AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem, Narsipatnam (RD), Anakapalle Dist, Pin-531113

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABUS

For PG-R24

M.Tech – CSE

(Applicable for batches admitted from 2024-2025)

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Tamaram (V), Makavarapalem, Narsipatnam (RD), Anakapalle Dist, Pin-531113

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
(Approved by A.I.C.T.E., New Delhi &Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem,Narsipatnam (RD), Anakapalle Dist,Pin-531113.
https://avanthienggcollege.ac.in/, E-mail: principal@avanthienggcollege.ac.in

Academic Regulations (R24) for M.Tech (Regular) Degree Course

(Applicable for the students of M.Tech from the Academic Year 2024-2025 onwards)

1. ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the Institute from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Institute or on the basis of any other order of merit as approved by the Institute, subject to reservations as laid down by the Govt. from time to time.

2. AWARD OF M. Tech DEGREE

a) A student shall be declared eligible for the award of the M.Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

b) The student shall register for all 68 credits and secure all the 68 credits.

c) The minimum instruction days in each semester are 90.

3. PROGRAMME OF STUDY

The following specializations are offered at present for the M.Tech Programme of study.

M.Tech

1. M.Tech- Computer Science & Engineering
2. M.Tech- Power Systems
3. M.Tech- Power Electronics
4. M.Tech- Digital Electronics and Communication Systems
5. M.Tech- VLSI Design

And any other course as approved by AICTE/University from time to time.

4. Departments offering M. Tech Programmes with specializations are noted below:

Department	Programme Code	Title
EEE	56	M.Tech- Power Systems
EEE	43	M.Tech- Power Electronics

ECE	38	M.Tech- Digital Electronics and Communication Systems
ECE	72	M.Tech - VLSI Design
CSE	58	M.Tech - Computer Science & Engineering

5. ATTENDANCE

a) A student shall be eligible to write the examinations of the institute if he acquires a minimum of 75% of attendance in aggregate of all the subjects / courses, and with minimum 50% in each and every course including practicals.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

c) Shortage of Attendance **below** 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.

d) Students whose shortage of attendance is not condoned in any semester are not eligibleto write their end semester examination of that class.

e) A prescribed fee shall be payable towards condonation of shortage of attendance.

f) A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek re-admission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-admission into the same class.

6. EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of InternalEvaluation and End Semester Examination.

a) For the theory subjects 75 marks shall be awarded based on the performance in the End Semester Examination and 25 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the **average** of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each midterm examination shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks, and it will be reduced to 25 marks. End semester examination is conducted for 75 marks for all FIVE (5) questions (one question from one unit) to be answered (either or).

b) For practical subjects, 75 marks shall be awarded based on the performance in the End Semester Examinations and 25 marks shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day to day work-5 marks, record- 5 marks and the remaining 15 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup mark of Procedure-20, Experimentation-30, Results-10, and Viva-voce-15.

c) For Mini Project with Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor / mentor and two other senior faculty members of the department. For Mini Project with Seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

d) A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

e) In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to re-appear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided, the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt shall stand cancelled. For re-registration, the candidates have to apply to the college by paying the requisite fees and get approval from the institute before the start of the semester in which re-registration is required.

f) In case the candidate secures less than the required attendance in any re-registered subject(s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.

g) Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the second examiner shall be appointed by the institute from the panel of examiners submitted

by the respective departments.

7. EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

a) A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.

b) Registration of Dissertation/ Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

c) After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

d) If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the PRC shall examine whether or not to change the topic/supervisor leads to a major change in initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

e) Continuous assessment of Dissertation-I and Dissertation-II during the Semester(s) will be monitored by the PRC.

f) A candidate shall submit his status report in two stages to the PRC, at least with a gap of 3 months between them.

g) The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. The candidate has to pass all the theory and practical subjects before submission of the Thesis.

h) Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

i) The thesis shall be adjudicated by one examiner selected by the institute. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

j) If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidates have to re-registered for the project and complete the project within the stipulated time after taking the

approval from the Institute.

k) The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

l) If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work for a maximum of 100 marks as one of the following:

I. Excellent
II. Good
III. Satisfactory
IV. Unsatisfactory

m) If the report of the Viva-Voce is unsatisfactory (ie, < 50 marks), the candidate shall retake the Viva- Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the college.

8. Cumulative Grade Point Average (CGPA)

As measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed: **A**fter each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Marks Range Theory/ Laboratory (Max – 100)	Marks Range Mini Project/ Project Work or Dissertation (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	S	Superior	10
≥80 to <90	≥80 to <90	A	Excellent	9
≥70 to <80	≥70 to <80	B	Very Good	8
≥60 to <70	≥60 to <70	C	Good	7
≥50 to <60	≥50 to <60	D	Average	6
<50	<50	F	Fail	0
		AB	Absent	0

i) A student obtaining Grade "F" or Grade "Ab" in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of

the letter grade and this will not be counted for the computation of SGPA/ CGPA / Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

SGPA: The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student, i.e.,

$$\mathbf{SGPA=\Sigma (C_i \times G_i) / \Sigma C_i}$$

Where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

CGPA: The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses under gone by a student over all the semesters of a program, i.e.

$$\mathbf{CGPA=\Sigma (C_i \times S_i) / \Sigma C_i}$$

Where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in whom the student is awarded Zero grade points will also be included.

Equivalent Percentage = (CGPA-0.75)*10

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

9. AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the programand is eligible for the award of M. Tech. Degree he shall be placed in one of the followingfour classes:

Class Awarded	CGPA to be secured	
First Class with Distinction	**≥ 7.75 (Without any supplementary appearance)**	**From the CGPA secured from 68 Credits.**
First Class	**≥ 7.75 (With any supplementary appearance)** **≥ 6.75 and < 7.75 (Without any supplementary appearance)**	
Second Class	**≥ 6.75 and < 7.75 (With any supplementary appearance)** **≥ 6.0 to < 6.75 (Without any supplementary appearance)**	

Pass Class	**≥ 6.0 to < 6.75 (With any supplementary appearance)**	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

10. WITH HOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the studentwill be withheld.

11. TRANSITORY REGULATIONS (For R24)

a) Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

b) The candidate who fails in any subject will be given two chances to pass the same subject;otherwise, he has to identify an equivalent subject as per R19 (JNTUK) academic regulations.

12. GENERAL

a) Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal / Dean-Academics of the institution is final.

d) The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
1	(a) Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) (b) Gives assistance or guidance or receivesit from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of anoutsider, he will be handed over to the police anda case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters

		from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in lettersto the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent/Assistant–Superintendent/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	examination.	
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the Academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.

10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institute for further action to award suitable punishment	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

Seminar/ comprehensive vivo evaluation

There shall be two seminar presentations during III semester and IV semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

(a) For Ist & IInd semesters Seminar 100 marks are allotted for each, which shall be awarded based on the performance of the student on the selected advanced topic which is subdivided as follows.

- Marks for assignment - 20
- Marks for Power Point Presentation - 60
- Marks for viva voce (Orals) - 20

Total marks - 100

(b) There shall be two seminar presentations during III semester and IV semester.

For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee (PRC) consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

(Dr. R Prasad Rao)
Dean(Academics) &
Member Secretary (AC)

(Dr.C P V N J Mohan Rao)
Chairman
Academic Council

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
(Approved by A.I.C.T.E., New Delhi &Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem,Narsipatnam (RD), Anakapalle Dist,Pin-531113.
https://avanthienggcollege.ac.in/, E-mail: principal@avanthienggcollege.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure: Program– M.Tech Computer Science & Engineering

(Applicable from the academic year 2024-2025)

I Semester- Course Structure **Regulations: R24**

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				Lecture	Tutorial	Practical	
1	PC	2458PC01	**Professional Core-1** Mathematical Foundations of Computer Science	3	0	0	3
2	PC	2458PC02	**Professional Core-2** Advanced Data Structure and Algorithms	3	0	0	3
3	PE	**Professional Elective-1**		3	0	0	3
		2458PE01.1	**1.** Big Data Analytics				
		2458PE01.2	**2.** Digital Image Processing				
		2458PE01.3	**3.** Advanced Operating Systems				
4	PE	**Professional Elective-2**		3	0	0	3
		2458PE02.1	1. Advanced Computer Networks				
		2458PE02.2	2. Internet of Things				
		2458PE02.3	3. Object Oriented Software Engineering				
5	MC	24MTMC01	Research Methodology and IPR	0	0	0	2
6	PC	2458PC03	**Laboratory-1** Advanced Data Structure and Algorithms Lab	0	0	4	2
7	PC	2458PC04	**Laboratory-2** Advanced Computing Lab	0	0	4	2
8	AC	**Audit Course-1**		2	0	0	0
		24MTAC01.1	**1.** English for Research Paper Writing				
		24MTAC01.2	**2.** Disaster Management				
			Total	**14**	**0**	**8**	**18**

Category	Courses	Credits
PC: Professional Core Course	2	6
PE: Professional Elective Course	2	6
MC: Compulsory Course	1	2
PC: Laboratory Course	2	4
AC: Audit Course	1	0
Total	**8**	**18**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Proposed Course Structure: Program– M.Tech Computer Science & Engineering

(Applicable from the academic year 2024-2025 to 2026-2027)

II Semester- Course Structure **Regulations: R24**

S.No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	PC	2458PC05	**Professional Core-3** Machine learning	3	0	0	3
2	PC	2458PC06	**Professional Core-4** Mean Stack Technologies	3	0	0	3
3	PE	**Professional Elective-3**			0	0	3
		2458PE03.1	1. Soft Computing				
		2458PE03.2	2. Ad Hoc & Sensor Networks				
		2458PE03.3	3. Advanced Databases and Mining				
4	PE	**Professional Elective-4**		3	0	0	3
		2458PE04.1	1. Cloud Computing				
		2458PE04.2	2. Principles of computer security				
		2458PE04.3	3. High Performance Computing				
5	PC	2458PC07	**Laboratory-3** Machine Learning with python lab	0	0	4	2
6	PC	2458PC08	**Laboratory-4** Mean Stack Technologies Lab	0	0	4	2
7	PR	2458PR01	Mini Project with Seminar	0	0	4	2
8	AC	**Audit Course-2**		2	0	0	0
		24MTAC02.1	1. Constitution of India				
		24MTAC02.2	2. Value Education				
Total				**14**	**0**	**12**	**18**

Category	Courses	Credits
PC: Professional Core	2	6
PE: Professional Elective	2	6
PC: Laboratory	2	4
PR: Project	1	2
AC: Audit Course	1	0
Total	**8**	**18**

Mathematical Foundations of Computer Science

Course Title: Mathematical Foundations of Computer Science	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PC01
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design.	

