

JAMIA HAMDARD

**DEPARTMENT OF COMPUTER
SCIENCE AND ENGINEERING**

**CBCS ENABLED SYLLABUS
MASTER OF TECHNOLOGY
COMPUTER SCIENCE & ENGINEERING
PART TIME**



SYLLABUS FOR MASTER OF TECHNOLOGY COMPUTER SCIENCE & ENGINEERING PART

TIME

Choice Based credit system (CBCS)

Approval Date: 26th June 2022



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

JAMIA HAMDARD

Deemed to be University

Accredited in 'A' Grade by NAAC

Declared to be designated as Institute of Eminence (IoE) by MHRD, GOI,

New Delhi - 110062

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**PROGRAMME NAME: MASTER OF TECHNOLOGY
COMPUTER SCIENCE & ENGINEERING PART TIME**

PROGRAMME CODE: 544

ACADEMIC SESSION OF INTRODUCTION OF THE PROGRAMME: (2022-23)

SCHOOL NAME: SEST

DEPARTMENT NAME: COMPUTER SCIENCE & ENGINEERING

**APPROVAL DATE OF THE BOARD OF STUDIES (BOS) MEETING FOR THE
PRESENT SYLLABUS
26 JUNE 2022**

**APPROVAL DATE NUMBER OF ACADEMIC COUNCIL OF MEETING FOR
THE PRESENT SYLLABUS**

ADMISSION & EXAMINATION BYE-LAWS

**FOR
MASTER OF TECHNOLOGY
(COMPUTER SCIENCE & ENGINEERING)
M. TECH. (CSE) Part Time**

Program Code: 544

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



**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
School of Engineering Sciences & Technology
JAMIA HAMDARD
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- **Approval date of the BOS meeting for the present syllabus:**

Approval date and number for the Academic Council meeting for the present syllabus

Name of Programme	Programme Code	Date of Revision
M.Tech CSE Part Time	544	02-11-2018

SCHOOL OF ENGINEERING SCIENCES AND TECHNOLOGY

Vision Statement (School Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (3 to 4) (School Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.

MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Vision Statement (Department/Centre Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (3 to 4) (Department/Centre Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.

MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

PROGRAM EDUCATIONAL OBJECTIVES

Upon the completion of Academic Programme (M.Tech. CSE Part Time), students will be able -

PEO 1: To prepare professionals who will have successful career in industries, academia, research and entrepreneurial endeavours.

PEO 2: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions to real life problems.

PEO 3: To prepare graduates who will thrive to pursue life-long learning and contribute to society as an ethical and responsible citizen.

Mapping Program Educational Objectives (PEOs) with Mission Statements (MS)

	MS-1	MS-2	MS-3	MS-4	MS-5
PEO-1	3	2	2	2	2
PEO-2	2	3	2	3	3
PEO-3	3	2	2	2	3

Write '3' in the box for 'high-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

PROGRAM OUTCOMES

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

- PO1: An understanding of the theoretical foundations and the limits of computing.
- PO2: An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems.
- PO3: An ability to design, develop and evaluate new computer-based systems for novel applications which meet the desired needs of industry and society.
- PO4: Understanding and ability to use advanced computing techniques and tools.
- PO5: An ability to undertake original research at the cutting edge of computer science & its related areas.
- PO6: An ability to function effectively individually or as a part of a team to accomplish a stated goal.
- PO7: An understanding of professional and ethical responsibility.

- PO8: An ability to communicate effectively with a wide range of audience.

- PO9: An ability to learn independently and engage in lifelong learning.

- PO10: An understanding of the impact of IT related solutions in an economic, social and environment context.

PROGRAMME SPECIFIC OUTCOMES:

PSO 1: Students should be able to develop and implement the solution of real life computing problems using contemporary technologies.

PSO 2: Students should be able to apply ethical principles and commit to professional and social responsibilities.

ADMISSION & EXAMINATION RULES

for

MASTER OF TECHNOLOGY (Computer Science & Engineering) Part Time

M.Tech. CSE Part Time Programme has been offered by the Department of Computer Science & Engineering.

1. PROGRAM OBJECTIVE

To facilitate the enhancement of qualifications of the in-service engineers/technocrats besides the fresh candidates and 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.

2. THE PROGRAM

Highlights of the program are described in the following table:

a.	<i>Name of the Program</i>	M. Tech. (CSE) Part Time
b.	<i>Nature</i>	Part-Time (Weekend)
c.	<i>Duration</i>	Three Years (6 Semesters)
d.	<i>Total number of credits</i>	78
e.	<i>Medium of Instruction and Examinations</i>	English
f.	<i>Eligibility Criteria</i>	Passed B.Tech./BE or equivalent degree in Computer Science/Computer Science & Engineering/Computer Engineering/ Information Technology/Software Engineering/ ICT with 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.	<i>Selection procedure</i>	As per the merit of the qualifying examination
h.	<i>Total Seats</i>	60 (50 General, + 10 Sponsored, including NRI); additional 6 seats available for Foreign Nationals.

i.	<i>Period of Completion</i>	Not more than 05 years (10 Semesters)
j.	<i>Commencement of the Program</i>	July of the every academic session

3. PROGRAM STRUCTURE

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

GENERAL NOTE

This is a Part-Time Program to facilitate the enhancement of qualifications of the in-service engineers/technocrats besides the fresh candidates. Preference will be given to in-service candidates or to those having working experience. Most of the teaching-learning process of this Weekend Program will be held during Saturdays/Sundays, but all the Semester-end examinations (Theory and Practical both, and Seminars/Project/Dissertation evaluation etc.) and all other official activities including fees submission, central library service, sports, etc. (except Teaching) will be held during weekdays (Monday to Friday) only. During the semesters with the courses like Project/Dissertation, the guidance by the supervisors will carried out during weekdays and consequently the students during these Project/Dissertation courses of the semesters must be prepared to visit the supervisors for guidance during weekdays.

Candidates before applying for admission must ensure themselves of the above conditions.

