

Anil Neerukonda Institute of Technology & Sciences (Autonomous)
(Permanent Affiliation by Andhra University & Approved by AICTE
Accredited by NBA (ECE, EEE, CSE, IT, Mech. Civil & Chemical) & NAAC)
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DEPARTMENT OF COMPUTER SCIENCE&ENGINEERING WITH
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Vision and Mission of ANITS

Vision

ANITS envisions to emerge as a world-class technical institution whose products represent a good blend of technological excellence and the best of human values.

Mission

To train young men and women into competent and confident engineers with excellent communicational skills, to face the challenges of future technology changes, by imparting holistic technical education using the best of infrastructure, outstanding technical and teaching expertise and an exemplary work culture, besides molding them into good citizens.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING WITH ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

The Genesis and Growth:

The CSE(AI&ML, DS) Department of ANITS was started in the academic year 2020-21 with an intake of 35 for B Tech program and the present in-take from the academic year 2023-24 is 240. The department also offers M Tech (AI&ML) from the Academic Year 2023-24 and the in-take is 18.

The Human resources and Infrastructure:

The department is presently having 24 highly qualified faculty members who are having rich academic and industrial experience. To make teaching and learning processes more effective, 1:15 faculty student ratio is being maintained in the department since inception. The department possess best infrastructure facilities. To serve the student needs beyond curriculum and make them industry ready, additional experiments are being conducted in the labs and software were installed which are beyond the prescribed syllabus.

The faculty strongly believe that for disseminating knowledge to the students and to make them abreast with latest developments, good research activities are the need of the day along with regular teaching. About 30 plus papers were published by the faculty in various international peer reviewed journals and Conferences in the last 2 years. Faculty are dynamic and regularly upgrade their skills by attending various workshops and seminars. The departments' activities and infrastructure are being further improved with funding from agencies like AICTE, UGC etc.

ANITS has MOU with NPTEL and Infosys Spring Board to encourage self-learning in students.

The students and the outcomes:

Due to the subtle efforts of faculty and the infrastructure available, the department attracts students of good EAMCET ranks in this region. The academic performance of the students is also a matter of prestige to the department as it stands first amongst all the affiliated colleges of Andhra University on the basis of student pass percentage. Special impetus is given to students to improve their managerial skills. They are motivated to organize various events in the department by themselves which includes national seminars and technical symposiums. They are also encouraged to participate in various events organized by reputed colleges and have won many prizes every year bringing laurels to the department.

To make the students aware of latest technologies and also industrial needs, guest lectures by eminent persons from academics and industry, industrial visits etc., are being organized regularly in the department. Apart from this, CSE (AI&ML, DS) department has CSI student chapter. The department is also having Student Activity Center (SAC) to encourage the students in Entrepreneurship, Sports, Social responsibility and Cultural events.

Department of CSE (AI&ML, DS)

VISION

To produce professionally competent, socially conscious ethical engineers to meet the needs of industry and the society.

MISSION

The department mission is to

- Provide state of the art academic environment to produce self-sustainable professionals.
- Impart high-quality, value-based education in cutting-edge technologies to solve real world problems
- Inculcate moral values and leadership skills to become holistic professionals.

PROGRAMME OUTCOMES (POs)

- PO-1 An ability to independently carry out research /investigation and development work to solve practical problems.
- PO-2 An ability to write and present a substantial technical report/document.
- PO-3 Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

- Apply Artificial Intelligence and Machine Learning concepts for development of intelligent systems and applications to multidisciplinary problems.
- Develop and implement automated solutions that leverage AI and ML computing techniques to address current societal problems.

ACADEMIC REGULATIONS FOR M.TECH PROGRAMME

W.E.F. THE ADMITTED BATCH OF 2023-24

I. Admissions:

Admissions into first year of M.Tech Programme of the Institute will be as per the norms stipulated by Andhra University & Andhra Pradesh State Council for Higher Education (APSCHE), Govt. of Andhra Pradesh.

II. Programmes Offered:

The following are the M.Tech Programmes offered by the Institute:

1. Food Processing Technology - Chemical Engineering Department
2. Soil Mechanics - Civil Engineering Department
3. Computer Science and Engineering (Data Science) - CSE (AI&ML, DS) Department
4. Computer Science and Engineering (AI & ML) - CSE (AI&ML, DS) Department
5. VLSI & Embedded Systems – ECE Department
6. Control Systems –EEE Department
7. Machine Design–Mechanical Engineering Department

I. Structure of the M.Tech Programme:

The normal duration of the course is 2 academic years for M.Tech Degree. Candidates should pursue a regular course of study, as detailed below, for not less than two academic years which consists of 4 semesters and should fulfill the academic requirements and pass all the prescribed examinations for the award of degree.

The curriculum of M.Tech programme is designed to have a total of 68 credits to get the degree awarded.

II. Duration of the Programme:

The duration of the programme is 2 academic years consisting of 2 semesters in each academic year. A student is permitted to complete the programme in a stipulated time frame of 4 consecutive academic years from the date of initial admission and if fails will forfeit his seat in M.Tech programme.

