ADMISSION & EXAMINATION BYE-LAWS

FOR

MASTER OF TECHNOLOGY

(COMPUTER SCIENCE & ENGINEERING)
M. TECH. (CSE)

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)

M.Tech. CSE Programme 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 Science, Big Data Analytics, Information Security, and Cyber Forensics.

2. THE PROGRAM

Highlights of the program are described in the following table:

a.	*Name of the Program*	M. Tech. (CSE)
b.	*Nature*	Regular and Full Time
c.	*Duration*	Two Years (4 Semesters)
d.	*Total number of credits*	68
e.	*Medium of Instruction and Examinations*	English
f.	*Eligibility Criteria*	Passed B.Tech./BE or equivalent degree in Computer Science/Computer Science & Engineering/Computer Engineering/ Information Technology/Software Engineering/ ICT with at least 55% marks (or equivalent CGPA) in aggregate **(OR)** MCA or M.Sc in IT/Computer Science/Information Science & Technology/Electronics/Software Engineering or equivalent degree with at least 55 % marks (or equivalent CGPA) in aggregate . **(OR)** B.Tech. / B.E. or equivalent degree in Electronics & Communication / Electronics Engineering / Electrical Engineering with at least 55% marks (or equivalent CGPA) in aggregate.
g.	*Selection procedure*	As per the merit of the qualifying examination
h.	*Total Seats*	30 in each program; inclusive of seats reserved for NRI / sponsored candidates; additional seats

		are available for Foreign Nationals.
i.	*Period of Completion*	Not more than 04 years (8 Semesters)
j.	*Commencement of the Program*	July of the every academic session

3. PROGRAM STRUCTURE

Semester-wise program structures, guidelines for teaching, practical and associated assessments of **M. Tech. CSE** programme 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		
MTCSE 101	Mathematical Foundations of Computer Science	PC	25	75	100	3-0-0	3
MTCSE 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
MTCSE 103	Research Methodology & IPR	RMIPR	25	75	100	2-0-0	2
	Audit Course – I	AC	25	75	100	2-0-0	0
MTCSE 104	Lab– I (Advanced Data Structures)	LAB	25	75	100	0-0-4	2
MTCSE 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		
MTCSE 201	Advanced Algorithms	PC	25	75	100	3-0-0	3
MTCSE 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
MTCSE 203	Lab – III (Based on Core)	LAB	25	75	100	0-0-4	2
MTCSE 204	Lab – IV (Based on Electives)	LAB	25	75	100	0-0-4	2
MTCSE 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
MTCSE 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		
MTCSE 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.

 # 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 from 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)

Course Code	Course Title	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Program Elective – I						
MTCSE PE111	Machine Learning	25	75	100	3-0-0	3
MTCSE PE112	Wireless Sensor Networks	25	75	100	3-0-0	3
MTCSE PE113	Introduction to Intelligent Systems	25	75	100	3-0-0	3
Program Elective – II						
MTCSE PE121	Data Science	25	75	100	3-0-0	3
MTCSE PE122	Distributed Systems	25	75	100	3-0-0	3
MTCSE PE123	Advanced Wireless & Mobile Networks	25	75	100	3-0-0	3
Program Elective – III						
MTCSE PE231	Data Preparation & Analysis	25	75	100	3-0-0	3
MTCSE PE232	Secure Software Design & Enterprise Computing	25	75	100	3-0-0	3
MTCSE PE233	Computer Vision	30	70	100	3-0-0	3
Program Elective – IV						
MTCSE PE241	Human Computer Interaction	25	75	100	3-0-0	3
MTCSE PE242	Graphics Processing Unit Computing	25	75	100	3-0-0	3
MTCSE PE243	Digital Forensics	25	75	100	3-0-0	3
Program Elective – V						
MTCSE PE351	Mobile Applications & Services	25	75	100	3-0-0	3
MTCSE PE352	Compilers for High Performance Computing	25	75	100	3-0-0	3
MTCSE PE353	Optimization Techniques	25	75	100	3-0-0	3

OPEN ELECTIVES (OE)

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

AUDIT COURSE (AC)

Paper Code	Title of the Paper	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Audit Course – I						
MTCSE AC111	English for Research Paper Writing	25	75	100	2-0-0	0
MTCSE AC112	Disaster Management	25	75	100	2-0-0	0
MTCSE AC113	Pedagogy Studies	25	75	100	2-0-0	0
Audit Course – II						
MTCSE AC221	Constitution of India	25	75	100	2-0-0	0
MTCSE AC222	Value Education	25	75	100	2-0-0	0
MTCSE 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.
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 at least 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 at least 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 students 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 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) M.Tech. (CSE)*** 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) M. Tech. (CSE)*** shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rule).