Program Summary

Course Type	Abbreviation	Credits
Program Core	PC	16
Program Elective	PE	20
Open Elective (OE)	OE	4
Research Methodology & IPR	RMIPR	2
Audit Course	AC	0
Laboratory	LAB	8
Mini Project with Seminar	MPS	2
Dissertation	DISS	26
Total Credits		78

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

Semester – I

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTCSEP 101	Mathematical Foundations of Computer Science	PC	40	60	100	3-1-0	4
	Program Elective – I	PE	40	60	100	3-1-0	4
MTCSEP 102	Research Methodology & IPR	RMIPR	40	60	100	2-0-0	2
MTCSEP 103	Lab – I (Based on Elective – I)	LAB	40	60	100	0-0-4	2
Total					400	8-2-4	12

Semester – II

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTCSEP 201	Advanced Data Structures	PC	40	60	100	3-1-0	4
	Program Elective – II	PE	40	60	100	3-1-0	4
	Audit Course – I	AC	40	60	100	2-0-0	0

MTCSEP 202	Lab– II (Advanced Data Structures)	LAB	40	60	100	0-0-4	2
MTCSEP203	Lab – III (Based on Elective – II)	LAB	40	60	100	0-0-4	2
Total					500	8-2-8	12

Semester – III

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTCSEP 301	Advanced Algorithms	PC	40	60	100	3-1-0	4
	Program Elective – III	PE	40	60	100	3-1-0	4
	Audit Course – II	AC	40	60	100	2-0-0	0
MTCSEP 302	Lab – IV (Based on Advanced Algorithms)	LAB	40	60	100	0-0-4	2
MTCSEP 303	Lab – V (Based on Elective – III)	LAB	40	60	100	0-0-4	2
Total					500	8-2-8	12

Semester – IV

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTCSEP 401	Soft Computing	PC	40	60	100	3-1-0	4
	Program Elective – IV	PE	40	60	100	3-1-0	4
MTCSEP 402	Lab – VI (Based on Soft Computing)	LAB	40	60	100	0-0-4	2
MTCSEP 403	Mini Project with Seminar@#	MPS	40	60	100	2-0-0	2
Total					400	8-2-4	12

Semester – V

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
	Program Elective – V	PE	40	60	100	3-1-0	4
	Open Elective	OE	40	60	100	3-1-0	4
MTCSEP 501	Dissertation – I//Industrial Project @#	DISS	100	100	200	0-0-16	8
Total					400	6-2-16	16

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

Semester – VI

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MTCSEP 601	Dissertation – II@#§	DISS	300	100	400	0-0-28	14

Grand Total of Credits = 78

@ *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 two 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 ELECTIVE (PE) for M.TECH. (CSE) Part Time PROGRAM

Course Code	Course Title	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Program Elective – I						
MTCSEP PE111	Machine Learning	40	60	100	3-1-0	4
MTCSEP PE112	Wireless Sensor Networks	40	60	100	3-1-0	4
MTCSEPPE113	Introduction to Intelligent Systems	40	60	100	3-1-0	4
Program Elective – II						
MTCSEP PE121	Data Science	40	60	100	3-1-0	4
MTCSEP PE122	Distributed Systems	40	60	100	3-1-0	4
MTCSEP PE123	Advanced Wireless & Mobile Networks	40	60	100	3-1-0	4
Program Elective – III						
MTCSEP PE231	Data Preparation & Analysis	40	60	100	3-1-0	4
MTCSEP PE232	Secure Software Design & Enterprise Computing	40	60	100	3-1-0	4
MTCSEP PE233	Computer Vision	40	60	100	3-1-0	4
Program Elective – IV						
MTCSEP PE241	Pattern Recognition	40	60	100	3-1-0	4
MTCSEPPE242	Graphics Processing Unit Computing	40	60	100	3-1-0	4
MTCSEP PE243	MOOCs1	40	60	100	3-1-0	4
Program Elective – V						
MTCSEP PE351	Compilers for High Performance Computing	40	60	100	3-1-0	4
MTCSEP PE352	Optimization Techniques	40	60	100	3-1-0	4
MTCSEP PE353	MOOCs2	40	60	100	3-1-0	4

OPEN ELECTIVES (OE)

Paper Code	Title of the Paper	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Open Elective						
MTCSEP OE511	Business Analytics	40	60	100	3-1-0	4
MTCSEP OE512	Block Chain Design and Their Use Cases	40	60	100	3-1-0	4
MTCSEP OE513	Operation Research	40	60	100	3-1-0	4
MTCSEP OE514	Cost Management of Engineering Projects	40	60	100	3-1-0	4
MTCSEP OE515	Internet of Things	40	60	100	3-1-0	4
MTCSEP OE516	Numerical Methods	40	60	100	3-1-0	4

AUDIT COURSE (AC)

Paper Code	Title of the Paper	Marks			L-T-P	Credits
		Internal Assessment	Semester Exam	Total		
Audit Course – I						
MTCSEP AC111	English for Research Paper Writing	40	60	100	2-0-0	0
MTCSEP AC112	Disaster Management	40	60	100	2-0-0	0
MTCSEP AC113	Pedagogy Studies	40	60	100	2-0-0	0
Audit Course – II						
MTCSEP AC221	Constitution of India	40	60	100	2-0-0	0
MTCSEP AC222	Value Education	40	60	100	2-0-0	0
MTCSEP AC223	Personality Development through Life Enlightenment Skills	40	60	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 two (2) Internal Assessment (Unit Tests) with a total of 30 marks(each of 15 marks each). Other modes of assessment (Assignment, attendance, etc) shall account for remaining 10 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	02 Hours 30 minutes	03 Hours
3.	Total Marks	60 (Sixty Only)	60 (Sixty Only)

8. DISSERTATION

- a. Each student of the final semester will have to go for a Research based Dissertation work either in the industry or in the Department under the guidance of one or two faculty members.
- b. Dissertation shall be based on latest research topics. In case of Specialization in ISCF, the broad area of research shall be from the domain of ISCF. In case of Specialization in Big Data Analytics, the broad area of research shall be from the domain of Big Data Analytics.
- c. Students are required to get approval of their title of Dissertation by Dissertation Assessment & Evaluation committee constituted by HOD. Supervisor of respective students must be member of the above committee. Students are required to give atleast three presentations for progress monitoring & assessment purpose to their respective supervisors. Viva-voce will be held only after the submission of completion report duly signed by the supervisor of the respective student. A plagiarism report duly signed by the students are mandatory to submit in compliance with UGC (Promotion of Academic Integrity and Prevention of Plagiarism in Higher

- Educational Institutions) Regulations, 2017 (or any such regulations notified time to time) by competent authority.
- d. *Students are required to publish atleast one article related to their work of Dissertation in UGC approved International Refereed Journal/International Conference. Before submitting the paper Student **MUST** take the consent of their respective supervisor.*
 - e. A supervisor will be allocated to every student for dissertation work as decided by the Dissertation Committee of the Department.
 - f. All the students, who are pursuing the Dissertation work, shall be continuously in touch with the internal supervisor.
 - g. **There shall be two 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 50%.

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 SIX semesters, the students shall be eligible for the award of M. Tech. Computer Science & Engineering (PART TIME) 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) PART TIME* 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) PART TIME* 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: MTCSEP 101

L-T-P: 3-1-0 **Credits:** 4

Course Prerequisite: Discrete Mathematics

Total Teaching Hours: 42 hours

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to:

CO-1: Understand the basic notions of discrete and continuous probability distribution, and solve the problems.

CO-2: Describe the random samples and the sampling distributions, and analyse different types of samples.

CO-3: Discuss Statistical inference and multivariate statistical models, and categorise & classify the data.

CO-4: Define and explain the basic concepts of graph theory and solve problems in almost every conceivable discipline using graph models.