III. Medium of Instruction:

The medium of instruction and examination is English.

IV. Minimum Instruction Days:

Each semester normally consists of a minimum of 16 weeks of instruction.

V. Academic Calendar:

The dates of all important events, such as commencement of class work, examinations, vacations, etc., during the academic year will be specified in the Academic Calendar of the Institute, as approved by the Academic Council.

VI. Examinations & Evaluation Process:

The performance of a student in each semester shall be evaluated course-wise with a maximum of 100 marks each for theory and practical courses.

(a) Theory Course:

For all lecture based theory courses, the assessment shall be for 40 marks through internal evaluation and 60 marks through external semester-end examination of three hours duration. The sessional marks shall be awarded through internal evaluation by the teachers concerned based on the continuous assessment which includes class tests, quiz, viva-voce, assignments, student regularity, two mid-examinations etc., according to a scheme notified by the department at the beginning of the semester.

Out of the 40 internal evaluation marks, 20 marks are assigned for 2 internal- mid exams, 10 marks are assigned for assignments, 5 marks are assigned for projects/case studies/quiz/tests and 5 marks are assigned for attendance. The average of 2 internal-mid exams is considered for 20 marks. Under any circumstances, no re-examination shall be conducted for the internal mid examinations.

External evaluation:

The question paper shall be set externally and the answer scripts are valued through a double valuation system. The average of the two valuations will be taken for award of marks. In case, the difference of the marks obtained in the two valuations is more than 20% then a third examiner shall value the script. Out of the three valuations, the average of marks obtained in third valuation and the marks obtained nearer to third valuation out of first two valuations

shall be considered. No revaluation for any subject/course shall be entertained as already double valuation system is in existence. However, recounting is allowed on the request of the candidate on payment of specified fee. Challenge valuation shall also be entertained on payment of specified fee.

(b) Laboratory Course:

Each student will perform about 10 to 12 experiments in each laboratory course. Laboratory course will be evaluated for 100 marks, out of which 50 marks are for external examination and 50 marks are for internal evaluation. The internal marks are awarded based on continuous assessment, record work, and internal lab examination and student regularity. The external examination will be conducted by two examiners, one of them being laboratory class teacher as internal examiner (nominated by the Principal on recommendation of HOD) and an external examiner nominated by the Principal from the panel of experts recommended by the HOD.

A candidate shall be declared to have passed in any theory subject/course if he secures not less than 40% in external theory examination and also a minimum of 50% of total marks of that course which assures a minimum of 'E' grade.

A candidate shall be declared to have passed in any practical course if he secures not less than 50% in external lab examination and also a minimum of 50% of total marks of that course which assures a minimum of 'E' grade.

Any student appearing for the semester-end practical examination is eligible only if he submits the bona-fide record certified by the laboratory class teacher and the HOD.

(c) Seminar

Conducting seminars plays a major role in helping students develop their presentation skills, in which the student may present any technical content (innovative or upcoming) related to his or her specialization.

If a course contains two seminar courses in two different semesters, Seminar-I may deal with any general topic, and Seminar-II may deal with technical topics.

A common way to divide the 50 marks for a seminar evaluation involves allocating scores or points to different aspects of the seminar presentation as follows:

- Content (15 marks)
- Presentation Skills (20 marks)
- Handling of queries and discussions (10 marks)
- Quality of visuals, clarity and usefulness of handouts (5 marks)
- The faculty has to conduct a minimum of two seminars in a semester.

(d) Audit Course

A common way to divide the 50 marks for an audit course (non-credit) is as follows:

- Mid Exams: 20 marks
- Group Projects/Assignments: 15 marks
- Class Tests/Quizzes: 10 marks
- Attendance: 5 marks

(e) **Thesis Work:**

The thesis work shall be carried out in two semesters of one full academic year. The students will be allotted for thesis by the department committee to various faculty members who act as guides. However, a student can carry-out his thesis work either in the department or in any other industry / research institute. In any such request to carry out thesis work outside the college, the permission of the Principal and an internal guide is mandatory. Such students should report to the internal guide once in a week essentially through mail or other communication.

The progress report of such work is to be submitted by the guide/external guide every month to the HOD. If the work is not found satisfactory, the HOD has the right to call back the student with the permission of the Principal. In any case the time and conditions for submission of the thesis will be same as for the regular candidates studying in the college.

The third semester work is evaluated internally by the committee nominated by the HOD consisting a minimum of four members (concerned in area of specialization) including the HOD. If the work is not satisfactory, the candidate has to improve to the satisfaction of the committee within one month from the end of the semester to carry on his fourth semester work. If he fails to satisfy the committee in the second attempt he has to get readmitted into the third semester as per college norms. The grades will be awarded just as in the case of laboratory work. An internal viva-voce by a committee nominated by the HOD is a prerequisite for the submission of the thesis. The fourth semester evaluation will be done through the viva-voce examination on the thesis by a board consisting of the following four examiners after submission of the thesis by the candidate duly certified by the Guide and the HOD.