Course Objectives: This course is aimed at enabling the students to

- To understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
- To develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

Course Outcomes:

To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.

CO1	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximumlikelihood based on population parameters.
CO2	To learn how to formulate and test hypotheses about sample means, variances and proportions and todraw conclusions based on the results of statistical tests.
CO3	Design various ciphers using number theory.
CO4	Apply graph theory for real time problems like network routing problem

UNIT I: Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

UNIT II: Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT III: Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT IV: Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

UNIT V: Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

Text Books:

1. Foundation Mathematics for Computer Science, John Vince, Springer.
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers
3. Probability and Statistics with Reliability, K. Trivedi, Wiley.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill.

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M. Mitzenmacher and E. Upfal.
2. Applied Combinatorics, Alan Tucker, Wiley.

Web References:

1. **https://www.nitt.edu/home/academics/departments/cse/programmes/mtech/curriculum/semester_2/mathematical_foundations_for_com/**
2. **https://www.aimsciences.org/mfc**
3. **https://www.ru.nl/en/education/masters/mathematical-foundations-of-computer-science**

Advanced Data Structures & Algorithms

Course Title: Advanced Data Structures & Algorithms	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PC02
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Fundamentals of Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binarytrees, representation, traversal, Graphs- storage, traversal.	

Course Objectives: From the course the student will learn

- Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.
- Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.
- AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Ability to write and analyze algorithms for algorithm correctness and efficiency
CO2	Master a variety of advanced abstract data type (ADT) and data structures and theirImplementation
CO3	Demonstrate various searching, sorting and hash techniques and be able to apply and solveproblems of real life
CO4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphsand search trees
CO5	Ability to compare various search trees and find solutions for IT related problems.

UNIT I: Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. **Stacks and Queues**: Algorithm Implementation using Linked Lists.

UNIT II: Searching-Linear and Binary, Search Methods, **Sorting**-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. **Trees**- Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). **Graphs**-Basic Concepts, Storage structures and Traversals.

UNIT III: Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, **Open Addressing**-Linear Probing, Double Hashing.

UNIT IV: Priority queues- Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .**Search Trees**- Binary Search Trees, Definition, ADT, Implementation, **Operations**-Searching, Insertion, Deletion.

UNIT V: Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering , N.B.Venkateswarulu, E.V.Prasad and S Chand & Co, 2009

Web References:

1. https://people.iith.ac.in/aravind/cs6013.html
2. https://dl.acm.org/doi/10.5555/1434862
3. https://nptel.ac.in/courses/106102064

Big Data Analytics

Course Title: Big Data Analytics	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE01.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: fundamental techniques and principles in achieving big data analytics with scalabilityand streaming capability.	

Course Objectives:

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes:

After the completion of the course, student will be able to

CO1	Illustrate on big data and its use cases from selected business domains.
CO2	Interpret and summarize on No SQL, Cassandra.
CO3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics andexplore on Big Data applications Using Hive.
CO4	Make use of Apache Spark, RDDs etc. to work with datasets.
CO5	Assess real time processing with Spark Streaming.

UNIT I: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster

Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT V: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj
2. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer, 2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George, 2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010
5. "Programming Pig", O'Reilley, Alan Gates, 2011

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2. https://www.ibm.com/topics/big-data-analytics
3. https://azure.microsoft.com/en-in/resources/cloud-computing-dictionary/what-is-big-data-analytics

Digital Image Processing

Course Title: Digital Image Processing	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE01.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Basic principles of digital image processing Design and implement algorithms that perform basic image processing.	

Course Objectives:

- Describe and explain basic principles of digital image processing.
- Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).
- Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).
- Assess the performance of image processing algorithms and systems.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Demonstrate the components of image processing
CO2	Explain various filtration techniques.
CO3	Apply image compression techniques.
CO4	Discuss the concepts of wavelet transforms.
CO5	Analyze the concept of morphological image processing

UNIT I: Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. **Image Enhancement Techniques**: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.

UNIT II: Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. **Image Restoration & Reconstruction**: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.

UNIT III: Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.

UNIT IV: Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.

UNIT V: Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations;

Feature extraction; Classification; Object recognition. **Digital Image Watermarking**: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Text Books:

1. Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education, (2009)

Reference Books:

1. Digital Image Processing. John Wiley, Pratt, W. K, (2001)
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. (2009),Tata McGraw-Hill

Web References:

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://dl.acm.org/doi/10.5555/1076432
3. https://www.sciencedirect.com/book/9781898563495/digital-image-processing

Advanced Operating Systems

Course Title:Advanced Operating Systems	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE01.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: fundamental concepts of distributed operating systems, its architecture anddistributed mutual exclusion.	

Course Objectives: This course is aimed at enabling the students to

- To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System and to cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion
CO2	Analyze on deadlock detection algorithms and agreement protocols.
CO3	Make use of algorithms for implementing DSM and its scheduling.
CO4	Apply protection and security in distributed operating systems.
CO5	Elaborate on concurrency control mechanisms in distributed database systems.

UNIT-1: Architectures of Distributed Systems, System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations of a distributed system, lamp ports logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms, a comparative performance analysis.

UNIT-2: Distributed Deadlock Detection, Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols, introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, and applications of agreement algorithms. Distributed resource management: introduction-architecture, mechanism for building distributed file systems design issues, log structured file systems.

UNIT- 3: Distributed shared memory, Architecture, algorithms for implementing DSM, memory coherence and protocols, design issues. Distributed Scheduling, introduction, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues. Failure Recovery and Fault tolerance: introduction, basic concepts, classification of failures, backward and forward error recovery, backward error recovery, recovery in concurrent systems, consistent set of check points, synchronous and asynchronous check pointing and recovery, check pointing for distributed database systems, recovery in replicated distributed databases.

UNIT- 4: Protection and security, preliminaries, the access matrix model and its implementations.-safety in matrix model, advanced models of protection. Data security, cryptography: Model of cryptography, conventional cryptography modern cryptography, private key cryptography, data encryption standard public key cryptography, multiple encryptions, authentication in distributed systems.

UNIT-5: Multiprocessor operating systems, basic multiprocessor system architectures, inter connection networks for multiprocessor systems, caching hypercube architecture. Multiprocessor Operating System, structures of multiprocessor operating system, operating system design issues, threads, process synchronization and scheduling. Database Operating systems: Introduction, requirements of a database operating system Concurrency control :Theoretical aspects, introduction, database systems, a concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, concurrency control algorithms, introduction, basic synchronization primitives, lock based algorithms, timestamp based algorithms, optimistic algorithms, concurrency control algorithms, data replication.

Text Books:

1. "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", Mukesh Singhal, Niranjan and G.Shivaratri, TMH, 2001

Reference Books:

1. "Modern operating system", Andrew S.Tanenbaum, PHI, 2003
2. "Distributed operating system-Concepts and design", Pradeep K.Sinha, PHI, 2003
3. "Distributed operating system", Pearson education, AndrewS.Tanenbaum, 2003

Web References:

1. https://omscs.gatech.edu/cs-6210-advanced-operating-systems
2. http://cs.uttyler.edu/Faculty/Rainwater/COSC3355/Animations/index.htm
3. http://williamstallings.com/OS/Animation/Animations.html

ADVANCED COMPUTER NETWORKS

Course Title: ADVANCED COMPUTER NETWORKS	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE02.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Understanding of Computer networks starting with OSIReference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.	

Course Objectives: This course is aimed at enabling the students to

- The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
- Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
- Provide the mathematical background of routing protocols.
- Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Illustrate reference models with layers, protocols and interfaces.
CO2	Describe the routing algorithms, Sub netting and Addressing of IP V4and IPV6.
CO3	Describe and Analysis of basic protocols of computer networks, and how they can be used to assist innetwork design and implementation.
CO4	Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellitenetworks
CO5	Describe the emerging trends in networks-MANETS and WS

Unit-I:**Network layer:** Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual –circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, **congestion control algorithms :**Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets

Unit-II: Internetworking and IP protocols: How networks differ, How net works can be connected, internetworking, tunneling, The network layer in the internet,IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT),IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers, Transition from IPV4 to IPV6 , Internet Control Protocols-IMCP, ARP, DHCP

Unit-III: Transport Layer Protocols: Introduction, Services, Port numbers,
User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, **SCTP:** SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

Unit- IV: Wireless LANS: Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture,

Bluetooth Layers **Other Wireless Networks:** WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation (3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

Unit–V: Emerging trends in Computer networks:

Mobile computing: Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security. **Wireless Sensor Networks:** WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design , Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features,P2P Networks: Characteristics of P2P Networks, Classification of P2P systems, Gnutella, BitTorrent, Session Initiation Protocol(SIP) , Characteristics and addressing, Components of SIP, SIP establishment, SIP security.

Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave, CENGAGE

Reference Books:

1. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs35/preview
2. https://www.dreamtechpress.com/product/advanced-computer-networks/
3. https://pbg.cs.illinois.edu/courses/cs538fa11/lectures/01-Overview.pdf

Internet of Things

Course Title: Internet of Things	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE02.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites:Understand IOT-related protocols,Objects and IoT Architectures.	

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Summarize on the term 'internet of things' in different contexts.
CO2	Analyze various protocols for IoT.
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4	Apply data analytics and use cloud offerings related to IoT.
CO5	Analyze applications of IoT in real time scenario

UNIT I: FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

UNIT III: DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

UNIT V: CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Text Books:

1.IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

Web References:

1. https://iotnotesbyparita.wordpress.com/iot-reference-architecture/
2. https://www.ibm.com/topics/internet-of-things
3. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Object Oriented Software Engineering

Course Title: Object Oriented Software Engineering	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE02.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Fundamentals of software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made	

Course Objectives:

- To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.
- To understand the what software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made.
- To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

Course Outcomes:

After the completion of the course, student will be able to

CO1	Apply the Object Oriented Software-Development Process to design software
CO2	Analyze and Specify software requirements through a SRS documents.
CO3	Design and Plan software solutions to problems using an object-oriented strategy.
CO4	Model the object oriented software systems using Unified Modeling Language (UML).
CO5	Estimate the cost of constructing object oriented software..

UNIT I: Introduction to Software Engineering: Software, Software Crisis, Software Engineering definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges. Software Processes: Software Process, Process Classification, Phased development life cycle, Software Development Process Models, Process, use, applicability and Advantages/limitations.

UNIT II: Object oriented Paradigm, Object oriented Concepts, Classes, Objects, Attributes, Methods and services, Messages, Encapsulation, Inheritance, Polymorphism, Identifying the elements of object model, management of object oriented Software projects, Object Oriented Analysis, Domain Analysis, Generic Components of OOA model,OOA Process, Object Relationship model, Object Behavior Model.

UNIT III: Object Oriented Design: Design for Object- Oriented systems, The Generic components of the OO design model, The System design process, The Object design process, Design Patterns, Object Oriented Programming.