Detailed Curriculum

Mathematical Foundations of Computer Science

Course Code: MTCSE 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 avariety 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 overfitting 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 mathmatical 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

Advanced Data Structures

Course Code: MTCSE 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.

Research Methodology and IPR

Course Code: MTCSE 103

L-T-P: 2-0-0

Total Teaching hours:

Course Prerequisite:

Course Objective:

The course will help students

- understand some basic concepts of research and its methodologies
- identify appropriate research topics
- select and define appropriate research problem and parameters
- prepare a project proposal (to undertake a project)

- organize and conduct research (advanced project) in a more appropriate manner
- write a research report and thesis
- write a research proposal (grants**)**

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 emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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

Advanced Algorithms

Course Code: MTCSE 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.

Soft Computing

Course Code: MTCSE 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

Program Electives
Machine Learning

Course Code: MTCSE PE111
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 (mixture models and latent factor 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

- AurÈlien GÈron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, Orielly 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

Wireless Sensor Networks

Course Code: MTCSE PE112
L-T-P: 3-0-0
Course Prerequisite: Wireless Communication

Total Teaching Hours: 48 hours

Course Objective:

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

Unit wise Syllabus

Unit – I: Introduction to Wireless Sensor Networks

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters.

Unit – II: Introduction to ns-3

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.

Unit – III: Medium Access Control Protocol design

Medium Access Control Protocol design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled Introduction to Markov Chain: Discrete time Markov Chain definition,
properties, classification and analysis MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis (Markov Chain).

Unit – IV: Security

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.

Unit – V: Routing protocols

Routing protocols: Introduction, MANET protocols Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast

Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain), Advanced topics in wireless sensor networks.

Unit – VI: Advanced Topics

ADVANCED TOPICS: Recent development in WSN standards, software applications.

Learning Outcome:

After completion of course, students would be able to:

- Describe and explain radio standards and communication protocols for wireless sensor networks.
- Explain the function of the node architecture and use of sensors for various applications.
- Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

Text/ Reference Books:

- W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks – Theory and Practice", Wiley 2010
- KazemSohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks - Technology, Protocols, and Applications", Wiley Interscience 2007
- Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer 2010

Introduction to Intelligent Systems

Course Code: MTCSE PE113
L-T-P: 3-0-0
Course Prerequisite: Data Structures and Data Management or Data Structures
Total Teaching Hours: 48 hours
Course Objective:

- The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty learning from experience and following problem solving strategies found in nature.

Unit wise Syllabus

Unit – I: Biological foundations to intelligent systems I

Biological foundations to intelligent systems I: Artificial neural networks, Backpropagation

networks, Radial basis function networks, and recurrent networks.

Unit – II: Biological foundations to intelligent systems II

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Unit – III: Search Methods Basic concepts of graph and tree search

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hillclimbing search. Optimisation and search such as stochastic annealing and genetic algorithm.

Unit – IV: Knowledge representation

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

Unit – V: Reasoning under uncertainty

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

Unit – VI: Recent Trends

Recent trends in Fuzzy logic, Knowledge Representation.

Learning Outcome:

After completion of course, students would be able to:

- Able to Demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyse and compare the relative merits of a variety of AI problem solving techniques.

Text/ Reference Books:

- Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.
- Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.

Data Science

Course Code: MTCSE PE121
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 core concepts and technologies

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, (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:

After completion of course, students would 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 Python.

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, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Distributed Systems

Course Code: MTCSE PE122
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 Database Management System Architecture

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

DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

Unit – 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: Distributed Query Optimization

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

Unit – V: Parallel Database Systems

PARALLEL DATABASE SYSTEMS: Parallel architectures; parallel query processing and optimization; load balancing

Unit – VI: Advanced Topics

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

Learning Outcome:

After completion of course, students would be able to:

- 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.