CO-5: Express & use the vector spaces and related topics.

CO-6: Enumerate objects and solve counting problems and analyse algorithms.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	1	2
CO2	3	3	3	1	2	2	-	-	-	2	2	1
CO3	2	3	2	1	2	-	3	2	-	-	3	-
CO4	3	2	3	2	2	-	-	3	-	-	-	3
CO5	3	3	2	1	-	-	-	-	1	-	2	2
CO6	3	3	2	2	2	-	-	-	-	-	1	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: Probability Functions and Distributions

8 hours

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

6 hours

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

Unit – III: Statistical Models

6 hours

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

Unit – IV: Graph Theory

8 hours

Graph Theory: Isomorphism, Planar graphs, graph coloring, 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

8 hours

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

6 hours

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

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

Teaching-Learning Strategies in brief

1. Build positive environment in the classroom.
2. Provide concrete basic and advanced knowledge of the subject.
3. Solve problems based on the basic & advanced concepts of the subject.
4. Encourage to the students to ask more & more questions.
5. Motivate to the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Research Methodology and IPR

Course Code: MTCSEP 102

L-T-P: 2-0-0 Credits: 2

Total Teaching hours: 40

Course Prerequisite:

Course Outcomes:

The course will help students

CO1: Understand some basic concepts of research and its methodologies

CO2: Identify appropriate research topics

CO3: Select and define appropriate research problem and parameters

CO4: Prepare a project proposal (to undertake a project)

CO5: Organize and conduct research (advanced project) in a more appropriate manner

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	3	1	1		2				1	2	3
CO3	3	3	1	2		2				1	3	3
CO4	3	3	1	2		2				1	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Research Problem, Scope & Objectives

8 hours

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

6 hours

Effective literature studies approaches, analysis Plagiarism, Research ethics

Unit – III: Effective Technical Writing

8 hours

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

6 hours

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

6 hours

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

Unit – VI: New Developments in IPR

6 hours

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.

Text/ Reference book:

- 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

Teaching-Learning Strategies in brief

1. Build positive environment in the classroom.
2. Provide concrete basic and advanced knowledge of the subject.
3. Solve problems based on the basic & advanced concepts of the subject.
4. Encourage to the students to ask more & more questions.
5. Motivate to the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Program: M.Tech CSE Part Time
Course Name: Machine Learning Lab (Lab Based on Elective-I)
Course Code: MTCSEP 105

L-T-P: 0-0-4

(L = Lecture hours, T = Tutorial hours, P = Practical hours)

Credits: 2

Course Outcomes:

CO-1: Understand modern notions in predictive data analysis

CO-2: Select data, model selection, model complexity and identify the trends

CO-3: Understand a range of machine learning algorithms along with their strengths and weaknesses

CO-4: Build predictive models from data and analyze their performance

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	1	2
CO2	3	3	3	1	2	2	-	-	-	2	2	1
CO3	2	3	2	1	2	-	3	2	-	-	3	-
CO4	3	2	3	2	2	-	-	3	-	-	-	3

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping.

List of Programs

1. Write a python program to compute
 - Central Tendency Measures: Mean, Median, Mode
 - Measure of Dispersion: Variance, Standard Deviation
2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
3. Study of Python Libraries for ML application such as Pandas and Matplotlib
4. Write a Python program to implement Simple Linear Regression.
5. Implementation of Multiple Linear Regression for House Price Prediction using sklearn.
6. Implementation of Decision tree using sklearn and its parameter tuning
7. Implementation of KNN using sklearn
8. Implementation of Logistic Regression using sklearn
9. Implementation of K-Means Clustering
10. Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

Teaching-Learning Strategies in brief

1. Build openness and positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Create collaborative environment among students.
4. Encourage students to ask questions and clarify doubts.
5. Motivate the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

1. Giving assignments and Quizzes based on the subject.
2. Conducting viva.
3. Mid Term assessment and semester examination.
4. Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.

Advanced Data Structures

Course Code: MTCSEP 201

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 42 hours

Course Prerequisite: UG level course in Data Structures

Course Outcomes:

The course will help students

CO1: The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.

CO2: Students should be able to understand the necessary mathematical abstraction to solve problems.

CO3: To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.

CO4: Student should be able to come up with analysis of efficiency and proofs of correctness.

CO5: To make students future ready for Applying Data Structure concepts in upcoming technologies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	1	2		2				1	2	2
CO4	3	2	1	2		2				3	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Dictionaries & Hashing

8 hours

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

8 hours

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

6 hours

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

Unit – IV: Text Processing

8 hours

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

6 hours

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadrees, k-D Trees.

Unit – VI: Recent Trends in Hashing, Trees & Computational Geometry 6 hours

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

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Program: M.Tech CSE Part Time

Course Name: Advanced Data Structure Lab

Course Code: MTCSEP 202

L-T-P: 0-0-4

(L = Lecture hours, T = Tutorial hours, P = Practical hours)

Credits: 2

Course Outcomes:

CO1: Able to design and implement the basic as well as advanced data structures.

CO2: Searching and sorting are ore emphasised using advanced data structure.

CO3: Able to implement Text Data Processing Techniques using BOYER Algorithms.

CO4: To learn efficient use of Hash Tables.

CO5: Able to implement Text Data Processing Techniques using LCS Algorithms.

MAPPING OF COURSE OUTCOME WITH PROGRAM OUTCOME

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co 1	1	2	3	1	3	2	1	2	2	3	2	1
Co 2	3	2	2	2	2	2	1	3	3	2	1	3
Co 3	2	2	1	3	1	3	2	1	2	2	3	2
Co 4	-	2	2	3	3	3	3	1	2	3	2	3
Co 5	-	-	2	1	4	2	1	1	2	3	1	2

MTCSEP 201 (ADS Lab) List of Experiments

1. Write a program in Python/Java/C to implement the functionality of Heap Sort
2. Write a program in Python/Java/C to implement the functionality of Hashing
3. Write a program in Python/Java/C to implement the functionality of Linear Probing
4. Write a program in Python/Java/C to implement the functionality of Quadratic Probing
5. Write a program in Python/Java/C to implement the functionality of Double Hashing
6. Write a program in Python/Java/C to implement the functionality of Skip Lists
7. Write a program in Python/Java/C to implement the functionality of BST
8. Write a program in Python/Java/C to implement the functionality of AVL
9. Write a program in Python/Java/C to implement the functionality of RB Tree
10. Write a program in Python/Java/C to implement the functionality of Brute Force Pattern Matching
11. Write a program in Python/Java/C to implement the functionality of Boyer Moore
12. Write a program in Python/Java/C to implement the functionality of KMP
13. Write a program in Python/Java/C to implement the functionality of Tries
14. Write a program in Python/Java/C to implement the functionality of Huffman Coding
15. Write a program in Python/Java/C to implement the functionality of LCS

Teaching-Learning Strategies in brief

1. Build openness and positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Create collaborative environment among students.
4. Encourage students to ask questions and clarify doubts.
5. Motivate the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

1. Giving assignments and Quizzes based on the subject.
2. Conducting viva.
3. Mid Term assessment and semester examination.
4. Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.