UNIT IV: Object Oriented testing: Broadening the view of Testing, Testing of OOA and OOD models, Object-Oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design.

UNIT V: Technical Metrics for Object Oriented Systems: The Intent of Object Oriented metrics, The

distinguishing Characteristics, Metrics for the OO Design model, Class-Oriented metrics, Operation-Oriented Metrics, Metrics foe Object Oriented testing, Metrics for Object Oriented projects. CASE Tools.

Text Books:

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH.
2. Object oriented and Classical Software Engineering, Timothy Lethbridge, Robert Laganiere, TMH
3. Software Engineering by Roger S Pressman, Tata McGraw Hill Edition.

Reference Books:

1. Component based software engineering: 7th International symposium, ivicaCrnkovic, Springer, CBSE 2004

Web References:

1. https://archive.nptel.ac.in/courses/106/105/106105153/
2. https://uim.fei.stuba.sk/wp-content/uploads/2018/02/Object-oriented-Software-Engineering-3rd-Edition.pdf
3. https://fall14cs.wordpress.com/wp-content/uploads/2016/03/object-oriented-software-engineering-practical-software-development-using-uml-and-java-2005.pdf

RESEARCH METHODOLOGY AND IPR

Course Title: RESEARCH METHODOLOGY AND IPR	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 24MTMC01
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Understanding of Research Design, Familiarity with Statistical Methods, Knowledge of Intellectual Property Rights, Ability to Conduct Literature Reviews, Skills in Data Collection and Analysis.	

Course Objectives:

1. Understand the principles of research methodology, including research design, data collection, and analysis techniques.
2. Develop skills in formulating research questions and hypotheses relevant to scientific inquiry.
3. Explore the concepts of intellectual property rights (IPR) and their significance in research and innovation.
4. Learn how to protect and manage intellectual property, including patents, copyrights, and trademarks.

Course Outcomes:

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

CO1	Understand research problem formulation.
CO2	Analyze research related information
CO3	Follow research ethics
CO4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2:

Effective literature studies approaches, analysis Plagiarism, Research ethics, 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 3:

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 4:

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

UNIT 5:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

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

Advanced Data Structures & Algorithms Lab

Course Title: Advanced Data Structures & Algorithms Lab	I Year- I Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2472PC01
Type of Course: Lecture	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Knowing about oops concepts for a specific problem.	

Course Objectives:

From the course the student will learn

- Knowing about oops concepts for a specific problem.
- Various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Identify classes, objects, members of a class and relationships among them needed for a specificproblem.
CO2	Examine algorithms performance using Prior analysis and asymptotic notations.
CO3	Organize and apply to solve the complex problems using advanced data structures (like arrays,stacks, queues, linked lists, graphs and trees.)
CO4	Apply and analyze functions of Dictionary

Experiment 1:

Write a java program to perform various operations on single linked list

Experiment 2:

Write a java program for the following

a) Reverse a linked list

b) Sort the data in a linked list

c) Remove duplicates

d) Merge two linked lists

Experiment 3:

Write a java program to perform various operations on doubly linked list.

Experiment 4:

Write a java program to perform various operations on circular linked list.

Experiment 5:

Write a java program for performing various operations on stack using linked list.

Experiment 6:

Write a java program for performing various operations on queue using linked list.

Experiment 7:

Write a java program for the following using stack

a) Infix to postfix conversion.

b) Expression evaluation.

c) Obtain the binary number for a given decimal number.

Experiment 8:
Write a java program to implement various operations on Binary Search Tree
Using Recursive and Non-Recursive methods.

Experiment 9:
Write a java program to implement the following for a graph.
a) BFS b) DFS

Experiment 10:
Write a java program to implement Merge & Heap Sort of given elements.

Experiment 11:
Write a java program to implement Quick Sort of given elements.

Experiment 12:
Write a java program to implement various operations on AVL trees.

Experiment 13:
Write a java program to perform the following operations:
a) Insertion into a B-tree b) Searching in a B-tree

Experiment 14:
Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals

Experiment 15:
Write a java program to implement all the functions of Dictionary (ADT) using Hashing.

Advanced Computing Lab

Course Title: Advanced Computing Lab	I Year- I Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2458PC04
Type of Course: Lecture	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: The student should have hands on experience in using various sensors like temperature, humidity, smoke, light.	

Course Objectives:

From the course the student will learn

- The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

Course Outcomes:

After the completion of the course, student will be able to

CO1	The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.
CO2	Development and use of s IoT technology in Societal and Industrial Applications.
CO3	Skills to undertake high quality academic and industrial research in Sensors and IoT.
CO4	To classify Real World IoT Design Constraints, Industrial Automation in IoT..

Experiment 1: Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.

Experiment 2: Study and Install IDE of Arduino and different types of Arduino.

Experiment 3: Study and Implement Zigbee Protocol using Arduino / RaspberryPi.

Experiment 4: Write a map reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.

Experiment 5: Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.

Write a single Spark application that

- Transposes the original Amazon food dataset, obtaining a PairRDD of the type<user_id>→ <list of the product_ ids reviewed by user_id>
- Counts the frequencies of all the pairs of products reviewed together.
- Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

Experiment 6:

Write a program to Implement Bankers algorithm for Dead Lock Avoidance.

Experiment 7:

Write a program to Producer-consumer problem Using semaphores.

Experiment 8:
Write a program for an image enhancement using pixel operation.

Experiment 9:
Write a Program to enhance image using image arithmetic and logical operations.

Experiment 10:
Write a program of bit stuffing used by Data Link Layer.

Experiment 11:
Write a program to configure a Network using Distance Vector Routing protocol.

Experiment 12:
Write a program to perform the function oriented diagram: DFD and Structured chart.

Experiment 13:
Write a program to perform the system analysis: Requirement analysis, SRS.

Experiment 14:
Write a program to draw the structural view diagram: Class diagram, object diagram.

Experiment 15:
Write C programs for implementing the Demorgan's law.

Machine Learning

Course Title: Machine Learning	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PC05
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Develop an appreciation for what is involved in learning from data and how to apply a variety of learning algorithms to data.	

Course Objectives:

Machine Learning course will

- Develop an appreciation for what is involved in learning from data.
- Demonstrate a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Domain Knowledge for Productive use of Machine Learning and Diversity of Data.
CO2	Demonstrate on Supervised and Computational Learning
CO3	Analyze on Statistics in learning techniques and Logistic Regression
CO4	Illustrate on Support Vector Machines and Perceptron Algorithm
CO5	Design a Multilayer Perceptron Networks and classification of decision tree

Unit I: Introduction: Towards Intelligent Machines Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

Unit II: Supervised Learning: Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Over fitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

Unit III: Statistical Learning: Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

Unit IV: Support Vector Machines (SVM): Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly seperable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, and Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

Unit V: Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. **Decision Tree Learning**: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Textbooks:

1. Applied Machine Learning,1st edition, M.Gopal, McGraw Hill Education,2018
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC) 1st Edition-2014

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William WHsieh, Cambridge Univ Press. *1* edition (August 31, 2009)
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley &SonsInc., 2nd Edition-2001 Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
3. Machine Learning by Peter Flach , Cambridge-1st Edition 2012

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2. https://c3.ai/introduction-what-is-machine-learning/references/
3. https://link.springer.com/article/10.1007/s42979-021-00592-x

MEAN Stack Technologies

Course Title: MEAN Stack Technologies	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code:2458PC06
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Fundamentals the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.	

Course Objectives:

From the course the student will learn

- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
- Writing optimized front end code HTML and JavaScript.
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution
- Design and implementation of Robust and Scalable Front End Applications.

Course Outcomes:

CO1	Identify the Basic Concepts of Web & Markup Languages.
CO2	Develop web Applications using Scripting Languages & Frameworks.
CO3	Make use of Express JS and Node JS frameworks
CO4	Illustrate the uses of web services concepts like restful, react js.
CO5	Adapt to Deployment Techniques & Working with cloud platform.

UNIT I: Introduction to Web: Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. **Html5** concepts, **CSS3**, Anatomy of a web page. **XML:** Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

UNIT II: JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. **Angular Java Script** Angular JS Expressions: ARRAY, Objects, $eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS

UNIT III: Node.js: Introduction, Advantages, Node.js Process Model, Node JS Modules. **Express.js:** Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your first Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling , Debugging, Developing Template Engines, Using Process Managers, Security & Deployment.

UNIT IV: RESTful Web Services: Using the Uniform Interface, Designing URIs, Web Linking, Conditional Requests. **React Js:** Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories

UNIT V: Mongo DB: Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Pro Mean Stack Development, ELadElrom, Apress
4. Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly
6. Web Hosting for Dummies, Peter Pollock, John Wiley Brand

Reference Books:

1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
3. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. Express.JS Guide, The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.

Web References:

.1. https://www.mongodb.com/resources/languages/mean-stack
2. https://builtin.com/articles/mean-stack
3. https://careerfoundry.com/en/blog/web-development/mean-stack/

Soft Computing

Course Title: Soft Computing	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE03.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: To introduce soft computing concepts and techniques and foster their abilities in designing appropriatetechnique for a given scenario.	

Course Objectives:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide student a hand-on experience on MATLAB to implement various strategies.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Elaborate fuzzy logic and reasoning to handle uncertainty in engineering problems.
CO2	Make use of genetic algorithms to combinatorial optimization problems.
CO3	Distinguish artificial intelligence techniques, including search heuristics,knowledge representation,planning and reasoning.
CO4	Formulate and apply the principles of self-adopting and self organizing neuro fuzzy inferencesystems.
CO5	Evaluate and compare solutions by various soft computing approaches for a given problem

UNIT I: Fuzzy Set Theory: Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

UNIT II: Optimization: Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, and Random Search, Downhill Simplex Search.

UNIT III: Artificial Intelligence: Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent-directed Search Production System and Learning.

UNIT IV: Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks Neuro Fuzzy Spectrum.

UNIT V: Applications Of Computational Intelligence: Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Coloripe Prediction

Text Books:

1. "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T.Sun and E.Mizutani, PHI, 2004, Pearson Education 2004
2. Artificial Intelligence by Saroj Koushik, Cengage Learning
3. "Artificial Intelligence and Intelligent Systems", N.P.Padhy, Oxford University Press, 2006

Reference Books:

1. Artificial Intelligence, Second Edition, Elaine Rich & Kevin Knight, Tata McGraw Hill Publishing Comp., New Delhi, , 2006
2. "Fuzzy Logic with Engineering Applications", Timothy J.Ross, McGraw-Hill, 1997

Web References:

1. https://www.sciencedirect.com/journal/applied-soft-computing
2. https://onlinecourses.nptel.ac.in/noc22_cs54/preview
3. https://www.peeref.com/journals/7538/soft-computing

Ad Hoc & Sensor Networks

Course Title: Ad Hoc & Sensor Networks	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE03.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Understandings of the fundamental concepts of wireless sensor networks and have a basicknowledge of the various protocols at various layers.	