Advanced Wireless and Mobile Networks

Course Code: MTCSE PE123
L-T-P: 3-0-0
Course Prerequisite: Computer Networks

Total Teaching Hours: 48 hours

Course Objective:

- The students should get familiar with the wireless/mobile market and the future needs and challenges.
- To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
- To learn how to design and analyse various medium access
- To learn how to evaluate MAC and network protocols using network simulation software tools.
- The students should get familiar with the wireless/mobile market and the future needs and challenges.

Unit wise Syllabus

Unit – I: Introduction to WLAN

INTRODUCTION: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

WIRELESS LOCAL AREA NETWORKS: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture &

protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading
Effects in Indoor and outdoor WLANs, WLAN Deployment issues

Unit – II: Wireless Cellular Networks

WIRELESS CELLULAR NETWORKS: 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

Unit – III: WiMAX

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview
WIRELESS SENSOR NETWORKS: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

Unit – IV: Wireless PANs

WIRELESS PANs: Bluetooth AND Zigbee, Introduction to Wireless Sensors.

Unit – V: Security in Wireless Networks

SECURITY: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

Unit – VI: Advanced Topics

ADVANCED TOPICS: IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks

Course Outcome:

After completion of course, students would be able to:

- Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
- Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
- Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
- Design wireless networks exploring trade-offs between wire line and wireless links.
- Develop mobile applications to solve some of the real world problems..

Text/ Reference Books:

- Schiller J., Mobile Communications, Addison Wesley 2000
- Stallings W., Wireless Communications and Networks, Pearson Education 2005
- Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
- Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000

- Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200.

Data Preparation and Analysis

Course Code: MTCSE PE231
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: Defining Data Analysis Problems
Knowing the client, Understanding the questions
Unit – II: Data Gathering and Preparation
Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.
Unit – III: Data Cleaning
Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.
Unit – IV: Exploratory Analysis
Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.
Unit – V: Visualization
Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.
Unit – VI: Ethics in Profession
Cases in computing, statistics and Communication

Learning Outcome :

After completion of course, students would be able to:

- Able to extract the data for performing the Analysis.
- Apply the variety of data exploration techniques including summary statistics and visualization

Text/ Reference Books:

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

Secure Software Design and Enterprise Computing

Course Code: MTCSE PE232
L-T-P: 3-0-0
Course Prerequisite: Computer Programming, Software Engineering

Total Teaching Hours: 48 hours

Course Objective:

- To fix software flaws and bugs in various software.
- To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
- Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Unit wise Syllabus

Unit – I: Secure Software Design

Secure Software Design: Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design
concepts, Perform security testing and quality assurance.

Unit – II: Enterprise Application Development

Enterprise Application Development: Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Unit – III: Enterprise Systems Administration

Enterprise Systems Administration: Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Unit – IV: Troubleshooting

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

Unit –V: SQL Injection

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Unit – VI: Case Study

Case study of DNS server, DHCP configuration and SQL injection attack.

Learning Outcome :

After completion of course, students would be able to:

- Differentiate between various software vulnerabilities.
- Software process vulnerabilities for an organization.
- Monitor resources consumption in a software.
- Interrelate security and software development process.

Text/ Reference Books:

- Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
- Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Computer Vision

Course Code: MTCSE PE233
L-T-P: 3-0-0
Course Prerequisite: Linear algebra, vector calculus, Data structures and Programming.

Total Teaching Hours: 48 hours

Course Objective:

- Be familiar with both the theoretical and practical aspects of computing with images.
- Have described the foundation of image formation, measurement, and analysis.
- Understand the geometric relationships between 2D images and the 3D world.
- Grasp the principles of state-of-the-art deep neural networks.

Unit wise Syllabus

Unit – I: Overview of Image Analysis

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

Unit – II: Edge Detection

Edge detection, Edge detection performance, Hough transform, corner detection

Unit – III: Segmentation

Segmentation, Morphological filtering, Fourier transform

Unit – IV: Feature Extraction

Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

Unit –V: Pattern Analysis

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semisupervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

Unit – VI: Recent Trends

Recent trends inActivity Recognition, computational photography, Biometrics.