1. The Head of the Department as Chairman
2. Senior Professor in the Department
3. Internal Guide and External Guide (if any)
4. External examiner nominated by the Principal from a panel recommended by the HOD.

The panel of the external subject experts shall be submitted to the Principal by the HOD in mutual consent with the guide and other subject experts of the Department.

The scheme of valuation of the thesis shall be according to the format given by Head and PG coordinator.

If the candidate fails in the viva-voce examination of the thesis, he has to reappear for the viva-voce. The candidate has to bear the charges for re-conducting the viva-voce.

The prerequisite for submission of the M.Tech thesis is that one should have published a paper in reputed international journal/proceedings of an annual conference.

VII. Attendance Regulations:

Attendance of a student is computed by considering total number of periods conducted in all courses as the denominator and the total number of periods actually attended by the student in all courses, as the numerator. It is desirable for a student to put in 100% attendance in all

the subjects. However, a candidate shall be permitted to appear for the semester end examination provided he/she maintains a minimum of 75% overall attendance in the semester.

The shortage of attendance on medical grounds can be condoned up to a maximum of 9% provided the student puts in at least 66% attendance and provided the Principal is satisfied with the genuineness of the reasons. The Medical Certificates are to be submitted to the Head of the Department when the candidate reports to the classes immediately after the leave. Certificates submitted afterwards shall not be entertained.

Condonation fee as fixed by the college for those who put in attendance between $\geq 66\%$ and $< 75\%$ shall be charged before the semester-end examinations.

In the case of students who participate in co-curricular, extra-curricular activities like student seminars, N.S.S, N.C.C, Inter-collegiate tournaments and any such other activities involving the representation of the Institute, with the prior approval of the Principal, the candidate may be deemed to have attended the classes during the actual period of such activity, solely for the purpose of attendance.

A student, who could not satisfy the minimum attendance requirement of 66% in any semester, shall be declared 'Detained'. He/she is not eligible to appear for the semester end examinations. He will not be promoted to the next semester and shall have to repeat that semester with the next batch(es) of students. Such students, who are detained and seek readmission, should submit undertaking/declaration that they will abide by the regulations existing at the time of readmission.

VIII. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No. IX.

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory subject if only he secures not less than 40% marks in the semester-end examination and a minimum of 50% marks in the sum of the internal evaluation and semester-end examination taken together. In the labs/projects, the student should secure a minimum of 50% marks in the external examination and a minimum of 50% marks in the sum of internal evaluation and external examination evaluation taken together.
- ii. Students, who fail to complete their two year course study within four academic years from the year of their admission or fail to acquire the credits stipulated for the course shall forfeit their seat in M.Tech course and their admission shall stand cancelled.

IX. Award of Grades:

The absolute grading system is adopted as follows:

S.No.	Range of Marks { % }	Grade	Description	Grade Points
1	90-100	O	Outstanding	10
2	80-89	A	Excellent	9
3	70-79	B	Very Good	8
4	60-69	C	Good	7
5	55-59	D	Fair	6
6	50-54	E	Satisfactory	5
7	49 and below	F	Fail	0
8	The grade 'I' represents absent (subsequently changed into pass or higher grades.)	I	Absent	0

The performance of a student at the end of the each semester is indicated in terms of Semester Grade Point Average (SGPA). The SGPA is calculated as below:

$$\text{SGPA} = \frac{\Sigma (\text{Credits of a course} \times \text{Grade points awarded for a course})}{\Sigma (\text{Credits of a course})}$$

SGPA is calculated for the candidates who have passed in all the courses in that semester.

Cumulative Grade Point Average (CGPA) will be calculated from II semester onwards up to the final semester and its calculation is similar to that of SGPA, considering all the courses offered from the first semester onwards.

CGPA is calculated for those who clear all the courses in all the previous semesters.

Award of Class:

For the award of class, a total of best 74 credits are considered. A candidate, who becomes eligible for the award of M.Tech. Degree, shall be placed in one of the following classes.

S.No.	Class	CGPA
1	First Class with Distinction	7.5 or more*
2	First Class	6.5 or more but less than 7.5
3	Second Class/Pass	5.0 or more but less than 6.5

***First class with Distinction will be awarded only to those students who clear all the subjects of the program in first attempt of regular examinations.**

The CGPA can be converted to aggregate percentage by multiplying CGPA with 10, in case of requirement by any other university or for any other purpose.

X. Eligibility for Award of M.Tech. Degree:

A student shall be eligible for the award of the M.Tech degree if he/she fulfils all the following conditions:

1. Registered and successfully completed all the components prescribed for eligibility in the programme of study to which he/she is admitted within the stipulated period,
2. Obtained CGPA greater than or equal to 5.0 (Minimum requirement for Pass),
3. No disciplinary action is pending against him/her and
4. Has no dues to the Institute including hostels.