Course Objectives:

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

Course Outcomes:

After the completion of the course, student will be able to

CO1	Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks
CO2	Discuss the MAC protocol issues of ad hoc networks
CO3	Enumerate the concept of routing protocols for ad hoc wireless networks with respect to TCP designissues
CO4	Analyze & Specify the concepts of network architecture and MAC layer protocol for WSN
CO5	Discuss the WSN routing issues by considering QoS measurements

UNIT I: Introduction : Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms ,Characteristics of the Wireless channel mobile ad hoc networks (MANETs), **Wireless Sensor Networks (WSNs):** concepts and architectures, Applications of Ad Hoc and Sensor Networks, Design Challenges in Ad hoc and Sensor Networks.

UNIT II: MAC Protocols For Ad Hoc Wireless Networks: Issues in designing a MAC Protocol, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi channel MAC - IEEE 802.11.

UNIT III: Routing Protocols And Transport Layer In Ad Hoc Wireless Networks: Routing Protocol: Issues in designing a routing protocol for Ad hoc networks, Classification, proactive routing, reactive routing (on-demand), hybrid routing, Transport Layer protocol for Ad hoc networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer solutions-TCP over Ad hoc wireless, Network Security, Security in Ad Hoc Wireless Networks, Network Security Requirements.

UNIT IV: Wireless Sensor Networks (WSNS) And Mac Protocols: Single node architecture - hardware and software components of a sensor node, **WSN Network architecture:** typical network architectures, data relaying and aggregation strategies, **MAC layer protocols:** self-organizing, Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.

UNIT V: WSN Routing, Localization & Qos: Issues in WSN routing, OLSR, Localization, Indoor and

Sensor Network Localization, absolute and relative localization, triangulation, QOS in WSN, Energy Efficient Design, Synchronization.

Text Books:

1. "Ad Hoc Wireless Networks: Architectures and Protocols ", C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008
2. “Wireless Adhoc and Sensor Networks”, Labiod. H, Wiley, 2008
3. “Wireless ad -hoc and sensor Networks: theory and applications”, Li, X, Cambridge University Press, 2008.

Reference Books:

5. “Ad Hoc & Sensor Networks: Theory and Applications”, 2nd edition, Carlos De Morais Cordeiro, Dharma Prakash Agrawal ,World Scientific Publishing Company, 2011
6. "Wireless Sensor Networks", Feng Zhao and Leonides Guibas,Elsevier Publication.
7. “Protocols and Architectures for Wireless Sensor Networks”, Holger Karl and Andreas Willig,Wiley, 2005 (soft copy available)
8. “Wireless Sensor Networks Technology, Protocols, and Applications”, Kazem Sohraby, Daniel Minoli, & TaiebZnati, John Wiley, 2007. (soft copy available)

Web References:

1. https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470050118.ecse004
2. https://ieeexplore.ieee.org/document/1249521
3. https://archive.nptel.ac.in/courses/106/105/106105160/

Advanced Databases and Mining

Course Title: Advanced Databases and Mining	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE03.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Fundamentals of data in the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy.	

Course Objectives:

- This Subject deals with dealing data in the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy, storing data for quick insertion, manipulation and deletion operations in order to retrieve data from the database.
- This subject provides an introduction to multidisciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods
- The concepts of data clustering includes a different methods of clustering such as k-means, k-mediods, db scan algorithm, role of data mining in web mining.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Analyze on normalization techniques.
CO2	Elaborate on concurrency control techniques and query optimization.
CO3	Summarize the concepts of data mining, data warehousing and data preprocessing strategies.
CO4	Apply data mining algorithms.
CO5	Assess various classification & cluster techniques.

UNIT I: Introduction: Concepts and Definitions, Relational models, Data Modeling and Query Languages, Database Objects. **Normalization Techniques:** Functional Dependency, 1NF, 2NF, 3NF, BCNF; Multi valued Dependency; Loss-less Join and Dependency Preservation.

UNIT II: Transaction Processing: Consistency, Atomicity, Isolation and Durability, Serializable Schedule, Recoverable Schedule, Concurrency Control, Time-stamp based protocols, Isolation Levels, Online Analytical Processing,

Database performance Tuning and Query optimization: Query Tree, Cost of Query, Join, Selection and Projection Implementation Algorithms and Optimization Database Security: Access Control, MAC, RBAC, Authorization, SQL Injection Attacks.

UNIT III: Data Mining: stages and techniques, knowledge representation methods, data mining approaches (OLAP, DBMS, Statistics and ML). **Data warehousing:** data warehouse and DBMS, multidimensional data model, OLAP operations. **Data processing:** cleaning, transformation, reduction, filters and discretization with weka.

UNIT IV: Knowledge representation: background knowledge, representing input data and output knowledge, visualization techniques and experiments with weka. **Data mining algorithms:** association rules, mining weather data, generating item sets and rules efficiently, correlation analysis.

UNIT V: Classification & Clustering: 1R algorithm, decision trees, covering rules, task prediction, statistical classification, Bayesian network, instance based methods, linear models, Cluster/2, Cobweb, k-

means, Hierarchical methods. **Mining real data:** preprocessing data from a real medical domain, data mining techniques to create a comprehensive and accurate model of data. **Advanced topics:** text mining, text classification, web mining, data mining software.

Text Books:

1. Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe, Addison-Wesley,6th edition-
2. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 3rd edition

Reference Books:

1. Principles of Distributed Database Systems, Prentice Hall, P. Valduriez, M. TamerOzsu 3rd edition-2000
2. Database systems: Design, implementation and Management, C.M. Coronel, S. Morris, P. Rob,Boston: Cengage Learning,9th edition-2011

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2. https://www.aalimec.ac.in/wp-content/uploads/2019/09/MC5403_ADBDM_UNIT_II_NOTES.pdf
3. https://www.aalimec.ac.in/wp-content/uploads/2019/09/MC5403_ADBDM_UNIT_I_NOTES.pdf

Cloud Computing

Course Title: Cloud Computing	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code:2458PE04.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: implement Virtualization and implement Task Scheduling algorithms.	

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

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

CO1	Interpret the key dimensions of the challenge of Cloud Computing.
CO2	Examine the economics, financial, and technological implications for selecting cloud computing forown organization.
CO3	Assessing the financial, technological, and organizational capacity of employer's for activelyinitiating and installing cloud-based applications.
CO4	Evaluate own organizations' needs for capacity building and training in cloud computing-related ITareas.
CO5	To Illustrate Virtualization for Data-Center Automation.

UNIT I: Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. **Parallel and Distributed Systems:** Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT II: Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing, **Cloud Computing:** Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research.

UNIT III: Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades, **Cloud Resource Management and Scheduling**: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling.

UNIT IV: Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table,

Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2), **Cloud Security:** Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT V: Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), **Google:** Google App Engine, Google Web Toolkit (Text Book 2), **Microsoft:** Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2).

Text Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

Reference book:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH

Web References:

1. https://www.techtarget.com/searchcloudcomputing/definition/cloud-computing
2. https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-cloud-computing
3. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Principles of Computer Security

Course Title: Principles of Computer Security	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code:2458PE04.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Fundamentals an overview of modern cryptographic theories and techniques, mainly focusingon their application into real systems.	

Course Objectives:

In the course the student will learn

- This course provides an overview of modern cryptographic theories and techniques, mainly focusing on their application into real systems.
- Topics include Database and Cloud Security, Malicious Software, Denial-of-Service Attacks, Software Security, Operating System Security, Wireless Network Security and mobile device security.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Describe the key security requirements of confidentiality, integrity, and availability, types of securitythreats and attacks and summarize the functional requirements for computer security.
CO2	Explain the basic operation of symmetric block encryption algorithms, use of secure hash functionsfor message authentication, digital signature mechanism.
CO3	Discuss the issues involved and the approaches for user authentication and explain how accesscontrol fits into the broader context that includes authentication, authorization, and audit.
CO4	Explain the basic concept of a denial-of-service attack, nature of flooding attacks, distributed denial-of-service attacks and describe how computer security vulnerabilities are a result of poor programming practices.
CO5	List the steps used to secure the base operating system, specific aspects of securing Unix/Linux systems, Windows systems, and security in virtualized systems and describe the security threats andcountermeasures for wireless networks.

Unit I: Introduction: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy. **Cryptographic Tools:** Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers.

Unit II: User Authentication: Electronic User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. **Access Control:** Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks.

Unit III: Database and Cloud Security: The Need For Database Security, Database Management Systems, Relational Databases, Sql Injection Attacks, Database Access Control, Database Encryption, Cloud Computing, Cloud Security Risks And Countermeasures, Data Protection In The Cloud, Cloud

Security As A Service. **Malicious Software:** Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation, Infected Content, Viruses, Propagation, Vulnerability Exploit, Worms, Propagation, Social Engineering, Spam E-Mail, Trojans, Payload, System Corruption, Payload, Attack Agent, Zombie, Bots, Payload, Information Theft, Key loggers, Phishing, Spyware, Payload, Stealthing, Backdoors, Root kits, Countermeasures.

Unit IV: Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack. **Software Security:** Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs.

Unit V: Operating System Security: Introduction To Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security. **Wireless Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Text Book:

1. Computer Security: Principles and Practices, 3e, William Stallings, Lawrie Brown, Pearson

Reference book:

1. Network Security Essentials, Principles and Practices, William Stallings, Pearson

Web References:

1. https://people.scs.carleton.ca/~paulv/5900wBooks.html
2. https://www.cs.unibo.it/babaoglu/courses/security/resources/documents/Computer_Security_Principles_and_Practice_(3rd_Edition).pdf
3. https://archive.nptel.ac.in/courses/106/106/106106129/

High Performance Computing

Course Title: High Performance Computing	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2458PE04.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: basic concepts related to HPC architecture and parallel computing	

Course Objectives:

The objective of the subject is to

- Introduce the basic concepts related to HPC architecture and parallel computing.
- To discuss various computational techniques for studying soft matter systems.
- To apply these concepts to examine complex bimolecular/materials systems that generally require large-scale HPC platform with hybrid CPU-GPU architectures.

Course Outcomes:

After the completion of the course, student will be able to

CO1	Design, formulate, solve and implement high performance versions of standard single threadedalgorithms.
CO2	Demonstrate the architectural features in the GPU and MIC hardware accelerators.
CO3	Design programs to extract maximum performance in a multicore, shared memory execution environment processor.
CO4	Analyze Symmetric and Distributed architectures.
CO5	Develop and deploy large scale parallel programs on tightly coupled parallel systems using themessage passing paradigm.