Learning Outcome :

After completion of course, students would be able to:

- Developed the practical skills necessary to build computer vision applications.
- To have gained exposure to object and scene recognition and categorization from images.

Text/ Reference Books:

- Computer Vision: Algorithms and Applications by Richard Szeliski.
- Deep Learning, by Goodfellow, Bengio, and Courville.
- Dictionary of Computer Vision and Image Processing, by Fisher et al.

Human and Computer Interection

Course Code: MTCSE PE241
L-T-P: 3-0-0
Course Prerequisite: Mobile computing

Total Teaching Hours: 48 hours

Course Objective:

- Learn the foundations of Human Computer Interaction
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile Human Computer interaction.
- Learn the guidelines for user interface.

Unit wise Syllabus

Unit – I: Human Interaction

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

Unit – II: Interactive Design

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Unit – III: Cognitive Models

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

Unit – IV: Mobile Ecosystem

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Unit –V: Web Interface Designing

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Unit – VI: Recent Trends

Recent Trends: Speech Recognition and Translation, Multimodal System

Course Outcome:

After completion of course, students would be able to:

- Understand the structure of models and theories of human computer interaction and vision.
- Design an interactive web interface on the basis of models studied.

Text/ Reference Books:

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
- Brian Fling, “Mobile Design and Development”, First Edition , OReilly Media Inc., 2009 (UNIT –IV)
- Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, OReilly, 2009.(UNIT-V).

Graphics Processing Unit Computing

Course Code: MTCSE PE242

L-T-P: 3-0-0

Course Prerequisite: Basics of Data Structure, Computer Architecture, Computer Graphics

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: 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

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

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

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning

Unit – VI: Advanced Topics

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

Learning Outcome :

After completion of course, students would be able to:

- 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, Wen-mei Hwu; 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)

Digital Forensics

Course Code: MTCSE PE243
L-T-P: 3-0-0
Course Prerequisite: Cybercrime and Information Warfare, Computer Networks
Total Teaching Hours: 48 hours
Course Objective:

- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
- E-evidence collection and preservation, investigating operating systems and file systems network forensics, art of steganography and mobile device forensics.

Unit wise Syllabus

Unit – I: Digital Forensics Science

Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

Unit – II: Cyber Crime Scene Analysis

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Unit – III: Evidence Management & Presentation

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Unit – IV: Computer Forensics

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Unit –V: Mobile Forensics

Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Unit – VI: Recent Trends

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Learning Outcome :

After completion of course, students would be able to:

- Understand relevant legislation and codes of ethics
- Computer forensics and digital detective and various processes, policies and procedures
- E-discovery, guidelines and standards, E-evidence, tools and environment.
- Email and web forensics and network forensics.

Text/ Reference Books:

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

Mobile Applications and Services

Course Code: MTCSE PE351
L-T-P: 3-0-0
Course Prerequisite: Wireless Communication and Mobile Computing

Total Teaching Hours: 48 hours

Course Objective:

- This course presents the three main mobile platforms and their ecosystems, namely
  Android, iOS, and PhoneGap/WebOS.
- It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets

- It also take into account both the technical constraints relative to storage capacity,
  processing capacity, display screen, communication interfaces, and the user interface, context and profile.

Unit wise Syllabus

Unit – I: Introduction

Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User

Unit – II: User Interface

VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs. Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

Unit – III: Communications via Network and Web

Communications via Network and the Web:State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms:Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics

Unit – IV: Packaging & Deployment

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

Unit –V: Development Process

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android

Unit – VI: Recent Trends

Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT

Course Outcome :

After completion of course, students would be able to:

- Identify the target platform and users and be able to define and sketch a mobile application understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap
- Design and develop a mobile application prototype in one of the platform (challenge project)

Text/ Reference Books:

- Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Compilers for High Performance Computing

Course Code: MTCSE PE352
L-T-P: 3-0-0
Course Prerequisite: Data Structure, Compiler Design, Theory of Computation

Total Teaching Hours: 48 hours

Course Objective:

- The objective of this course is to introduce structure of compilers and high performance
  compiler design for students. Concepts of cache coherence and parallel loops in compilers are included.