Advanced Algorithms

Course Code: MTCSEP 301

L-T-P: 3-1-0 **Credits:** 4

Total Teaching hours: 40

Course Prerequisite: Algorithm Design & Analysis

Course outcomes:

CO-1: Analyze the complexity and performance of different algorithms in different contexts.

CO-2: Determine the appropriate data structure for solving a particular set of problems.

CO-3: Create and identify the computational issues and apply suitable algorithms to solve it effectively

CO-4: Design and implement optimized algorithmic solutions in real world problems involving large data sets and artificial intelligence.

CO-5: Design efficient and effective algorithmic solutions for different real world problems

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	3	3	3	1	-	-	-	-	1	-
CO2	3	3	3	3	3	1	-	-	-	-	2	-
CO3	3	3	3	3	3	1	-	-	-	-	2	-
CO4	3	3	3	3	3	1	-	-	-	-	3	-
CO5	3	3	3	3	3	1	-	-	-	-	3	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit 1:

8 hours

Theory of NP- Hard and NP-Complete Problems P, NP and NP-Complete complexity classes; Introduction to a few NPCompleteness proofs, Other complexity classes

Unit 2:

10 hours

Sorting: Review of various sorting algorithms, topological sorting Graph, Definitions and Elementary Algorithms, Shortest path by BFS, DFS.

Algorithms Types and their Applications, Simple recursive algorithms.

Backtracking algorithms. Divide and conquer algorithms. Dynamic programming algorithms.

Greedy algorithms. Branch and bound algorithms. Brute force algorithms. Randomized algorithms.

Unit 3:

8 hours

Introduction to greedy paradigm, knapsack algorithm, Minimum spanning tree. Application to MST.

Unit 4:

8 hours

Shortest Path in Graphs, Dynamic programming paradigm, Examples of dynamic programming.

Unit 5:

8 hours

Algorithms for large data sets, Applications in Data Science and AI, Common algorithms for large data sets.

Reference Books:

1. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein.
2. The Design and Analysis of Computer Algorithms, Aho, Hopcroft, Ullman.
3. Algorithm Design, Kleinberg and Tardos.
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Providing examples, real life scenarios etc through online references, animation, slide show and video
2. Making groups for peer to peer learning and enabling discussions for motivating coordination and team-player skills

Assessment methods and weightages in brief

1. Assessing different groups through presentation and oral questionnaires
2. Assessing through quizzes for better objective evaluation
3. Sessional examination (2 Nos.)
4. Assignments.
5. Class tests
6. Semester examination
7. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Name of The Course: M. Tech. CSE Part Time
Course Code: MTCSEP 303
Title of the Course: Data Preparation & Analysis LAB
L-T-P: 0-0-4
(L = Lecture hours, T = Tutorial hours, P = Practical hours)
Credits: 2

Course Outcomes:

CO-1: To identify the data parsing and transformations. and understand the difference between data and information with formats. (Cognitive Level: analyse)

CO2: To explain and apply the basic concept of data cleaning for valuable information with a minimum consistency checking (Cognitive level: apply)

CO-3: To understand statistical exploratory analysis with hypothesis generation. (Cognitive Level: Evaluate)

CO-4: To design visualizations for exploratory analysis and understand the concept of correlations and connections for geo-located data. (Cognitive level: Create)

CO-5: To learn data transformations and segmentation to solve statistical problems. Able to extract the data for performing the Analysis. (Cognitive level: Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	1	1	1							2	2
CO2	2	3	2	2	2				2	2	2	1
CO3	2	2	2	2	3	3	1	2	3		3	1
CO4	3	3	2	2	2	2	2	3	2		2	1
CO5	2	2	2	2	2	2	2	2	2	2	2	1

3-High Level, 2-Medium Level, 1-Low Level

List of Experiments

1. Perform DATA PRE-PROCESSING AND DATA CUBE processing using IBM SPSS
2. Perform DATA CLEANING using IBM SPSS
3. Perform EXPLORATORY ANALYSIS using IBM SPSS
4. Perform ASSOCIATION ANALYSIS using IBM SPSS
5. Execute Apriori using WEKA
6. Execute FP Growth using WEKA
7. Perform HYPOTHESIS GENERATION using IBM SPSS

8. Perform TRANSFORMATION TECHNIQUES using IBM SPSS
9. Perform DATA VISUALIZATION using IBM SPSS
10. Perform CLUSTERS ASSESSMENT using IBM SPSS

Teaching-Learning Strategies in brief

1. Build openness and positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Create collaborative environment among students.
4. Encourage students to ask questions and clarify doubts.
5. Motivate the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

1. Giving assignments and Quizzes based on the subject.
2. Conducting viva.
3. Mid Term assessment and semester examination.
4. Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.

Program: M.Tech CSE Part Time
Course Code: MTCSEP 401
Title of the Course: Soft Computing
L-T-P: 3-1-0 Credits: 4
Total Teaching hours: 40
Course Prerequisite: Basic knowledge of mathematics

Course outcomes:

After completing this Course, the students should be able to

CO-1: Identify and describe soft computing techniques and their roles in building intelligent machines

CO 2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

CO-3: Analyze the effectiveness of using Neural Networks for solving real life problems.

CO 4: Explain the application of genetic algorithms to combinatorial optimization problems.

CO 5: Evaluate and compare solutions by various soft computing approaches for a given problem.

CO-6: Design deep learning based models for solving various machine learning problems

**Mapping of Course Outcomes (COs) with Program Outcomes (POs)
and Program Specific Outcomes (PSOs)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	1	1	2	1	1	1	1	1	1	3	1
CO2	2	3	3	3	2	1	1	1	1	1	3	1
CO3	3	2	2	2	3	1	2	1	1	2	2	1
CO4	2	3	2	3	3	2	1	2	2	1	3	1
CO5	2	2	3	2	2	1	2	1	1	1	3	1
CO6	3	3	2	2	3	1	1	2	2	2	3	1

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction To Soft Computing And Neural Networks 8 hours

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 8 hours

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 6 hours

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

6 hours

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

Unit – V: Matlab/Python Lib

6 hours

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

6 hours

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

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

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Providing examples, real life scenarios etc through online references, animation, slide show and video
2. Making groups for peer to peer learning and enabling discussions for motivating coordination and team-player skills

Assessment methods and weightages in brief

1. Assessing different groups through presentation and oral questionnaires
2. Assessing through quizzes for better objective evaluation
3. Sessional examination (2 Nos.)
4. Assignments.
5. Class tests
6. Semester examination
7. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Program: M.Tech CSE Part Time

Course Code: MTCSEP 402

Title of the Course: Lab III Lab Based on Core (Soft Computing)

L-T-P: 0-0-4

Credits: 2

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

CO-1: Identify and describe soft computing techniques and their roles in building intelligent machines

CO 2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

CO-3: Analyze the effectiveness of using Neural Networks for solving real life problems.