XI. Malpractices:

The Controller of Examinations/Dean of Examinations shall refer the cases of suspected malpractices in mid examinations and semester-end examinations to Malpractice Enquiry Committee constituted by the Institute. Such committee shall follow the approved scales of punishment. The Principal shall take necessary final action against the erring students based on the recommendations of the committee.

XII. Amendments to Regulations:

The Institute may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabi and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

XIII. General:

- Where the words 'he', 'him', 'his', occur in the regulations, they include 'she', 'her', 'hers'.
- The academic regulation should be read as a whole for the purpose of any interpretation.
- In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

R-23 COURSE STRUCTURE

M.TECH (Artificial Intelligence & Machine Learning)

DEPT. OF CSE (AI & ML, DS): ANITS

I Year – I Semester

Course Code	Title of the Course	Category	Periods per week			Max. marks		Total Marks	Credits
			L	T	P	Sess.	End Exam		
23AM111	Mathematical Foundation for Machine Learning	BS	3	0	0	40	60	100	3
23AM112	Machine Learning	PC	3	0	0	40	60	100	3
23AM113	Professional Elective – I	PE	3	0	0	40	60	100	3
23AM114	Professional Elective – II	PE	3	0	0	40	60	100	3
23AM115	Research Methodology and IPR	MC	2	0	0	40	60	100	2
23AM116	Machine Learning using Python Lab	PC	0	0	3	50	50	100	2
23AM117	Professional Elective-II Lab	PE	0	0	3	50	50	100	2
23AM118	Universal Human Values and Professional Ethics	Audit	2	0	0	50	--	50	0
Total			16	0	6	350	400	750	18

Professional Elective–I:	A. Problem solving methods in Artificial Intelligence B. Image Processing C. Expert Systems
Professional Elective–II:	A. Information Security B. Data Analytics C. Neural Networks

I Year – II Semester

Course Code	Title of the Course	Category	Periods per week			Max. marks		Total Marks	Credits
			L	T	P	Sess.	End Exam		
23 AM121	Deep Learning	PC	3	0	0	40	60	100	3
23 AM122	Computational Intelligence	PC	3	0	0	40	60	100	3
23 AM123	Professional Elective – III	PE	3	0	0	40	60	100	3
23 AM124	Professional Elective – IV	PE	3	0	0	40	60	100	3
23 AM125	Deep Learning Lab	PC	0	0	3	50	50	100	2
23 AM126	Professional Elective-IV Lab	PE	0	0	3	50	50	100	2
23 AM127	seminar	SC	0	0	3	50	--	500	2
23 AM128	Teaching and Learning in Higher Education	Audit	2	0	0	50	--	50	0
Total			14	0	9	360	340	700	18

Professional Elective–III:	A. Information Retrieval System B. Internet of Things and Drones C. Pattern Recognition
Professional Elective – IV:	A. Artificial Intelligence in Robotics B. No SQL C. Natural Language Processing

II Year – I Semester

Course Code	Title of the Course	Category	Periods per week			Total	Max. marks		Total Marks	Credits
			L	T	P		Sess.	End Exam		
23 AM 211	MOOCs-I	OE	0	0	0	0	100	—	100	3
23 AM 212	MOOCs-II	OE	0	0	0	0	100	—	100	3
23 AM 213	Project Phase-I	PR	0	0	20	20	100	—	100	10
Total			0	0	20	20	300	—	300	16

II Year – II Semester

Course Code	Title of the course	Category	Periods per week			Total	Max. Marks		Total Marks	Credits
			L	T	P		Sess.	End Exam		
23AM 221	Project Phase-II	PR	0	0	32	32	100	100	200	16
Total			0	0	32	32	100	100	200	16

The prerequisite for submission of the M Tech thesis is that one should communicate his/her work to any referred journal or Publication in a conference/journal.

SEM-I

MATHEMATICAL FOUNDATION FOR MACHINE LEARNING	
Code: 23AM111	Credits: 3
Instruction : 3 periods /Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Matrices, Differentiation.

Course Objectives:

To provide the basic knowledge of fundamental concepts in linear algebra, vectors, probability and statistics required for a program in artificial intelligence.

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

1.	Understand the concepts of vector spaces.
2.	Understand the concepts of inner product spaces.
3.	Understand the concepts Eigen values, Eigen vectors and singular value decompositions.
4.	Understand the concepts of vector calculus.
5.	Apply the knowledge of probability and distributions in multivariate analysis.

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	1	-	2	1	1
2	2	-	2	2	2
3	2	1	2	2	2
4	1	-	2	2	2
5	2	1	2	2	2

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I

10 Periods

Linear Algebra : Systems of linear equations – Matrices – Solving systems of linear equations – Vector spaces – Linear independence – Basis and Rank – Linear mappings – Affine spaces.

UNIT II

10 Periods

Analytic Geometry: Norms – Inner products – Lengths and Distances – Angles and Orthogonality – Orthonormal Basis - Orthogonal complement – Inner product of functions – Orthogonal projections – Rotations.

UNIT III

10 Periods

Matrix Decompositions: Determinant and trace – Eigen values and Eigen vectors – Cholesky decomposition – Eigen decomposition and diagonalization – Singular value decomposition – Matrix approximation.