Unit wise Syllabus

Unit – I: High Performance System

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance.

Unit – II: Data Dependence

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use- Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.

Unit – III: Array Region Analysis

Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis. Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.

Unit – IV: Concurrency Analysis

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

Unit –V: Message Passing Machines

Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.

Unit – VI: Recent Trends

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

Learning Outcome :

After completion of course, students would be able to:

- Familiar with the structure of compiler.
- Parallel loops, data dependency and exception handling and debugging in compiler.

Text/ Reference Books:

- Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson

Optimization Techniques

Course Code: MTCSE PE353

L-T-P: 3-0-0
Course Prerequisite: Linear Algebra and Numerical Methods

Total Teaching Hours: 48 hours

Course Objective:

- The objective of this course is to provide insight to the mathematical formulation of real world problems.
- To optimize these mathematical problems using nature based algorithms. And the solution is useful specially for NP-Hard problems.

Unit wise Syllabus

Unit – I: Optimization
Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

Unit – II: Structure of Optimization Algorithms
General Structure of Optimization Algorithms, Constraints, The Feasible Region.

Unit – III: Mathematical Programming
Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

Unit – IV: Genetic Optimization
Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Unit –V: Real Life Problem
Real life Problems and their mathematical formulation as standard programming problems.

Unit – VI: Recent Trends
Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications..

Course Outcome :

After completion of course, students would be able to:

- Formulate optimization problems.
- Understand and apply the concept of optimality criteria for various types of optimization problems.
- Solve various constrained and unconstrained problems in Single variable as well as multivariable.
- Apply the methods of optimization in real life situation.

Text/ Reference Books:

- Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
- Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
- An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
- Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
- John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 9780-8493-1914-3.
- H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.
- Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank;
- Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer
- Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3-540-68274-5.
- Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

OPEN ELECTIVES

Business Analytics

Course Code: MTCSE OE311
L-T-P: 3-0-0
Total Teaching Hours: 48 hours
Course Prerequisite: Optimization, Data Mining
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 an 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.

Industrial Safety

Course Code: MTCSE OE312
L-T-P: 3-0-0
Total Teaching Hours: 48 hours
Course Prerequisite: NIL
Course Objective:
To impart knowledge on different facets and aspects of engineering systems safety, focusing on tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings.

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

Unit – V: Periodic & 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.

Unit – VI: Accident investigation and Analysis Accident Investigation, Control Chart Analysis, Accident Data Analysis: Regression, Classification Tree.

Course Outcome:

- Students will be equipped with concepts of engineering systems safety, dimensions of engineering systems safety, safety design and analysis mathematics,
- Understand design for engineering systems safety and control for safety, and integrating safety with other operational goals such as quality and reliability.

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.

Operations Research

Course Code: MTCSE OE313
L-T-P: 3-0-0
Total Teaching Hours: 48 hours
Course Prerequisite: NIL
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: 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.

Unit – VI: Transportation Problem

Introduction, Formulation of Transportation Problem (TP), Transportation Algorithm (MODI Method), the Initial Basic Feasible Solution, Moving Towards Optimality.

Course Outcome:
On finishing the course students will be able to

- Define and formulate linear programming problems and appreciate their limitations.
- Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
- Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.

- Develop mathematical skills to analyse and solve integer programming and network models arising from a wide range of applications.

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

Cost Management of Engineering Projects

Course Code: MTCSE OE314
L-T-P: 3-0-0
Total Teaching Hours: 48 hours
Course Prerequisite: NIL
Course Objective

- To teach students the techniques relating to managing engineering activities.
- To help engineer's transition into management, engineering managerial functions.
- To motivate individual and group behavior, productivity assessment/improvement.

Unit wise Syllabus

Unit-I

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.

Unit-II

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.

Unit-III

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.

Unit-IV

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.

Unit-V

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.

Unit-VI

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

Course Outcome:

- Identify and use the tools of project management.
- Effectively use project reporting tools and techniques.
- Understand and appraise the changing business climate and how the changes have impacted project management
- Understand the importance of risk, cost, schedule and resource control and management of a project
- Understand the need for effective project management skills, training and the specific training needs of project managers.
- Demonstrate an understanding of the role of Project Management vs. Functional Management.
- Write clear goal and objective statements and establish measurable criteria for project success.

