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: ZilaPachayat.
- Elected officials and their roles, CEO ZilaPachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit – VI: 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.

Course Outcome:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Text/ Reference Books:

- The Constitution of India, 1950 (Bare Act), Government Publication.
- 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.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

**Course Outline and Detailed Curriculum for
VALUE EDUCATION****Course Code:** MTDS AC222**L-T-P:** 2-0-0**Total Teaching Hours:** 48 hours**Course Prerequisite:****Course Objective:**

Students will be able to

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

Unit wise Syllabus**Unit – I: Value & Self Development**

- 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

Unit – II: Cultivation of Values

- 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 & Behaviour Development

- 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

Unit – IV: Character & Competence

- 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

Course Outcome:

Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

Text/ Reference Books:

- Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

**Course Outline and Detailed Curriculum for
PEDAGOGY STUDIES**

Course Code: MTDS AC223

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

Students will be able to:

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

Unit wise Syllabus

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

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

Unit – III: Pedagogical Practices

- 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

- 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: Future Directions

- Research gaps and future directions
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact

Course Outcome:

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy

Text/ Reference Books:

- Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, *Compare*, 31(2):245-261.
- Agrawal M (2004) Curricular reform in schools: The importance of evaluation, *Journal of Curriculum Studies*, 36 (3): 361-379.
- Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
- Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basimaths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272–282.
- Alexander RJ (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.

- Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
- www.pratham.org/images/resource%20working%20paper%202.pdf.

CONSTITUTION OF INDIA

Course Code: MTDS AC221

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit wise Syllabus

Unit – I: History of Making of the Indian Constitution

History, Drafting Committee, (Composition & Working)

Unit – II: Philosophy of the Indian Constitution

Preamble, Salient Features

Unit – III: Contours of Constitutional Rights & Duties

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit – IV: Organs of Governance

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit – V: Local Administration

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: ZilaPachayat.
- Elected officials and their roles, CEO ZilaPachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit – VI: 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.

Course Outcome:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Text/ Reference Books:

- The Constitution of India, 1950 (Bare Act), Government Publication.
- 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.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

**Course Outline and Detailed Curriculum for
VALUE EDUCATION**

Course Code: MTDSAC222

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

Students will be able to

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

Unit wise Syllabus

Unit – I: Value & Self Development

- 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

Unit – II: Cultivation of Values

- 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 & Behaviour Development

- 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

Unit – IV: Character & Competence

- 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

Course Outcome:

Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

Text/ Reference Books:

- Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Personality Development through Life Enlightenment Skills

Course Code: MTDS AC223

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective:

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

Unit- I

Introduction to Personality Development The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

Unit -II

Attitude & Motivation Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation.

Unit -III

Stages of development: Freudian stages of development, Erik Erickson's stages of development. Maslow's hierarchy of needs.

Unit -IV: Islamic Life Skills

Communication Skills, Basic Human Rights, Dealing with Peer Pressure, Drug and Substance abuse, Economic Development in Islam,

Unit -V: Approach to day to day work and duties

- Approach to day to day work and duties.
- ShrimadBhagwadGeeta : 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 -VI: Statements of basic knowledge

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

Text/ Reference Books:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi
2. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
3. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
4. Rashtriya Sanskrit Sansthanam, New Delhi.
5. Maulana, A. O. (2004). *Potential Islamic Teachings that can be used in interventions*. Unpublished Research. Maastricht. Maastricht University
6. Jafiri. M.T. Ayatollah. (1999). *A comparative study of the tow systems Universal Human Right, form the viewpoint of Islam and the West*.
7. Partners Collaborating in Youth Empowerment in Kenya, PACOYEK. (and AIDS Peer Education Manual.
8. Robbins. A. (2001). *Awaken the giant within. How to take control of yo emotional, physical and financial destiny*.
9. UNICEF. (2006). *Woman to Woman Initiative. Resource Information* Presented by Maulana, A. O
10. UNICEF/LONGMAN. (2003). *SARA, Skills for life*. Principal writer Mab
11. WHO. (2001). Skills for Health. *Skills-based health education including An Important component of a Child-Friendly/Health-promoting School*. withtechnical support of Aldinger. C. and Vince Whitman. C. Health an Development Programme (HHD) at Education Development Center, in
12. WHO. (2003). *Woman in Islam and her role in human development* Presented by Al Khayat. M.H.
13. WHO. (2004). *Health as a Human Right in Islam*. Presented by Al M.H.
14. Sadr, Sayyid Mahdi as (2001). *The AhlUl-Bayt: ethical Role –Models*.