CO 4: Explain the application of genetic algorithms to combinatorial optimization problems.

CO 5: Evaluate and compare solutions by various soft computing approaches for a given problem.

CO-6: Design deep learning based models for solving various machine learning problems

**Mapping of Course Outcomes (COs) with Program Outcomes (POs)
and Program Specific Outcomes (PSOs)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	1	1	2	1	1	1	1	1	1	3	1
CO2	2	3	3	3	2	1	1	1	1	1	3	1
CO3	3	2	2	2	3	1	2	1	1	2	2	1
CO4	2	3	2	3	3	2	1	2	2	1	3	1
CO5	2	2	3	2	2	1	2	1	1	1	3	1
CO6	3	3	2	2	3	1	1	2	2	2	3	1

3-High Level, 2-Medium Level, 1-Low Level

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

List of experiments

1. Lab - I – Basic Fuzzy Operations (Write a Python program to perform basic Fuzzy Operations (Union, Intersection and Complement).
2. Lab - II – Implement AND Function using MP Neuron (Write a program in Python to perform AND function using the McCulloch Pits Neuron using)
3. Lab - III – Implement OR Function Using MP Neuron (Write a program in Python to perform OR function using the McCulloch Pits Neuron.)
4. Lab - IV – NOR Function Using MP Neuron (Write a program in Python to perform NOR function using the McCulloch Pits Neuron.)
5. Lab - V – Find out Max-Min Decomposition

6. Lab - VI – Find Fuzzy relation is reflexive or not
7. Lab - VII – Find a relation is a tolerance or not.
8. Lab - VIII – Find a relation is equivalence or not.
9. Lab - IX – Find the Lambda Cut.
10. Lab - X– Maximizing equation using Genetic Algorithm .

Teaching-Learning Strategies in brief

1. Build openness and positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Create collaborative environment among students.
4. Encourage students to ask questions and clarify doubts.
5. Motivate the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

1. Giving assignments and Quizzes based on the subject.
2. Conducting viva.
3. Mid Term assessment and semester examination.
4. Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.

Program Electives

Machine Learning

Course Code: MTCSEPPE111

L-T-P: 3-1-0 Credits: 4

Course Prerequisite:

Total Teaching Hours: 42 hours

Course Outcomes:

CO-1: To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IoT nodes.

CO-2: To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.

CO-3: Explore supervised and unsupervised learning paradigms of machine learning.

CO-4: To explore Deep learning technique and various feature extraction strategies.

CO-5: Design experiments to evaluate and compare different machine learning techniques on real-world problems

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	2	1	2	1	1	1	1	1	1	3	1
CO2	2	3	3	3	2	2	1	2	1	1	3	2
CO3	3	2	2	2	3	2	2	1	2	2	2	1
CO4	2	3	2	2	2	2	1	2	2	1	3	2
CO5	2	2	3	2	2	1	2	1	1	1	3	1

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Supervised Learning

8 hours

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

6 hours

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

Unit – III: Evaluating Machine Learning

8 hours

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

Unit – IV: Sparse Modeling & Estimation

6 hours

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

Unit – V: Scalable Machine Learning

8 hours

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

6 hours

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

Text/ Reference Books:

- Tom M. Mitchell, Machine Learning, McGraw Hills
- Aurélien 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

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Wireless Sensor Networks

Course Code: MTCSEP PE112

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Wireless Communication

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: Architect sensor networks for various application setups.

CO-2: Devise appropriate data dissemination protocols and model links cost.

CO-3: Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.

CO-4: Evaluate the performance of sensor networks and identify bottlenecks.

CO-5: To familiar with WSN standard and its applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	1	2		2				1	2	2
CO4	3	2	1	2		2				3	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction to Wireless Sensor Networks

8 hours

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

6 hours

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

6 hours

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

6 hours

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

Unit – V: Routing protocols

8 hours

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

6 hours

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

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

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Introduction to Intelligent Systems

Course Code: MTCSEP PE113

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Data Structures and Data Management or Data Structures

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: 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

CO-2: Problems for which solutions are difficult to express using the traditional algorithmic approach.

CO-3: It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior

CO-4: Dealing with uncertainty learning from experience and following problem solving strategies found in nature.

CO-5: Knowledge representation and use of inference.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	1	2		2				1	2	2
CO4	3	2	1	2		2				3	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Biological foundations to intelligent systems I

8 hours

Biological foundations to intelligent systems I: Artificial neural networks, Back propagation Networks, Radial basis function networks, and recurrent networks.

Unit – II: Biological foundations to intelligent systems II

6 hours

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

8 hours

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, hill climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

Unit – IV: Knowledge representation

8 hours

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

6 hours

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

6 hours

Recent trends in Fuzzy logic, Knowledge Representation.

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Data Science

Course Code: MTCSEP PE121

L-T-P: 3-1-0 Credits: 4

Course Prerequisite:

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: Provide you with the knowledge and expertise to become a proficient data scientist

CO-2: To understand how data is collected from multiple sources and stored

CO-3: Demonstrate an understanding of statistics and machine learning concepts that are vital for data science

CO-4: Critically evaluate data visualizations based on their design and use for communicating stories from data

CO-5: Produce Python code to statistically analyse a dataset

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	1	2		2				1	2	2
CO4	3	2	1	2		2				3	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction to core concepts and technologies

6 hours

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

6 hours

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

8 hours

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

8 hours

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

6 hours

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

Unit – VI: Recent trends

6 hours

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

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Distributed Systems

Course Code: MTCSEP PE122

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Database Management Systems

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: 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.

CO-2: To provide hardware and software issues in modern distributed systems.

CO-3: To get knowledge in distributed architecture, naming, synchronization, consistency and

CO-4: Replication, fault tolerance, security, and distributed file systems.

CO-5: To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	1	2		2				1	2	2
CO4	3	2	1	2		2				3	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction to Distributed Database Management System Architecture

8 hours

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

6 hours

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

8 hours

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

6 hours

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

Unit – V: Parallel Database Systems

6 hours

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

Unit – VI: Advanced Topics

6 hours

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

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Advanced Wireless and Mobile Networks

Course Code: MTCSEP PE123

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Computer Networks

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: The students should get familiar with the wireless/mobile market and the future needs and challenges.

CO-2: To get familiar with key concepts of wireless networks, standards, technologies and their basic operations

CO-3: To learn how to design and analyse various medium access

CO-4: To learn how to evaluate MAC and network protocols using network simulation software tools.