UNIT I: Graphics Processing Units: Introduction to Heterogeneous Parallel Computing, GPU architecture, Thread hierarchy, GPU Memory Hierarchy.

UNIT II: GPU Programming: Vector Addition, Matrix Multiplication algorithms. 1D, 2D, and 3D Stencil Operations, Image Processing algorithms – Image Blur, Gray scaling. Histogramming, Convolution, Scan, Reduction techniques.

UNIT III: Many Integrated Cores: Introduction to Many Integrated Cores. MIC, Xeon Phi architecture, Thread hierarchy, Memory Hierarchy, Memory Bandwidth and performance considerations.

UNIT IV: Shared Memory Parallel Programming: Symmetric and Distributed architectures, OpenMP Introduction, Thread creation, Parallel regions. Work sharing, Synchronization.

UNIT V: Message Passing Interface: MPI Introduction, Collective communication, Data grouping for communication.

Text Books:

1. Programming Massively Parallel Processors A Hands-on Approach, 3e, Wen-Mei W Hwu, David B Kirk and Morgan Kaufmann-2019
2. Intel Xeon Phi Coprocessor Architecture and Tools, Rezaur Rahman, Apress Open, 1st edition-2013
3. Using OpenMP, Barbara Chapman, Gabriele Jost, Rudd Vander Pas, MIT Press, 2008

Reference books:

1. "A Parallel Algorithm Synthesis Procedure for High-Performance Computer Architectures" by Dunn Ian N, 2003

Web References:

1. https://cloud.google.com/discover/what-is-high-performance-computing
2. https://docs.aws.amazon.com/architecture-diagrams/latest/high-performance-computing-on-aws/high-performance-computing-on-aws.html
3. https://archive.nptel.ac.in/courses/106/108/106108055/

Machine Learning with Python Lab

Course Title: Machine Learning with Python Lab	I Year- II Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2458PC07
Type of Course: Lecture	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: To learn and understand different Data sets in implementing the machine learning algorithms.	

Course Objectives:

This course will enable students to

- To learn and understand different Data sets in implementing the machine learning algorithms.
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes(COs): At the end of the course, student will be able to

CO1	Implement procedures for the machine learning algorithms
CO2	Design Python programs for various Learning algorithms
CO3	Apply appropriate data sets to the Machine Learning algorithms
CO4	Identify and apply Machine Learning algorithms to solve real world problems

Experiment-1:

Exercises to solve the real-world problems using the following machine learning methods:
a) Linear Regression
b) Logistic Regression.

Experiment-2:

Write a program to Implement Support Vector Machines.

Experiment-3:

Exploratory Data Analysis for Classification using Pandas and Matplotlib.

Experiment-4:

Implement a program for Bias, Variance, and Cross Validation.

Experiment-5:

Write a program to simulate a perception network for pattern classification and function approximation.

Experiment-6:

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment-7:

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:

Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the

classifier, considering few test data sets.

Experiment-9:
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment-10:
Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment-11:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

MEAN Stack Technologies Lab

Course Title: MEAN Stack Technologies Lab	I Year- II Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2458PC08
Type of Course: Lecture	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Learn the core concepts of both the frontend and backend programming course	

Course Objectives:

From the course the student will

- Learn the core concepts of both the frontend and backend programming course.
- Get familiar with the latest web development technologies.
- Learn all about SQL and Mongo databases.
- Learn complete web development process.

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

CO1	Identify the Basic Concepts of Web & Markup Languages.
CO2	Develop web Applications using Scripting Languages & Frameworks.
CO3	Creating & Running Applications using JSP libraries.
CO4	Creating Our First Controller Working with and Displaying in Angular Js and Nested Forms with ng-form.
CO5	Working with the Files in React JS and Constructing Elements with Data.

Experiment-1:

Develop static pages (using only HTML) of an online Book store. The pages should resemble: www.amazon.com. The website should consist of the following pages. Home page

- Registration and user Login
- User profile page
- Books catalog
- Shopping cart
- Payment by credit card Order Conformation

Experiment-2:

Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

Experiment-3:

Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:

a) Input: Click on Display Date button using on click ( ) function Output: Display date in the textbox

b) Input: A number n obtained using prompt Output: Factorial of n number using alert

c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert

d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert

Experiment-4:

Create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click.

Experiment-5:
Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.

Experiment-6:
Develop and demonstrate PHP Script for the following problems:
a) Write a PHP Script to find out the Sum of the Individual Digits.
b) Write a PHP Script to check whether the given number is Palindrome or not

Experiment-7:
Implement the following in CSS
a) Implementation of 'get' and 'post' methods.
b) Implementation in colors, boarder padding.
c) Implementation button frames tables, navigation bars.

Experiment-8:
Implement the web applications with Database using
a) PHP,
b) Servlets and
c) JSP.

Experiment-9:
Write a program to design a simple calculator using
a) JavaScript
b) PHP
c) Servlet and
d) JSP.

Experiment-10:
Create registration and login forms with validations using Jscript query.

Experiment-11:
Jscript to retrieve student information from student database using database connectivity.

Experiment-12:
Implement the following in React JS
a) Using React Js creating constructs data elements.
b) Using React Js implementations DoM.

Experiment-13:
Implement the following in Angular JS
a) Angular Js data binding.
b) Angular JS directives and Events.
c) Using angular Js fetching data from MySQL.

Experiment-14:
Develop and demonstrate Invoking data using Jscript from Mongo DB.

Experiment-15:
Create an Online fee payment form using JSCript and MangoDB.

(AUDIT - I)

ENGLISH FOR RESEARCH PAPER WRITING

Course Title: English for Research paper writing	**I Year- I Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2472AC01.1
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre-requisites: Understanding academic writing conventions, familiarity with research methodologies, proficiency in grammar and vocabulary, knowledge of citation styles, awareness of ethical considerations in research.	

Course objectives:

Students will be able to:

c) Understand that how to improve your writing skills and level of readability Learn about what to write in each section

d) Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Course Outcomes:

CO1	Demonstrate effective planning and preparation techniques for academic writing, including structuring paragraphs and sentences clearly.
CO2	Apply strategies for clarifying ideas, avoiding ambiguity, and ensuring conciseness in written communication.
CO3	Develop skills to construct well-organized sections of a paper, including abstracts, introductions, and literature reviews.
CO4	Evaluate and critique various sections of academic papers, focusing on the methods, results, and discussion.
CO5	Utilize key skills to enhance the quality of writing in academic submissions, ensuring clarity and adherence to academic standards

Unit-1

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

Unit-2

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

Unit-3

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

Unit-4

key skills are needed when writing a Title, key skills are neededwhen writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit -5

skills are needed when writing the Methods, skills needed whenwriting the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Reference Books:

a) Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)

b) Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

c) Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.Highman‟sbook .

d) Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011.

(AUDIT - I)
DISASTER MANAGEMENT

Course Title: Disaster Management	**I Year- I Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2472AC01.2
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre requisites: Disaster Risk Assessment, Emergency Response Planning, Community Awareness and Education, Resource Management and Logistics, Coordination with Agencies and Stakeholders	

Course Objectives: -

Students will be able to:

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

Course Outcomes: -

CO1	Analyze and differentiate between various types of disasters, including natural and manmade, and their significance in different contexts.
CO2	Assess the economic and ecological repercussions of disasters, including the impact on human and animal life, as well as ecosystem destruction.
CO3	Identify and evaluate disaster-prone areas in India, focusing on specific hazards such as earthquakes, floods, and cyclones, and their associated risks.
CO4	Develop disaster preparedness strategies, including risk evaluation techniques and the use of remote sensing and data from various agencies for effective management.
CO5	Formulate disaster risk assessment and mitigation strategies, emphasizing community participation and emerging trends in disaster management practices.

Syllabus

Unit-1

Introduction, Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit-2

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

Unit-3

Disaster Prone Areas in India Study of Seismic Zones: Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics .

Unit-4

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Unit-5

Risk Assessment & Disaster Mitigation

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. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

References:

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

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

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

(AUDIT - II)
VALUE EDUCATION

Course Title: VALUE EDUCATION	**I Year- II Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2472AC02.1
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre requisites: Awareness of Personal Values, Understanding of Ethical Principles, Empathy and Compassion, Critical Thinking Skills, Commitment to Lifelong Learning.	

Course Objectives

Students will be able to

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

Course outcomes

Students will be able to

CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

Syllabus

Unit-1

Values and self-development

Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non-moral valuation. Standards and principles, Value judgements.

Unit-2

Importance of cultivation of values.

Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature ,Discipline.

Unit-3

Personality and Behavior Development

Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labor, 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. 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

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

(AUDIT - II)
CONSTITUTION OF INDIA

Course Title: CONSTITUTION OF INDIA	**I Year- II Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2472AC02.2
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre requisites: Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Amendment Procedure.	

Course Objectives:
Students will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals‟ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

Syllabus

Unit-1
History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Unit-2
Philosophy of the Indian Constitution, Preamble Salient Features
Contours of Constitutional Rights & Duties:
Fundamental Rights Right to Equality Right to Freedom. Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights. Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.

Unit-3
Organs of Governance: Parliament Composition, Qualifications and Disqualifications Powers and Functions Executive President Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

Unit-4

Local Administration:

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

Unit-5

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

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)

NAAC "A+" Accredited Institute

Tamaram (V), Makavarapalem, Narsipatnam (RD), Anakapalle Dist, Pin-531113.

www.avanthienggcollege.ac.in, mail: principal@avanthienggcollege.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure: Program– M.Tech Computer Science & Engineering

(Applicable from the academic year 2024-2025 to 2026-2027)

I Year I Semester- Course Structure **Regulations: R24**

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				Lecture	Tutorial	Practical	
1	PC	R2458PC01	**Professional Core-1** Mathematical Foundations of Computer Science	3	0	0	3
2	PC	R2458PC02	**Professional Core-2** Advanced Data Structure and Algorithms	3	0	0	3
3	PE	**Professional Elective-1**		3	0	0	3
		R2458PE01.1	**1.** Big Data Analytics				
		R2458PE01.2	**2.** Digital Image Processing				
		R2458PE01.3	**3.** Advanced Operating Systems				
4	PE	**Professional Elective-2**		3	0	0	3
		R2458PE02.1	1. Advanced Computer Networks				
		R2458PE02.2	2. Internet of Things				
		R2458PE02.3	3. Object Oriented Software Engineering				
5	MC	R24MTMC01	Research Methodology and IPR	0	0	0	2
6	PC	R2458PC03	**Laboratory-1** Advanced Data Structure and Algorithms Lab	0	0	4	2
7	PC	R2458PC04	**Laboratory-2** Advanced Computing Lab	0	0	4	2
8	AC	**Audit Course-1**		2	0	0	0
		R24MTAC01.1	**1.** English for Research Paper Writing				
		R24MTAC01.2	**2.** Disaster Management				
			Total	**14**	**0**	**8**	**18**