UNIT IV

10 Periods

Vector Calculus : Differentiation of univariate functions – Partial differentiation and Gradients – Gradients of vector valued functions – Gradients of matrices – Useful identities for computing gradients – Backpropagation and automatic differentiation – Higher order derivatives – Linearization and multivariate Taylor series.

UNIT V

10 Periods

Probability and Distributions: Construction of a probability space – Discrete and Continuous probabilities – Sum rule, Product rule, and Baye’s theorem – Gaussian distribution – Conjugacy and the exponential family – Change of variables/Inverse transform.

TEXT BOOKS:

1. **M. P. Deisenroth, A. A. Faisal and C. S. Ong**, Mathematics for Machine Learning, Cambridge University Press (1st Edition).

REFERENCES:

1. **Stephen Boyd and Lieven Vandenberghe**, Introduction to Applied Linear Algebra – Vectors, Matrices, and Least squares, Cambridge Univ. Press (2018).
2. **S. Axler**, Linear algebra done right, Springer International Publishing (3rd Edition).
3. **E. Keryszig**, Advanced Engineering Mathematics, John Wiley and Sons, Inc., U. K. (10th Edition).
4. **Kishore S. Trivedi**, Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition, John Wiley and Sons Ltd., 2016.

MACHINE LEARNING	
Code : 23AM112	Credits: 3
Instruction : 3 Periods / Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Python programming skill.
2. Preliminary concepts of probability, algebra and statistics.

Course Objectives:

1. Understand the main categories and fundamental concepts of Machine Learning systems
2. Familiarize the main steps in a typical Machine Learning project
3. Effective utilization of regression, clustering and classification algorithms.
4. Ability to apply machine learning techniques to solve real world problems

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Define the machine learning, types of ML and challenges of ML.
2.	Describe the extraction of data, withdraw insights of data and fine tune the data for applying ML model.
3.	Implementation of Classification models on MNIST Data set and Regression models.
4.	Apply SVM, DT and Ensemble Learning techniques for solving Real world problems.
5.	Solve curse of dimensionality problem and Apply K-Means, DBSCAN and Gaussian Mixtures to solve Unlabeled data.

Mapping of course outcomes with program outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	-	-	1	1
2	3	1	2	3	3
3	3	1	3	3	3
4	3	1	3	3	3
5	3	-	3	3	3

SYLLABUS

UNIT-I:

8 Hours

Machine learning landscape:

What Is Machine learning?, Why Use Machine Learning?, Types of Machine Learning Systems, Main Challenges of Machine Learning, Testing and Validating.

UNIT-II:

8 Hours

End-to-End Machine learning Project:

Working with Real Data, Get the Data, Discover and Visualize the Data to Gain Insights, Prepare the Data for Machine Learning Algorithms, Select and Train a Model, Fine-Tune Your Model.

UNIT-III:

14 Hours

Training Model and MNIST Data set Classification:

Linear Regression, Gradient Descent, Polynomial Regression, Logistic Regression.

MNIST, Training a Binary Classifier, Performance Measures, Multiclass Classification, Error Analysis, Multilabel Classification, Multioutput Classification.

UNIT-IV:

12 Hours

SVM, Decision Trees and Ensemble Learning:

Linear SVM Classification, Nonlinear SVM Classification, SVM Regression.

Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy?, Regularization Hyperparameters.

Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting, Stacking.

UNIT-V:

8 Hours

Dimensionality Reduction and Clustering:

The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Kernel PCA, LLE, Other Dimensionality Reduction Techniques.

Clustering, K-Means, Clustering for image segmentation, Clustering for Pre-processing, Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.

Text Books:

1. AurelionGeron, "Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems", 2/e, O'Reilly Media, 2019.
2. Sebastian Raschka, "Python Machine Learning" Packt Publishing 2015.

Reference Books:

1. Tom M. Mitchell, "Machine Learning" First Edition by Tata McGraw- Hill Education.
2. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009

Web Resources:

1. <https://nptel.ac.in/courses/106106139>
 2. <https://www.youtube.com/watch?v=PPLop4L2eGk>
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PROBLEM SOLVING METHODS IN ARTIFICIAL INTELLIGENCE	
Code:23AM113(A)	Credits:3
Instruction : 3 Periods / Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Data Structures, Algorithms

Course Objectives:

1. Provide a solid understanding of Artificial Intelligence's history, concepts, and applications.
2. Develop problem-solving skills using various search algorithms and constraint satisfaction methods.
3. Familiarize students with adversarial search and reasoning under uncertainty using probability and Bayesian networks.

Course Outcome:

By the end of the course, the student will be able to:	
1.	Demonstrate an understanding of the foundational concepts and historical development of Artificial Intelligence.
2.	Apply various problem-solving methods and search algorithms to find solutions efficiently in different problem domains.
3.	Develop strategies and make optimal decisions in competitive environments using adversarial search techniques.
4.	Design and implement constraint satisfaction algorithms to solve real-world problems efficiently.
5.	Apply probabilistic reasoning and Bayesian networks to handle uncertainty and make informed decisions in uncertain domains.