CO-5: The students should get familiar with the wireless/mobile market and the future needs and challenges.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	1	1		3				1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	1	2		2				1	2	2
CO4	3	2	1	2		2				3	3	3
CO5	3	3	1	2		3				1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction to WLAN

8 hours

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

6 hours

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

8 hours

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

6 hours

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

Unit – V: Security in Wireless Networks

6 hours

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

Unit – VI: Advanced Topics

6 hours

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

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Data Preparation and Analysis

Course Code: MTCSEP PE231

L-T-P: 3-1-0 Credits: 4

Course Prerequisite:

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: To Gain knowledge to identify the data parsing and transformations. and understand the difference between data and information with formats.

CO-2: To explain the basic concept of data cleaning for valuable information with a minimum consistency checking.

CO-3: To understand statistical exploratory analysis with hypothesis generation.

CO-4: To design visualizations for exploratory analysis and understand the concept of correlations and connections for geo located data.

CO-5: To learn data transformations and segmentation to solve statistical problems. Able to extract the data for performing the Analysis.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	2	2		2	1		1	1	2	2
CO4	3	2	1	2		2			2	3	3	3
CO5	3	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Defining Data Analysis Problems

6 hours

Knowing the client, Understanding the questions

Unit – II: Data Gathering and Preparation

8 hours

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

Unit – III: Data Cleaning

8 hours

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

Unit – IV: Exploratory Analysis

6 hours

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

Unit – V: Visualization

6 hours

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

Unit – VI: Ethics in Profession

6 hours

Cases in computing, statistics and Communication

Text/ Reference Books:

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

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Secure Software Design and Enterprise Computing

Course Code: MTCSEP PE232

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Computer Programming, Software Engineering

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: To fix software flaws and bugs in various software.

CO-2: To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic

CO-3: Techniques for successfully implementing and supporting network services on an enterprise scale.

CO-4: Techniques for successfully implementing and supporting network services Heterogeneous systems environment.

CO-5: Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	2	2		2	1		1	1	2	2
CO4	3	2	1	2		2			2	3	3	3
CO5	3	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Secure Software Design

6 hours

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

8 hours

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

8 hours

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

6 hours

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

6 hours

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

Unit – VI: Case Study

6 hours

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

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Computer Vision

Course Code: MTCSEP PE233

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Linear algebra, vector calculus, Data structures and Programming.

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: Be familiar with both the theoretical and practical aspects of computing with images.

CO-2: Have described the foundation of image formation, measurement, and analysis.

CO-3: Understand the geometric relationships between 2D images and the 3D world.

CO-4: Grasp the principles of state-of-the-art deep neural networks.

CO-5: Design experiments to evaluate and compare different machine learning techniques on real-world problems

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	2	2		2	1		1	1	2	2
CO4	3	2	1	2		2			2	3	3	3
CO5	3	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Overview of Image Analysis

8 hours

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

Unit – II: Edge Detection

6 hours

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

Unit – III: Segmentation

6 hours

Segmentation, Morphological filtering, Fourier transform

Unit – IV: Feature Extraction

6 hours

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

Unit – V: Pattern Analysis

8 hours

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

6 hours

Recent trends in Activity Recognition, computational photography, Biometrics.

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Human and Computer Interaction

Course Code: MTCSEP PE241

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Mobile computing

Total Teaching Hours: 40 hours

Course Outcomes:

After completing this Course (or unit of a course) the students should be able to:

CO1: Appraise the Human I/O channels

CO2: Apply the Interactive Design principles

CO3: Compare and describe different types of cognitive models

CO4: Assess the applicability of mobile ecosystem

CO5: Interpret the various aspects of Web Interface Designing

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	-	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	-	-	-	-	2	-
CO3	-	2	-	-	-	-	1	-	-	-	-	-
CO4	-	1	2	-	-	1	-	-	-	-	1	-
CO5	-	2	2	-	-	-	-	-	-	-	1	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: Human Interaction

6 hours

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

8 hours

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

8 hours

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

Unit – IV: Mobile Ecosystem

6 hours

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

6 hours

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

Unit – VI: Recent Trends

6 hours

Recent Trends: Speech Recognition and Translation, Multimodal System

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).

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Graphics Processing Unit Computing

Course Code: MTCSEP PE242

L-T-P: 3-1-0 Credits: 4

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

Total Teaching Hours: 42 hours

Course Outcomes:

CO-1: To learn parallel programming with Graphics Processing Units (GPUs).

CO-2: To convey a deep understanding of GPU architecture and APIs.

CO-3: Understanding the traditional use of GPUs for general purpose computations.

CO-4: To learn debugging and profiling parallel programs.

CO-5: To learn the concepts in parallel programming

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	2	3	2	3	-	-	-	-	3	3	1
CO2	2	3	3	3	3	-	-	-	-	2	3	1
CO3	3	3	3	2	3	-	-	-	-	3	3	1
CO4	3	3	3	3	3	-	-	-	-	2	3	1
CO5	2	3	3	3	3	-	-	-	-	3	3	2

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

Unit wise Syllabus

Unit – I: Introduction

8 hours

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

8 hours

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

8 hours

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

6 hours

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

6 hours

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

Unit – VI: Advanced Topics

6 hours

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

Text/ Reference Books:

- Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wenmei 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)

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Digital Forensics

Course Code: MTCSEP PE243

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Cybercrime and Information Warfare, Computer Networks

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.

CO-2: Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.

CO-3: Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools

CO-4: E-evidence collection and preservation, investigating operating systems and file systems network forensics, art of steganography and mobile device forensics.

CO-5: File systems network forensics, art of steganography and mobile device forensics.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	2	3	2	3	-	-	-	-	3	3	1
CO2	2	3	3	3	3	-	-	-	-	2	3	1
CO3	3	1	3	2	3	2	-	-	-	3	3	1
CO4	3	3	3	3	3	-	1	-	-	2	3	1
CO5	2	3	1	3	3	2	-	-	-	3	3	2

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: Digital Forensics Science

6 hours

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

6 hours

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

8 hours

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

8 hours

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

6 hours

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

6 hours

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

Text/ Reference Books:

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

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Mobile Applications and Services

Course Code: MTCSEP PE351

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Wireless Communication and Mobile Computing

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: The students should get familiar with the wireless/mobile market and the future needs and challenges.

CO-2: This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.

CO-3: It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets

CO-4: It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces

CO-5: To get familiar with user interface, context and profile for Mobile Devices.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	3	1	1	2	1		2		2	2	2
CO3	2	3	2	2		2	1	3	1	1	2	2
CO4	3	2	2	2	1	2			2	3	3	1
CO5	1	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction

6 hours

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

6 hours

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

8 hours

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

8 hours

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

6 hours

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

6 hours

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

Text/ Reference Books:

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

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Compilers for High Performance Computing

Course Code: MTCSEP PE352

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Data Structure, Compiler Design, Theory of Computation

Total Teaching Hours: 40 hours

Course Outcomes:

CO-1: The objective of this course is to introduce structure of compilers and high performance compiler design for students.