Category	Courses	Credits
PC: Professional Core Course	2	6
PE: Professional Elective Course	2	6
MC: Compulsory Course	1	2
PC: Laboratory Course	2	4
AC: Audit Course	1	0
Total	**8**	**18**

S.No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	PC	R2458PC05	**Professional Core-3** Machine learning	3	0	0	3
2	PC	R2458PC06	**Professional Core-4** Mean Stack Technologies	3	0	0	3
3	PE	**Professional Elective-3**			0	0	3
		R2458PE03.1	1. Soft Computing				
		R2458PE03.2	2. Ad Hoc & Sensor Networks				
		R2458PE03.3	3. Advanced Databases and Mining				
4	PE	**Professional Elective-4**		3	0	0	3
		R2458PE04.1	1. Cloud Computing				
		R2458PE04.2	2. Principles of computer security				
		R2458PE04.3	3. High Performance Computing				
5	PC	R2458PC07	**Laboratory-3** Machine Learning with python lab	0	0	4	2
6	PC	R2458PC08	**Laboratory-4** Mean Stack Technologies Lab	0	0	4	2
7	PR	R2458PR01	Mini Project with Seminar	0	0	4	2
8	AC	**Audit Course-2**		2	0	0	0
		R24MTAC02.1	1. Constitution of India				
		R24MTAC02.2	2. Value Education				
			Total	**14**	**0**	**12**	**18**

Category	Courses	Credits
PC: Professional Core	2	6
PE: Professional Elective	2	6
PC: Laboratory	2	4
PR: Project	1	2
AC: Audit Course	1	0
Total	**8**	**18**

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	
1	PE	R2458PE05.1 R2458PE05.2 R2458PE05.3	**Professional Elective-5** 1. Block Chain Technology. 2. Natural Language Processing. 3. Deep Learning 4. MOOCs-1 (NPTEL/SWAYAM) (12 Week Program related to the program which is not listed in the course structure)	3	0	0	3
2	OE	R2457OE01.1 R2457OE01.2 R2457OE01.3 R2457OE01.5 R2457OE01.6	**Open Elective** 1. MOOCs-2 (NPTEL/SWAYAM)-Any 12 Week Course on Engineering/ Management/ Mathematics offered by other than parent department) 2. Course offered by other departments in the college a) Business Analytics b) Industrial Safety c) Operations Research d) Composite Materials e) Waste to Energy	3	0	0	3
3	PJ	R2458DP01	**Dissertation-I / Industrial Project #**	0	0	20	10
			Total	6	0	20	16

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

II Year II Semester- Course Structure **Regulations: R24**

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	
1	PJ	R2458DP02	Dissertation-II	0	0	32	16
			Total Credits	**0**	**0**	**32**	**16**

Open Electives offered by the Department of CSE

1) Python Programming 2) Principles of Cyber Security 3) Internet of Things

4) Machine Learning 5) Digital forensics 6) Next Generation Databases

Chairperson
Board of Studies (CSE)

R2458PE05.1 **Block Chain Technology** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

1. Understand the foundational concepts of block chain technology, including its history, structure, features, and applications.
2. Explain the working principles of block chain systems, including block creation, transaction management, consensus mechanisms, and cryptographic tools.
3. Analyze block chain architecture and apply development methodologies to design block chain-based solutions using platforms like Ethereal and Solidity, with reference to real-world use cases.
4. Develop and interact with smart contracts and decentralized applications (DApps) using tools such as Geth and Mist, while understanding best practices and design patterns for DApps.
5. Explore advanced block chain concepts such as fault tolerance, consensus algorithm comparisons, and privacy and security considerations.

Course Outcomes

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

Course Outcomes (COs)		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**DoK**
CO1	Describe the basic concepts, structure, features, and real-world uses of block chain technology.	3	2	1	1	2	2	3	2	2	L1, L2
CO2	Explain how block chain works, including blocks, transactions, consensus mechanisms, and cryptographic tools	3	3	2	1	2	2	3	2	2	L2, L3
CO3	Design block chain-based applications and understand Ethereum and Solidity for developing real-life use cases	3	3	3	2	2	2	3	3	3	L3, L4
CO4	Develop and interact with smart contracts and DApps using Ethereum tools and understand their structure and patterns.	3	2	3	3	3	2	3	3	3	L4, L5
CO5	Identify and discuss advanced block chain topics such as consensus models, security, privacy, and scalability issues.	3	3	3	2	2	3	3	3	3	L5, L6

SYLLABUS

UNIT I: **10 Hours**

Introduction to Block chain: What is Block chain, History and evolution, Basic structure and features, Real-world example of a block chain application, Layers of block chain (block chain stack), Pros and cons of using block chain.

Self-Learning Topics: **CO's-CO1**

Block chain Interoperability.

UNIT II: **15 Hours**

How Block chain Works: Basics of block chain and public ledgers, understanding blocks and transactions, Consensus mechanisms (how agreement is achieved), Key cryptographic tools: Hash functions, Merkle Trees, Basic game theory in block chain. **CO's-CO2**

Self-Learning Topic: Transaction Malleability & Replay Attacks, Harding and Parallelism.

UNIT III: **15 Hours**

Block chain Architecture & Use Cases: How to design block chain applications, Common templates and development methods, Introduction to Ethereum and Solidity programming, Real-life examples from different industries **CO's-CO3**

Self-Learning Topics: EVM Internals & Bytecode Analysis, Layer 2 Scaling Solutions, Cross-chain Communication & Interoperability.

UNIT IV: **10 Hours**

Smart contracts: Smart contract, structure of a contract, interacting with smart contracts using Geth client and Mist wallet, smart contract examples, smart contract patterns.

Decentralized applications (Dapps) Dapps, implementing Dapps, Ethereum Dapps, case studies related to Dapps. **CO's-CO4**

Self-Learning Topics: Contract Upgradeability, Smart Contract Auditing, Security-Focused Design

UNIT-V: **10 Hours**

Advanced Block chain Topics: Byzantine Fault Tolerance, Proof-of-Work vs Proof-of-Stake, Blockchain security and privacy, Common smart contract issues, Scalability challenges.**CO's-CO5**

Self-Learning Topics: Elliptic Curve Cryptography (ECC), Threshold Signatures & Multi-signature Wallets.

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Expert Talk (To be Delivered by SMEs from Industries) **COs/ POs / PSOs**

1. Explain how blockchain operates, including cryptographic techniques and consensus CO2–PO1, PO4, PSO1.
2. Analyze blockchain application design and real-world implementations CO3-PO5, PO6, PSO2.
3. Explore industrial blockchain use cases and new business models CO5-PO3, PO6.

Text Books:

1. Blockchain applications: a hands-on approach, Bahga A., Madisetti V., VPT.

Reference Books:

1. Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress, 2018.
2. Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara and Paul R. Allen, McGraw Hill, 2018.
3. Blockchain enabled Applications Vikram Dhillon, David Metcalf and Max Hooper, Apress, 2017, The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology,William Mougayar, Wiley, 2016.
4. Blockchain Science: Distributed Ledger Technology, Roger Wattenhofer, Inverted Forest Publishing; 3rd edition, 2019**.**

Web References:

1. https://learning.oreilly.com/library/view/handbook-of-digital/9780123742674.

Chairperson
Board of Studies (CSE)

R2458PE05.2 **Natural Language Processing** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

- Learn introduction to classical and modern techniques in NLP.
- Understand Word level analysis.
- Learn how to employ literary-historical NLP-based analytic techniques named entity recognition.
- Understand sentiment analysis and topic modelling.
- To learn how to organize, visualize, and group text data, and understand how machines work with different languages to find and translate information.

Course Outcomes

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

Course Outcomes (COs)		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	DoK
CO1	Describe the fundamental concepts and techniques of natural language processing.	3	2	1	1	1	2	3	2	1	L1, L2
CO2	Apply and analyze text processing techniques such as N-grams, TF-IDF, and word embeddings, and implement part-of-speech tagging using rule-based and statistical methods.	3	3	2	1	1	2	3	2	1	L2, L3, L4
CO3	Illustrate how to collect data from social media, web and other sources using APIs, web scraping.	3	3	2	1	1	2	3	2	1	L2, L3, L4
CO4	Understand sentiment analysis, topic modeling, and stylometry, and learn how to apply them in real-world scenarios.	3	3	2	1	2	2	3	2	2	L2, L3, L4
CO5	Design and implement robust machine translation systems, build multilingual question answering models, and develop cross-lingual information retrieval systems.	3	3	2	2	2	2	3	2	2	L5, L6

SYLLABUS

UNIT I: **13 Hours**

Introduction to NLP: History of NLP, applications and challenges of NLP, Language Modelling: Grammar-based language model, Statistical language model, Tokenization, Introduction to Morphology, Morphology fundamentals, Morphology Paradigms. **CO's-CO1**

Self-Learning Topics: The Role of Large Corpora in NLP, The Impact of the Internet and Big Data

UNIT-II: **15 Hours**

Word Level and Syntactic Analysis: N-grams Models of Syntax - Counting Words, Unsmoothed N-grams. Smoothing- Back-off Deleted Interpolation – Entropy - English Word Classes - Tag sets for English Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging. **CO's-CO2**

Self-Learning Topics: Higher-order N-grams, Good-Turing Smoothing.

UNIT III: 14 Hours

Data Collection and Software tools: Introduction to Data Collection and Tools, Data Collection using API, Social Media, Web scraping, Text Mining: Software tools such as NLTK; Named Entity Recognition. Data analysis and Visualization. **CO's-CO3**

Self-Learning Topics: Structured vs. Unstructured data, Data Cleaning for Social Media Text

UNIT IV: 12 Hours

Fundamentals of sentimental analysis and topic modeling: Sentiment Analysis; Block diagram of sentiment analysis, Applications, Topic Modeling, Goals of topic modeling; Stylometry. **CO's-CO4**

Self-Learning Topics: Techniques for Sentiment Analysis, Challenges in Sentiment Analysis

UNIT V: 14 Hours

Introduction to text classification and visualization: Text classification, Text Visualization; Dendograms, PCA, Plotting the Text; Document Clustering;

Machine Translation: Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR). **CO's-CO5**

Self-Learning Topics: Text Preprocessing for Visualization, Evaluation Techniques for CLI

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Text Books:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)
2. Jacob Eisenstein. Natural Language Processing
3. Delip Rao and Brian McMahan. Natural Language Processing with PyTorch

Reference Books:

1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning

Reference Links:

1. https://nptel.ac.in/courses/106/105/106105158/ A course on Nautrual Language Processing, by Prof. Pawan Agrawal, IIT Kharagpur.
2. https://nptel.ac.in/courses/106/106/106106211/ A course on Applied Nautral Laguage Processing, Prof. Rameseshan Ramchandran, IIT Madras.