Mapping of course outcomes with program outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	-	-	1	1	1
2	3	1		2	2
3	3		3	2	2
4	3	1		2	2
5	3	1	2	2	2

UNIT- I: INTRODUCTION**10 Periods**

Introduction, Foundation of Artificial Intelligence, History of Artificial Intelligence, Application of Artificial Intelligence, Intelligent Agents–Agents and Environments, Concept of Rationality, Nature of Environments, Structure of Agents.

UNIT- II: SEARCH AND PROBLEM SOLVING**10 Periods**

Problem solving Methods, Search for solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristics Functions, Local Search Algorithms and Optimization, Local Search in Continuous Spaces, Searching with Non-deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments.

UNIT-III: ADVERSARIAL SEARCH**10 Periods**

Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs, Alternative Approaches.

UNIT-IV: CONSTRAINT SATISFACTION PROBLEMS**10 Periods**

Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, Structure of Problem.

UNIT-V UNCERTAIN KNOWLEDGE AND REASONING**10 Periods**

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Bayes' Rule and its use, Probability Reasoning: Representing Knowledge in an Uncertain Domain, Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions.

Text Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence A Modern Approach”, Third edition, Pearson Education.

Reference Books:

1. Rich E & Knight K, “Artificial Intelligence”, 4th Edition, Tata McGraw hill.
2. George F Luger, “Artificial Intelligence: Structure and strategies of complex problem solving”, 6th Edition, Addison Wisley.

IMAGE PROCESSING	
Code:23AM113 (B)	Credits:3
Instruction: 3 Periods/Week	Sessional Marks: 40
Final Exam: 3 Hours	End Exam Marks: 60

Pre requisites: Knowledge of linear algebra, basic probability and statistics, knowledge of basic programming language.

Course Objectives:

1. To understand the fundamentals of image processing
2. To explain various image restoration and enhancement techniques
3. To understand image segmentation techniques

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Describe the fundamentals of image processing
2.	Apply the image enhancement techniques
3.	Describe image restoration procedures.
4.	Categorize various compression techniques
5.	Apply the image segmentation techniques

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	1	-	2	1	1
2	2	-	2	2	2
3	2	1	2	2	2
4	1	-	2	2	2
5	2	1	2	2	2

SYLLABUS

UNIT-I

10 Periods

INTRODUCTION: Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system.

DIGITAL IMAGE FUNDAMENTALS: Image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, Introduction to the basic mathematical tools used in digital image processing

UNIT- II

10 Periods

INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING: Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, basic smoothing and sharpening spatial filters.

UNIT-III

10 Periods

IMAGE RESTORATION: A model of the image degradation/ restoration process, noise models, restoration in the presence of noise–only spatial filtering, periodic noise reduction using frequency domain filtering.

UNIT-IV

10 Periods

IMAGE COMPRESSION: Fundamentals, Huffman coding, Golomb coding, arithmetic coding, LZW coding, run-length coding, symbol-based coding, bit-plane coding

UNIT-V

10 Periods

IMAGE SEGMENTATION: Fundamentals, Point, Line, And Edge Detection, Thresholding, Segmentation By Region Growing and by Region Splitting And Merging, Region Segmentation using Clustering and Super pixels, Region Segmentation using Graph Cuts.

Text Books:

Rafeal C. Gonzalez, Richard E. Woods, *Digital Image Processing*, 3rd Edition, Pearson Education/PHI, 2017

Reference Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 2nd Edition, Thomson Learning, 2010.
2. Alasdair McAndrew, “Introduction to Digital Image Processing with Matlab”, 1st Edition, Thomson Course Technology, 2010.

EXPERT SYSTEMS	
Code:23AM113(C)	Credits:3
Instruction : 3 Periods /Week	Sessional Marks :40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Knowledge on Artificial Intelligence

Course Objectives:

In this course the student will learn the methodology used to transfer the knowledge of a human expert into an intelligent program that can be used to solve problems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Apply the methodology to transfer human knowledge into an expert system
2.	Apply knowledge representation
3.	Design a knowledge base and Implement a rule-based expert System
4.	Evaluate Expert System tools
5.	Apply CLIPS for the implementation of an expert system

Mapping of course outcomes with program outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	1	2	2	2
2	2	-	2	3	2
3	3	-	3	2	2
4	3	2	2	3	2
5	2	-	3	3	2

SYLLABUS

UNIT-I : Knowledge Representation: 10 Periods

Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets ,The dependence graph of data log rule sets, Objects

UNIT II: Solving problems by reasoning 10 Periods

Solving problems by reasoning: The structure of the knowledge base, The reasoning algorithm, Conflict resolution, Explanation of the reasoning.