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.

Composite Materials

Course Code: MTCSE OE315
L-T-P: 3-0-0
Total Teaching Hours: 48 hours
Course Prerequisite:
Course Objective

- The course covers the properties of fibre-reinforced polymer composites and the mechanical performance of laminated composites, including failure behaviour.

- Students will be able to model, simulate and optimise the performance of composite structures as well as develop practical skills in one or more common manufacturing techniques.
- Students will be taught how to use and apply classical laminate theory to intelligently design laminates with tailored mechanical responses in commercial composite analysis software.
- The course will also include a design exercise for a composite component or structure.

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

Unit – VI: PROMAL for Windows Software Package: A User's Guide

To set up PROMAL on a personal computer Show how to use PROMAL for matrix algebra such as multiplication of matrices, solving a set of equations and finding inverse of a matrix, developing and maintaining a database for properties of unidirectional laminas, conducting macromechanics of a lamina, conducting micromechanics of a lamina, conducting macromechanics of a laminate Show by examples how to use each of the above programs

Course Outcome:

Students will have the skills and knowledge to

- Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.

- Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.
- Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composites
- Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project
- Critique and synthesise literature and apply the knowledge gained from the course in the design and application of fibre-reinforced composites.

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.

Waste to Energy

Course Code: MTCSE OE316
L-T-P: 3-0-0
Total Teaching Hours: 48 hours
Course Prerequisite: Basics of Chemistry and Biology
Course Objective:
To impart the knowledge of
production of energy from different types of wastes through thermal, biological and chemical routes.

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.

Unit – VI: Energy production

Energy production from waste plastics, gas cleanup. Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells. Energy production from wastes through fermentation and transesterification. Cultivation of algal biomass from wastewater and energy production from algae.

Course Outcome:

- The course will upgrade students knowledge with the current thoughts and newer technology options along with their advances in the field of the utilization of different types of wastes for energy production.

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

ENGLISH FOR RESEARCH PAPER WRITING

Course Code: MTCSE AC111

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite: Basics of English Language

Course Objective:

Students will be able to:

- Understand that how to improve your writing skills and level of readability
- 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:

Students will be able to write good quality research paper.

Text/ Reference Books:

- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
- Sahni, Pardeep Et. 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

DISASTER MANAGEMENT

Course Code: MTCSE AC112

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite: None

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: After completion of the course student will

- Understand repercussions of hazards and disasters.
- Get familiar with disaster management theory (cycle, phases)
- have knowledge of Technological innovations in Disaster Risk Reduction: Advantages and problems
- Understand disaster mitigation

Text/ Reference Books:

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

PEDAGOGY STUDIES

Course Code: MTCSE AC113

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite: None

Course Objective:

The course imparts knowledge of pedagogical practices being used by teachers in formal and informal classrooms.

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 basi maths 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: MTCSE AC221

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite: None

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: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat:

Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

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.

VALUE EDUCATION

Course Code: MTCSE AC222

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite:

Course Objective: The course will be able to

- Help student understand value of education and self- development
- Imbibe good values in students.
- Help students 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- estructive 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

Unit – V: Value Education towards National and Global Development

Constitutional Values: Sovereign, Democracy, Socialism, Secularism, Equality, Justice, Liberty, Freedom, Fraternity, Social Values: Pity and Probity, Self-Control, Universal Brotherhood. Professional Values: Knowledge Thirst, Sincerity in Profession, Regularity, Punctuality, Faith.

Unit – VI: Religious, Moral Values, and Aesthetic Values::

Tolerance, Wisdom, character. Love and Appreciation of literature, fine arts and respect for the same.

Course Outcome:

Students will

- Have knowledge of self-development
- Learn the importance of Human values
- Develop 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: MTCSE AC223

L-T-P: 2-0-0

Total Teaching Hours: 48 hours

Course Prerequisite: None

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 wise Syllabus

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: Neetisatakam

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's)

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

Approach to day to day work and duties, Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Unit – VI: Statements of basic knowledge

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

Course Outcome:

Students will be able to

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

Text/ Reference Books:

- Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi
- “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication
- Department), Kolkata
- Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
- Rashtriya Sanskrit Sansthanam, New Delhi.