Chairperson
Board of Studies (CSE)

R2458PE05.3 **Deep Learning** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

1. Learn deep learning methods for working with sequential data,.
2. Learn deep recurrent and memory networks,
3. Learn deep Turing machines.
4. Apply such deep learning mechanisms to various learning problems.
5. Know the open issues in deep learning ,and have a grasp of the current research directions.

Course Outcomes

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

Course Outcomes (COs)		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	DoK
CO1	Demonstrate the basic concepts fundamental learning techniques and layers.	3	2	1	1	2	2	3	2	2	L1, L2
CO2	Discuss the Neural Network training, various random models**.**	3	3	2	1	2	2	3	2	2	L2, L3
CO3	Explain different types of deep learning network models.	3	3	3	2	2	2	3	3	3	L3, L4
CO4	Classify the Probabilistic Neural Networks.	3	2	3	3	3	2	3	3	3	L4, L5
CO5	Implement tools on Deep Learning techniques. .	3	3	3	2	2	3	3	3	3	L5, L6

SYLLABUS

UNIT I: **10 Hours**

Introduction: Various paradigms of learning problems,Perspectives and Issues in deeplearning framework,reviewoffundamentallearningtechniques.**Feedforwardneuralnetwork:**ArtificialNeural Network, activation function, multi-layer neural network.

CO's-CO1

UNIT II: **15 Hours**

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization.

Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

CO's-CO2

UNIT III: **15 Hours**

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

CO's-CO3

UNIT IV: **10 Hours**

UNIT IV: Probabilistic Neural Network: Hopfield Net, Boltzmann machine, RBMs, Sigmoid net, Auto encoders. related to Dapps.

CO's-CO4

UNIT-V: **10 Hours**

Applications: Object recognition, sparse coding, computer vision, natural language processing.

Introduction to Deep Learning Tools: Caffe, Theano, Torch **CO's-CO5**

Board of Studies : Computer Science and Engineering

Text Books:

1. Goodfellow.I., Bengio.Y, and Courville.A., Deep Learning, MIT Press,2016..
2. Bishop.C.M., PatternRecognitionandMachineLearning,Springer,2006.

Reference Books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt.Ltd, 2009.
2. Matrix Computations, Golub, G., H., andVanLoan, C., F,JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar,TataMcGraw-HillEducation,2004.

Chairperson
Board of Studies (CSE)

R2458OE01.1 **Principles of Cyber Security** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

The main objectives of the course are to

- To provide a foundational understanding of cyber security concepts, threats, and risk management.
- To explore various forms of cyber crimes and their impact on individuals and organizations.
- To understand national and international legal frameworks governing cyber laws.
- To introduce data privacy and protection principles along with global regulatory frameworks.
- To develop knowledge of cyber security management practices, compliance standards, and governance mechanisms.

Course Outcomes

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

Course Outcomes (COs)		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
CO1	Demonstrate an understanding of fundamental cyber security concepts, terminologies, and the evolving threat landscape.	3	2				2	3	2	L1,L2
CO2	Identify and analyze various types of cyber crimes, their impact on individuals and organizations, and the techniques used to perpetrate them.	3	3			1	2	3	2	L4,L5
CO3	Interpret and evaluate the legal frameworks related to cyber law, including the IT Act 2000, and assess legal and ethical implications of emerging technologies.	2	3		1	3	3	2	2	L4,L5
CO4	Explain principles of data privacy and data protection, and compare global data protection regulations like GDPR and PIPEDA**.**	2	3		1	3	3	2	2	L1,L3
CO5	Design a basic cyber security management plan incorporating risk assessment, compliance requirements, and national cyber security strategies.	3	3	3	3	3	3	3	3	L5,L6

SYLLABUS

Unit I : Overview of Cyber security **10 Hours**

Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure,

Cyber war fare, Case Studies. **CO's-CO1**

Self-Learning Topics: Cyberspace and the Role of Attack Vectors

UNIT-II: Cyber crimes **15 Hours**

Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online frauds, Cyber bullying, website defacement, Cyber squatting, Crypto jacking, Dark net- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news cyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.

Self-Learning Topics: Understanding Various Types of Cyber Crimes **CO's-CO2**

UNIT III: **Cyber Law** **15 Hours**

Cyber crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Block chain, Dark net and Social media, Cyber Laws of other countries, Case Studies. **CO's-CO3**

Self-Learning Topics: Understanding Cyber Crime Laws and Legal Landscape in the Digital Era

UNIT IV: Data Privacy and Data Security **10 Hours**

Defining data, meta-data, big data, and non personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues. **CO's-CO4**

Self-Learning Topics: Understanding and Implementing Data Privacy and Security Regulations

UNIT-V: Cyber security Management, Compliance and Governance **10 Hours**

Cyber security Plan- cyber security policy, cyber crises management plan. Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy. **CO's-CO5**

Self-Learning Topics: Developing a Comprehensive Cybersecurity Governance Framework

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Text Books:

1. Cyber Crime and Information Technology Act, 2000 by Shweta Thakur Jaswal & Vikram Singh Jaswal.
2. Cyber Security and Cyber Laws by Dr. S. S. Rattan.

Reference Books:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.

2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Online Learning Resources/Virtual Labs:

1. **https://www.balbix.com/insights/attack-vectors-and-breach-methods/**
2. **https://cag.gov.in/uploads/icisa_virtual_publishing/Journal-with-cover-DG-message-08-10-2024-06704c77f434894-25842653.pdf**

Chairperson
Board of Studies (CSE)

R2458OE01.2 **INTERNET OF THINGS** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

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

Course Outcomes (COs)		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
CO1	Summarize on the term 'internet of things in different contexts.	3	2	1	1	2	2	2	2	L1,L2
CO2	Analyze various protocols for IoT.	3	3	2	1	1	2	3	2	L2,L3
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino.	3	3	3	2	1	2	3	2	L3,L4
CO4	Apply data analytics and use cloud offerings related to IoT.	3	3	3	2	2	3	3	3	L4,L5
CO5	Analyze applications of IoT in real time scenario.	3	3	2	2	2	3	3	3	L5,L6

SYLLABUS

UNIT I: Fundamentals of IoT: **10 Hours**

Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. **CO's-CO1**

Self Learning Concepts: History and milestones in IoT development, Wireless technologies: Wi-Fi, ZigBee, LoRa, NB-IoT, Bluetooth Low Energy (BLE)

UNIT II: IoT PROTOCOLS **15 Hours**

IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Self Learning Concepts: Time Division Multiple Access, IPv4 vs IPv6 **CO's-CO2**

UNIT III: Design and Development **10 Hours**

Design and Development: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming. **CO's-CO3**

Self Learning Concepts: IoT solution design workflow, AVR, ARM Cortex-M, Types of Arduino boards

UNIT IV: Data Analytics and Supporting Services **15 Hours**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG. **CO's-CO4**

Self Learning Concepts: Semi-structured data (JSON, XML in IoT), Edge ML vs Cloud ML RDDs vs DataFrames vs Datasets

UNIT V: Case Studies/Industrial Applications**:** **10 Hours**

Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control. **CO's-CO5**

Self Learning Concepts: Network, Data Security, Management, and Application layers, Predictive maintenance, asset tracking, quality control

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David I Year - I Semester L T P C 3 0 0 3 Internet of Things (MTCSE11YY) Boyle and Elsevier, 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

Text Books

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Online Learning Resources Links:

1. https://www.coursera.org/specializations/iot

2. https://www.coursera.org/learn/iot
3. https://www.coursera.org/articles/internet-of-things

Web References:

1. https://en.wikipedia.org/wiki/Internet_of_things
2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
3. https://www.tutorialspoint.com/internet_of_things/index.htm

Chairperson
Board of Studies (CSE)

R2458OE01.3 **Machine Learning** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

- Learn how to design a learning system and understand concept learning tasks.
- Understanding the concepts in statistical learning, including how to build, evaluate, and improve machine learning models using statistical methods.
- Learn how to use supervised learning methods to do classification and regression.
- Learn and apply ensemble methods and support vector machines for classification and regression.
- Learn the basics of unsupervised learning and reinforcement learning.

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

											Dok
	Course Outcomes (COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	
CO1	Understanding of machine learning algorithms and their use in data-driven knowledge discovery and program synthesis.	3	3	2	1	-	2	3	2	1	L1, L2
CO2	Understand how to evaluate and improve machine learning models using basic statistical learning methods.	3	3	2	2	1	2	3	2	1	L2, L3
CO3	Demonstrate on various regression techniques.	3	3	2	2	-	2	3	2	2	L3, L4
CO4	Analyze and apply ensemble methods and support vector machines for classification and regression tasks.	3	3	2	1	2	2	3	2	2	L3, L4, L5
CO5	Illustrate the clustering techniques and apply basic reinforcement learning algorithms to solve problems using data.	3	3	2	2	1	2	3	2	2	L5, L6

SYLLABUS

UNIT I: **14 Hours**

Introduction: Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Applications and Challenges of Machine Learning.

Concept Learning Task: Introduction, Hypothesis space, Find-S algorithm, Version space, Candidate Elimination algorithm, Overfitting and Underfitting. **CO's–CO1**

Self-Learning Topics: Instance based learning, Evaluation metrics

UNIT II: **13 Hours**

Statistical Learning: Introduction, Supervised and Unsupervised Learning, Loss functions, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization. **CO's–CO2**

Self-Learning Topics: Model Evaluation and Selection, Generalized Models. .

UNIT III: **15 Hours**

Supervised Learning (Regression/Classification): Distance based Methods, Nearest Neighbors, Decision Trees, and Naive Bayes.

Linear Models: Linear Regression, Logistic Regression.

Binary Classification: Multiclass/Structured outputs, MNIST, Ranking. **CO's–CO3**

Self-Learning Topics: Regularization Techniques, Feature Engineering and Selection.

UNIT- IV: **12 Hours**

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification, SVM Regression. **CO's–CO4**

Self-Learning Topics: Model Evaluation and Hyper parameter Tuning, Model Interpretability and Explain ability.

UNIT-V: **13Hours**

Unsupervised Learning: Types and Challenges, Clustering – K means, DBSCAN, Hierarchical, Association Rule Mining, Anomaly detection.

Reinforcement Learning: Introduction, The learning task Q learning. **CO's-CO5**

Self-Learning Topics: Anomaly Detection, Dimensionality Reduction Techniques.

Board of Studies: Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education (India) Private Limited, 2013.
2. Introduction to Machine Learning, Ethem Alpaydın, 3rd Edition, MIT press, 2014.
3. Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020.