UNIT III: Rule Based Systems: 10 Periods

Forward reasoning: The method of forward reasoning, A simple case study of forward reasoning, Backward reasoning: Solving problems by reduction, The method of backward reasoning, A simple case study of backward reasoning, Bidirectional reasoning. Contradiction freeness: The notion of contradiction freeness, Testing contradiction freeness, The search problem of contradiction freeness

UNIT-IV: Tools for Representation and Reasoning: 10 Periods

The Lisp programming language: The fundamental data types in Lisp, Expressions and their evaluation, some useful Lisp primitives, some simple examples in Lisp, The Prolog programming language: The elements of Prolog programs, The execution of Prolog programs, Built-in predicates, and Some simple examples in Prolog.

UNIT V: Real-Time Expert Systems: 10 Periods

The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem Synchronization and communication between real-time and intelligent subsystems: Synchronization and communication primitives, Priority handling and time-out.

Text Books:

1. Intelligent Control Systems-An Introduction with Examples by Katalin M. Hangos, Rozália Lakner , Miklós Gerzson, Kluwer Academic Publishers.
2. Intelligent Systems and Control: Principles and Applications Paperback – 12 Nov 2009 by Laxmidhar Behera, Indrani Kar by OXFORD.

References Books:

1. Intelligent Systems and Technologies Methods and Applications by Springer publications.
2. Intelligent Systems - Modeling, Optimization and Control, by Yung C. Shin and Chengying Xu, CRC Press, Taylor & Francis Group, 2009.

INFORMATION SECURITY	
Code:23AM114(A)	Credits : 3
Instruction : 3 Periods /Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Pre-Requisites:

- 1. Basic knowledge of Computer Networks.**

Course Objectives:

1. Learn the fundamental concepts of Cryptography.
2. Acquire the knowledge about the applications of Cryptography.
3. Interpret the concepts of foot printing and reconnaissance with various tools.
4. Analyse the working of sniffing tools for gaining access to the captured network traffic.
5. Learn the significance of SQL Injection and its applications.

Course Outcomes:

By the end of the course, the student will be able to:

1.	Understand the fundamental concepts of Cryptography.
2.	Acquire the knowledge about the Cryptography algorithms.
3.	Memorize the concepts of foot printing and reconnaissance with various tools.
4.	Demonstrate the working of sniffing tools for gaining access to the captured network traffic.
5.	Understand the significance of SQL Injection and its applications.

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	1	1	2	2	-
2	2	-	2	2	1
3	2	2	2	2	-
4	3	1	2	2	1
5	2	-	2	2	1

SYLLABUS

UNIT-1

10 periods

Security goals, attacks-passive and active attacks, services and mechanisms, techniques. Mathematics for cryptography: Integer Arithmetic, Modular Arithmetic, Linear Congruence. A model for network security, Internet Standards. Buffer overflow and format string vulnerabilities,

UNIT-2

10 periods

Symmetric Cryptography: Introduction, Substitution ciphers, Transposition ciphers, Feistel Structure, DES-AES-RC4.
Public Key Cryptography: Encryption/Decryption using RSA, RSA with example. TCP Session hijacking, ARP Attacks, man-in-the-middle attacks, SQL injection, Phishing attacks, Tools-Ettercap, Burpsuite.

UNIT-3

10 periods

Gaining Access, Sniffers: System Hacking, password cracking, password cracking techniques, passive online attacks, active online attacks, offline attacks; Sniffers: Understanding Sniffers, Using a Sniffer, Sniffing Tools-Wireshark, TCP Dump, Reading Sniffer Output, Switched Network Sniffing, Detecting Sniffing Attacks.

(From Chapter 7 & 9 of Book 3)

UNIT-4

10 periods

SQL Injection: Introducing SQL Injection, Results of SQL Injection, the Anatomy of a Web Application, Databases and Their Vulnerabilities, Anatomy of a SQL Injection Attack, Altering Data with a SQL, Injection Attack, Injecting Blind, Information Gathering, Evading Detection Mechanisms, SQL Injection Countermeasures.

(Chapters 13 & 14 of Book 3)

UNIT-5

10 periods

System Intrusion Detection and Prevention: Basics, roles of IDS in network defence, IDS sensor placement, case study. IPS – basics, Limitations, NIPS, HIPS, Honey pots and Honey nets, Password protection, Password Selection Strategies, Malicious Programs, Types of viruses, worms, Trojan horses.

Text Books:

1. Network security Essentials, Applications and standards, 3e, William Stallings, Pearson Education (for unit-1).
2. Cryptography and Network Security, Behrouz A. Forouzan, Tata McGraw Hill. (unit-2)
3. CEHv8 Certified Ethical Hacker Version 8 Study Guide, by Sean-Philip Oriyano, Sybex (A Wiley Brand) ISBN: 978-1-118-64767-7 (unit-3 and 4).
4. Cryptography and Network Security: Principles and Practice, William Stallings, 5th edition, Pearson.

Reference Books:

1. B. Menezes, Network security and Cryptography, Cengage Learning India, 2010.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
3. Principles of Information Security, Whitman, Thomson.