CO-2: Concepts of cache coherence and parallel loops in compilers are included.

CO-3: Concepts of data dependence, conditional and parallel loops

CO-4: Implementation of array region analysis and pointer analysis

CO-5: Description of message passing machines, SIMD and MIMD types.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	3	1	1	2	1		2		2	2	2
CO3	2	3	2	2		2	1	3	1	1	2	2
CO4	3	2	2	2	1	2			2	3	3	1
CO5	1	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: High Performance System

6 hours

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

Unit – II: Data Dependence

8 hours

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

8 hours

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

6 hours

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

6 hours

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

6 hours

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

Text/ Reference Books:

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

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Optimization Techniques

Course Code: MTCSEP PE353

L-T-P: 3-1-0 Credits: 4

Course Prerequisite: Linear Algebra and Numerical Methods

Total Teaching Hours: 40 hours

Course Outcomes:

After completing this Course (or unit of a course) the students should be able to:

CO1: Formulate the design problems

CO2: Appraise the general structure of optimization algorithms

CO3: Compare and describe various Mathematical Programming techniques

CO4: Assess the usefulness of Genetic Optimization approaches

CO5: Evaluate the real-life problems and formulate them mathematically as standard programming problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	3	-	-	1	1	1	-	-	-	-	-
CO2	1	2	-	-	1	-	-	-	-	-	-	-
CO3	1	2	-	-	1	-	-	-	1	-	-	-
CO4	1	2	-	2	1	-	-	-	1	-	-	-
CO5	1	3	-	-	1	1	1	-	-	-	-	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: Optimization

6 hours

Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

Unit – II: Structure of Optimization Algorithms

6 hours

General Structure of Optimization Algorithms, Constraints, The Feasible Region.

Unit – III: Mathematical Programming

8 hours

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

Unit – IV: Genetic Optimization

8 hours

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Unit – V: Real Life Problem

6 hours

Real life Problems and their mathematical formulation as standard programming problems.

Unit – VI: Recent Trends

6 hours

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

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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

OPEN ELECTIVES

Business Analytics

Course Code: MTCSEP OE511

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 40 hours

Course Prerequisite: Optimization, Data Mining

Course Outcomes:

After completing this Course (or unit of a course) the students should be able to:

CO1: Appraise the scope and process of Business Analytics

CO2: Interpret Trendlines and Regression

CO3: Compare linear and non-linear optimization

CO4: Assess the different forecasting models

CO5: Formulate decision problems and decision strategies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	1	-	2	-	-	-	1	-	-	1	-
CO2	1	2	-	2	-	-	-	-	-	-	1	-
CO3	1	2	-	2	-	-	-	-	-	-	1	-
CO4	1	2	-	2	-	-	-	-	-	-	1	-
CO5	1	3	-	2	-	-	-	-	-	-	1	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: Business Analytics

6 hours

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

8 hours

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

8 hours

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

6 hours

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 Carlo Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit – V: Decision Analysis

6 hours

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

6 hours

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

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Industrial Safety

Course Code: MTCSEP OE512

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 42 hours

Course Prerequisite: NIL

Course Outcomes:

CO-1: To impart knowledge on different facets and aspects of engineering systems safety, focusing on tools, techniques and methodologies

CO-2: Prevention of occurrences of unsafe operations and accidents under different industrial settings.

CO-3: Calculation of Maintenance cost Service life of equipment.

CO-4: Knowledge of lubricant, Definition, principle and factors affecting the corrosion.

CO-5: preventive maintenance of mechanical and electrical equipment

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	3	1	1	2	1		2		2	2	2
CO3	2	3	2	2		2	1	3	1	1	2	2
CO4	3	2	2	2	1	2			2	3	3	1
CO5	1	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unitwise Syllabus

Unit – I: Industrial Safety

6 hours

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

6 hours

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

8 hours

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

8 hours

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

machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit – V: Periodic & Preventive Maintenance

8 hours

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

6 hours

Accident Investigation, Control Chart Analysis, Accident Data Analysis: Regression, Classification Tree.

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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

Operations Research

Course Code: MTCSEP OE513

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 40 hours

Course Prerequisite: NIL

Course Outcomes

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

CO-1: Students should able to apply the dynamic programming

CO-2: Problems of discrete and continuous variables.

CO-3: Students should able to apply the concept of non-linear programming

CO-4: Students should able to carry out sensitivity analysis

CO-5: Student should able to model the real world problem and simulate it.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	2	2		2	1		1	1	2	2
CO4	3	2	1	2		2			2	3	3	3
CO5	3	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Optimization Techniques

6 hours

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

Unit – II: Formulation of LPP

8 hours

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

Unit – III: Nonlinear Programming Problem

8 hours

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

Unit – IV: Scheduling & Sequencing

6 hours

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

Unit – V: Competitive Models

6 hours

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

Unit – VI: Transportation Problem

6 hours

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

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

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Cost Management of Engineering Projects

Course Code: MTCSEP OE514

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 40 hours

Course Prerequisite: NIL

Course Outcomes

CO-1: Identify and use the tools and techniques of project management.

CO-2: Effectively use project reporting tools and techniques.

CO-3: Understand the importance of risk, cost, schedule and resource control and management of a project

CO-4: Understand the need for effective project management skills, training and the specific training needs of project managers.

CO-5: 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.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	3	3	3	3	2	1	1	3	3	3
CO2	3	3	3	3	3	3	2	1	1	3	2	1
CO3	3	3	3	3	3	3	2	1	1	3	2	2
CO4	3	3	3	3	3	3	2	1	1	3	1	2
CO5	3	3	3	3	3	3	2	1	1	3	3	3

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit-I

6 hours

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

6 hours

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

6 hours

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**8 hours**

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**8 hours**

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**6 hours**

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

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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Composite Materials

Course Code: MTCSEP OE515

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 40 hours

Course Prerequisite:

Course Outcomes

CO-1: The course covers the properties of fiber-reinforced polymer composites.

CO-2: The mechanical performance of laminated composites, including failure behavior.

CO-3: Students will be able to model, simulate and optimize the performance of composite structures as well as develop practical skills in one or more common manufacturing techniques.

CO-4: 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.

CO-5: The course will also include a design exercise for a composite component or structure.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	3	1	1	2	1		2		2	2	2
CO3	2	3	2	2		2	1	3	1	1	2	2
CO4	3	2	2	2	1	2			2	3	3	1
CO5	1	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction

6 hours

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

8 hours

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

6 hours

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

8 hours

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

6 hours

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

Unit – VI: PROMAL for Windows Software Package: A User's Guide 6 hours

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

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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

Waste to Energy

Course Code: MTCSEP OE516

L-T-P: 3-1-0 Credits: 4

Total Teaching Hours: 40 hours

Course Prerequisite: Basics of Chemistry and Biology

Course Outcomes:

CO-1: To enable students to understand of the concept of Waste to Energy.