Reference Books:

1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.
2. MACHINE LEARNING - An Algorithmic Perspective, Stephen Marsland, 2nd Edition, 2015.

Web References:

1. Machine Learning Mastery
2. Machine Learning by Andrew Ng on Coursera
3. Principles of Machine Learning on edX
4. Kaggle Learn Machine Learning

Chairperson
Board of Studies (CSE)

R2458OE01.4 **Digital Forensics** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

The main objectives of the course are to

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

Course Outcomes:

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

Course Outcomes (COs)		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	DoK
CO1	Understanding the Computer forensics.	3	2	1		1	2	3	2	1	L1,L2, L3
CO2	Understand relevant legislation and codes of ethics.	2	2		1	3	3	2	2	3	L1, L2,L3, L4
CO3	Analyze the knowledge to investigate through the digital evidence.	3	3	3	1	2	3	3	2	3	L3,L4
CO4	E-discovery, guidelines and standards, E-evidence, tools and environment.	3	3	2	1	2	2	3	2	3	L4,L5
CO5	Email and web forensics and network forensics.	3	3	2	1	2	2	3	2	2	L4,L5, L6

SYLLABUS

UNIT I: **10 Hours**

Foundations: Basic Principles and methodologies for digital forensics, Design systems with forensic needs in mind. Phases of Digital Forensics. Introduction to Digital Forensics Tools, Life of a Digital Forensic Investigator. **CO's-CO1**

Self Learning Concepts: Basic Principles and Methodologies for Digital Forensics

UNIT II: **15 Hours**

Data Acquisition, Computer Crime and Scene Analysis: Computer Crime and investigative process, analysis of cyber criminalities area, 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.

Data Acquisition: Principles of Digital Forensic Acquisition, Evidence Handling and Processing Digital Forensic Data. **CO's-CO2**

Self Learning Concepts: Computer Crime and Investigative Process

UNIT III: **15 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. **CO's-CO3**

Self Learning Concepts: Create and Manage Shared Folders Using Operating Systems

UNIT IV: **10 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. **CO's-CO4**

Self Learning Concepts: Understanding Computer Forensics Workstations and Software

UNIT V: **10 Hours**

Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

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

Self Learning Concepts: Mobile Forensics Techniques **CO's-CO5**

Board of Studies : Computer Science and Engineering
Approved in BoS No: 02, --, April, 2025
Approved in ACM No: 02

Text Books:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.
3. Thomas J Holt , AdamM Bossler, Kathryn C Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge, 2016
4. Eoghan Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2017
5. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, III Edition, 2016.

Reference Books:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and DigitalForensics: An Introduction, Routledge.
3. Angus McKenzie Marshall, Digital Forensics: Digital Evidence in Criminal Investigations, Wiley- Blackwell, 2018.

Online Learning Resources/Virtual Labs:

1. https://ec.europa.eu/programmes/erasmus-plus/project-result-content/2a54509d-b6bb-43d8-8250-eae26782c392/FORC%20Book%201.pdf

Chairperson
Board of Studies (CSE)

R2458OE01.5 **Next Generation Databases** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

1. To understand the evolution of databases through different technological revolutions.
2. To explore modern database systems including NoSQL, Document, Graph, and Column databases.
3. To examine the architecture and applications of In-Memory and Object-Oriented databases.
4. To study Big Data technologies like Hadoop and Spark, and their role in modern data processing.
5. To analyze disruptive and futuristic database technologies including Blockchain and Quantum Databases.

Course Outcomes:

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

Course Outcomes (COs)		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	DoK
CO1	Describe the evolution and revolution in database technologies and their architectural models.	3	2	1	-	-	2	3	2	L1, L2
CO2	Analyze and differentiate various NoSQL database types such as document, graph, and column-oriented databases.	3	3	2	-	-	2	3	2	L2, L3
CO3	Demonstrate the working principles and use-cases of In-Memory and Object-Oriented databases.	3	3	2	2	1	3	3	3	L3, L4
CO4	Explain and implement Big Data tools such as Hadoop and Spark in database management.	3	3	2	2	2	2	3	3	L4, L5
CO5	Evaluate emerging database technologies such as Blockchain and Quantum Computing and their implications for the future.	3	3	3	2	1	3	3	3	L5, L6

SYLLABUS

UNIT I: **10 Hours**

Database Revolution: Three Database Revolutions, Early Database Systems-The First Database Revolution, The Second Database Revolution- Relational theory, Transaction Models, The First Relational Databases, Client- server Computing, Object-oriented Programming and the OODBMS, The Relational Plateau, The Third Database Revolution, Google and Hadoop, The Rest of the Web, Cloud Computing, Document Database, The "NewSQL", The Non relational Explosion. Google, Big Data, and Hadoop

Google, Big Data, and Hadoop: The Big Data Revolution- Cloud, Mobile, Social, and Big Data, Google: Pioneer of Big Data, Google Hardware, The Google Software Stack, More about MapReduce, Hadoop: Open-Source Google Stack -Hadoop's Origins, The Power of Hadoop,

Hadoop's Architecture, HBase, Hive, Pig, The Hadoop Ecosystem.

Self Learning Concepts: Latest Revolution concepts in Google and Hadoop. **CO's-CO**

UNIT II: **15 Hours**

Document Databases: What is a document database, NoSQL databases, why choose NoSQL? Performance overview of different databases, why a document store, how does it work, Data storage, Data querying and the map/reduce paradigm, Inserting and Modifying, ACID, The different solutions -Open-source solution, Proprietary solution.

Examples - CouchDB, Why CouchDB, the storage, concurrency, managing the database, queries the database, Specificity of Couch DB. **CO's-CO2**

Self Learning Concepts: MongoDB, Why Mongo DB? The storage, concurrency, managing the database, querying the database, Specificity of Mongo DB.

UNIT III: **15 Hours**

Graph Databases & Column Databases: What is a Graph? RDBMS Patterns for Graphs, RDF and SPARQL, Property Graphs and Neo4j, Gremlin, Graph Database Internals, Graph Compute Engines. What are Column Databases, why it used? The Columnar Alternative - Columnar Compression, Columnar Write Penalty, Sybase IQ, C-Store, and Vertica, Column Database Architectures -Projections. **CO's-CO3**

Self Learning Concepts: Columnar Technology in Other Databases

UNIT- IV: **10 Hours**

In-Memory Databases & Object Databases: What is In-Memory Databases? The End of Disk? - Solid State Disk, The Economics of Disk, SSD- Enabled Databases, In-Memory Databases Examples Times Ten, Redis, SAP HANA, VoltDB, Oracle 12c "in-Memory Database", Berkeley Analytics Data Stack and Spark, Spark Architecture. Overview of object databases, Object Oriented Database, Object Relational Database, mapping of object relational mapping and standards of ODBMS, **CO's-CO4**

Self Learning Concepts: Objectivity DB, db4o and Gemstone features and advantages

UNIT V: **10 Hours**

Databases of the future: The revolution revisited counterrevolutionaries-have we come full circle? can we have it all? - consistency models, schema, database languages, storage, a vision for a converged database, other convergent databases, Disruptive database technologies-storage technologies, Blockchain-What it is? Understanding Technologies, when it is used? Quantum computing-Quantum Transaction, Quantum Search. Quantum Query Language.

Self Learning Concepts: Quantum Query Language **CO's-CO5**

Board of Studies: Computer Science and Engineering
Approved in BoS No: 02, --, April, 2025
Approved in ACM No: 02

Text Books:

1. Next Generation Databases – NoSQL, NewSQL and Bigdata, Guy Harrison, Apress.
2. CouchDB, Document oriented Databases,Alain Issa, François Schiltz,ULB
3. Document stores and MongoDB, Kaïs Albichari , Tanguy d"Hose, ULB
4. MongoDB Architecture Guide, MongoDB university, white paper

5. Graph Databases-neo4j, Ian Robinson,Jim Webber & Emil Eifrem, 2nd edition ,Oreilly

Reference Books:

1. Oracle® Database,Database In-Memory Guide,12c Release, Lance Ashdown, Oracle Press
2. Fundamentals of Object Databases: Object-Oriented and Object-Relational Design,SuzanneW. Dietrich and Susan D. Urban, Morgan & cLaypool publishers
3. Blockchain basics, Technical Introduction in 25 Steps,Daniel Drescher, Apress

Web References:

1. couchdb.apache.org
2. CouchDB: The Definitive Guide:guide.couchdb.org/
3. Amazon DynamoDB vs. CouchDB vs. MongoDB Comparison
4. https://db-engines.com/en/system/Amazon+DynamoDB%3BCouchDB%3BMongoDB
5. https://university.mongodb.com/

Chairperson
Board of Studies (CSE)

R2458OE01.6 **Python Programming** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these.

Course Outcomes:

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

Course Outcomes (COs)		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
CO1	Understand and apply the core programming concepts of Python, including syntax, variables, data types, control structures, and operators.	3	2	1	1		2	3	2	L1, L2
CO2	To create and manipulate functions, handle textual data using string operations, and manage collections using lists, thereby enabling modular, readable, and data-driven Python programming.	3	3	2	2		2	3	2	L2, L3
CO3	To develop the ability to effectively use data structures—dictionaries, tuples, and sets—for storing, accessing, and manipulating complex and diverse data types.	3	3	2	2		2	3	2	L3, L4
CO4	To enable students to perform efficient file operations involving text, binary, and structured data formats, and to design and implement object-oriented programs.	3	3	3	2	1	2	3	2	L4, L5
CO5	To introduce essential data science tools and techniques using Python, work with structured data formats like JSON/XML, and perform numerical and data analysis using NumPy and Pandas.	3	3	3	2	1	3	3	3	L5, L6

SYLLABUS

UNTI I: **15 Hours**

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associatively, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement. **CO's-CO1**

Self-Learning Topics: Memory Management and Garbage Collection, Exception Hierarchy and Custom Exception Handling

UNIT II: **10 Hours**

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement. **CO's-CO2**

Self-Learning Topics: Lambda Functions and Functional Programming in Python, List Comprehensions and Generator Expressions

UNIT-III: **15 Hours**

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Self-Learning Topics: Dictionary Comprehensions and Nested Dictionaries, Advanced Tuple Usage and Named Tuples, Set Operations and Real-World Applications **CO's-CO3**

UNIT IV: **10 Hours**

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Self-Learning Topics: Working with JSON and XML File Formats, Advanced Object-Oriented Concepts: Magic Methods and Operator Overloading **CO's-CO4**

UNIT V: **10 Hours**

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy

with Python, Pandas. **CO's-CO5**

Self-Learning Topics: Data Wrangling and Cleaning Using Pandas, Using NumPy for Vectorized Operations and Broadcasting

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Chairperson
Board of Studies (CSE)