CO-2: To link legal, technical and management principles for production of energy form waste.

CO-3: To learn about the best available technologies for waste to energy.

CO-4: To analyze of case studies for understanding success and failures.

CO-5: To facilitate the students in developing skills in the decision making process.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	2	3	2	3	-	-	-	-	3	3	1
CO2	2	3	3	3	3	-	-	-	-	2	3	1
CO3	3	3	3	2	3	-	-	-	-	3	3	1
CO4	3	3	3	3	3	-	-	-	-	2	3	1
CO5	2	3	3	3	3	-	-	-	-	3	3	2

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: Introduction to Energy from Waste

6 hours

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

6 hours

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

8 hours

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

6 hours

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

8 hours

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

6 hours

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.

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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

AUDIT COURSE

ENGLISH FOR RESEARCH PAPER WRITING

Course Code: MTCSEP AC111

L-T-P: 2-0-0

Total Teaching Hours: 40 hours

Course Prerequisite: Basics of English Language

Course Outcomes:

After completing this Course (or unit of a course) the students should be able to:

CO1: Appraise the different aspects of Planning and Preparation involved in writing research papers

CO2: Interpret and highlight the key findings

CO3: Compare and describe various sections of a research paper

CO4: Assess the skills needed to write various sections of a research paper

CO5: Evaluate the usefulness of different types of phrases in the context of research paper writing

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	-	-	-	-	2	1	3	1	3	1	-	1
CO2	-	-	-	-	-	1	3	2	3	-	-	2
CO3	-	-	-	-	-	-	3	-	3	-	-	-
CO4	-	-	-	-	-	-	3	-	3	-	-	-
CO5	-	-	-	-	-	-	3	-	3	-	-	-

Unit wise Syllabus

Unit – I: Planning and Preparation

8 hours

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

6 hours

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

Unit – III: Review Study

8 hours

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

Unit – IV: Writing Skill

6 hours

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

6 hours

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

6 hours

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

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

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

DISASTER MANAGEMENT

Course Code: MTCSEP AC112

L-T-P: 2-0-0

Total Teaching Hours: 40 hours

Course Prerequisite: None

Course Outcomes:

Students will be able to:

CO-1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO-2: Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO-3: Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO-4: Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries,

CO-5: Critically understand the strengths and weaknesses of disaster management in their home country or the countries they work in.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	3	1	1	2	1		2		2	2	2
CO3	2	3	2	2		2	1	3	1	1	2	2
CO4	3	2	2	2	1	2			2	3	3	1
CO5	1	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Introduction

6 hours

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

8 hours

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

8 hours

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

6 hours

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

6 hours

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

6 hours

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) &Total Marks-100.**

PEDAGOGY STUDIES

Course Code: MTCSEP AC113

L-T-P: 2-0-0

Total Teaching Hours: 40 hours

Course Prerequisite: None

Course Outcomes:

CO-1: The course imparts knowledge of pedagogical practices being used by teachers in formal and informal classrooms.

CO-2: Evidence on the effectiveness of pedagogical practices.

CO-3: Identify critical evidence gaps to guide the development.

CO-4: Appraise the different aspects of Planning and Preparation involved in writing research papers

CO-5: Interpret and highlight the key findings

Unit wise Syllabus

Unit – I: Introduction and Methodology

8 hours

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

8 hours

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

Unit – III: Pedagogical Practices

8 hours

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

8 hours

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

8 hours

Research gaps and future directions, Research design, Contexts, Pedagogy,

Teacher education, Curriculum and assessment, Dissemination and research impact.

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.
- Akyeamong 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 basic 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.

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning through discussion among the peer group
2. Learning through Case Studies
3. Open ended questions by teacher
4. Open ended questions from students
5. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. time-constrained examinations;
2. closed-book and open-book tests;
3. individual project reports(case-study reports)
4. viva voce interviews
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

CONSTITUTION OF INDIA

Course Code: MTCSEP AC221

L-T-P: 2-0-0

Total Teaching Hours: 42 hours

Course Prerequisite: None

Course Outcomes:

After completing this Course, the students should be able to

CO1. To give overview of Development of constitution of India

CO2. To Explain Schedule and sources of constitution of India

CO3. To discuss Citizenship Act, 1955

CO4. To highlight the Fundamental Rights

CO5. To make aware of Amendment of constitution

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	2	1	3							2	3
CO2	3	2	2		2			2	2	3	2	3
CO3			2	3	2	1					3	
CO4					2				2	2	2	
CO5			2		3	2		2	2	3	3	

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit wise Syllabus

Unit – I: History of Making of the Indian Constitution

6 hours

History, Drafting Committee, (Composition & Working)

Unit – II: Philosophy of the Indian Constitution

6 hours

Preamble, Salient Features

Unit – III: Contours of Constitutional Rights & Duties

8 hours

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

8 hours

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

8 hours

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

6 hours

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.

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.

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

VALUE EDUCATION

Course Code: MTCSEP AC222

L-T-P: 2-0-0

Total Teaching Hours: 40 hours

Course Prerequisite:

Course Outcomes: The course will be able to

CO-1: Help student understand value of education and self- development

CO-2: Imbibe good values in students.

CO-3: Help students know about the importance of character.

CO-4: To give students a deeper understanding about the purpose of life.

CO-5: To teach and inculcate the essential qualities to become a good leader.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	2	2		2	1		1	1	2	2
CO4	3	2	1	2		2			2	3	3	3
CO5	3	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit – I: Value & Self Development

6 hours

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

8 hours

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

8 hours

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self- destructive habits. Association and Cooperation, Doing best for saving nature

Unit – IV: Character & Competence

6 hours

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 6 hours

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: 6 hours

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

Text/ Reference Books:

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

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Encourage the students to ask more & more questions.
4. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Sessional examination (2 Nos.)
2. Assignments.
3. Class tests
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 Marks) & Total Marks-100.**

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code: MTCSEP AC223

L-T-P: 2-0-0

Total Teaching Hours: 40 hours

Course Prerequisite: None

Course Outcomes:

CO-1: To learn to achieve the highest goal happily

CO-2: To become a person with stable mind, pleasing personality and determination

CO-3: To awaken wisdom in students.

CO-4: The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications.

CO-5: It helps understand personality traits and formation and vital contribution in the world of business.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	2	1		3		1		1	3	3
CO2	3	2	1	1	2	2		2		1	2	2
CO3	2	3	2	2		2	1		1	1	2	2
CO4	3	2	1	2		2			2	3	3	3
CO5	3	2	1	2		3		2		1	3	3

3-High Level, 2-Medium Level, 1-Low Level

Unit wise Syllabus

Unit-I: Introduction to Personality Development

6 hours

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

8 hours

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

6 hours

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

Unit – IV: Neetisatakam

8 hours

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 (do's), Verses- 71,73,75,78 (do's)

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

6 hours

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

6 hours

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

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.

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