E-Resources :

1. https://www.nisc.go.jp/security-site/campaign/files/aj-sec/handbook-all_eng.pdf
2. <https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-100.pdf>

DATA ANALYTICS	
Code: 23AM114(B)	Credits: 3
Instruction: 3 Periods /Week	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Prerequisites:

1. Basics on Probability and statistics.
2. Fundamentals of Python programming.

Course Objectives:

1. To familiarize with basics data analytics and data analytics in Python.
2. Equip the students with core statistical models and visualization techniques to perform exploratory data analysis using Python.
3. Exploring the importance of analysis of variance and multivariate analysis of variance (MANOVA) and implementing them in Python with different kinds of data sets.

Course Outcomes:

By the end of the course, the student will be able to:

1.	Understand the basic principles of data analytics for performing basic data analysis on given data.
2.	Apply the data visualization methods in Python for exploratory data analysis.
3.	Apply Simple Statistical Techniques for Univariate and Bivariate Analyses
4.	Apply the nature and logic of the analysis of variance.
5.	Apply linear and multi linear regression models.

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	2		2	2	1
2	3	1	2	2	1
3	3		3	2	1
4	3	1	2	2	1
5	3	1	2	2	1

SYLLABUS

UNIT-1 **10 periods**
Introduction and Overview of Applied Statistics: How Statistical Inference Works, Statistics and Decision-Making, Data Analysis, Data Science, Machine Learning, Big Data. The Scatter plot, Correlograms, Histograms and Bar Graphs, Heatmaps, Line Charts.

UNIT-2 **10 periods**
Simple Statistical Techniques for Univariate and Bivariate Analyses: Pearson Product-Moment Correlation, Computing Correlation in Python, T-Tests for Comparing Means, Paired-Samples t-Test in Python, Binomial Test, The Chi-Squared Distribution.

UNIT-3 **10 periods**
Analysis of Variance (ANOVA): T-Tests for Means as a Special Case of ANOVA, Analysis of Variance (one-way classification), ANOVA in Python, Analysis of Variance (two-way classification).

UNIT-4 **10 periods**
Simple and Multiple Linear Regression: Regression, Regression in Python, The Least-Squares Principle, The Population Least-Squares Regression Line, **Multiple Linear Regression**, How to Assess Goodness of Fit.

UNIT-5 **10 periods**
Multivariate Analysis of Variance (MANOVA): Why Technically Most Univariate Models are Actually Multivariate, Multivariate Model and Running a Multivariate Model, Multivariate Tests of Significance: Why They Are Different from the F-Ratio. Performing MANOVA in Python.

Text Book:

1. Applied Univariate, Bivariate, and Multivariate Statistics Using Python, Daniel J. Denis, Wiley, First Edition.

Reference Books:

1. Applied Multivariate Statistical Analysis, Richard. A. Johnson and Dean.W. Wichern, Pearson Prentice Hall, 6th Edition, 2007.
2. An Introduction to Multivariate Statistical Analysis, T.W. Anderson, Wiley, 3rd Edition, 2003.

Web Resource:

1. <https://www.westga.edu/academics/research/vrc/univariate-bivariate-analyses.php>

NEURAL NETWORKS	
Code:23AM114(C)	Credits: 3
Instruction : 3 Periods/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Mathematical Concepts like Statistics, Calculus, Linear Algebra and Probability.

Course Objectives:

1. To understand the biological neural network and to model equivalent neuron models.
2. To analyze the architecture, learning algorithms and issues of various Neural Network Architectures.
3. To Provide application oriented knowledge to build neural networks for different problems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Examine different Neural Network Architectures and Learning Rules.
2.	Analyse and differentiate Single Layer Perceptron and Multi-layered Perceptron based on their capabilities.
3.	Apply Back Propagation and solve different Neural Network Problems.
4.	Apply Self Organizing Maps in solving different pattern classification tasks.
5.	Differentiate Neural Networks and Deep Learning Algorithms.

Mapping of Course Outcomes with Program Outcomes:

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	3	-	2	2	2
2	3	1	3	2	2
3	3	1	3	2	2
4	3	1	3	2	2
5	2	-	2	2	2

SYLLABUS

UNIT- I

10 Periods

Introduction: A Neural Network, Human Brain, Models of a Neuron, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning.

UNIT-II:

10 Periods

Single Layer Perceptron: Unconstrained optimization, LMS algorithm, learning curves, perceptrons, convergence theorem, limitations of single-layer perceptron

Multilayer Perceptron: Back-propagation algorithm, XOR problem, feature detection, accelerated convergence of back-propagation algorithm, limitations

UNIT-III:

10 Periods

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT-IV:

10 Periods

Self-Organizing Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Learning Vector Quantization, Adaptive Pattern Classification.

UNIT-V:

10 Periods

Applications of Neural Networks: Recent trends in Neural Networks, Applications of Neural Networks, What is Deep Learning, Difference between Neural Networks and Deep Learning. Case Study: Using Feed forward Neural Networks for Handwritten Digit Recognition.

Text Books:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

Reference Books :

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005.
2. Neural Networks in Computer Intelligence, Li Min Fu TMH 2003.
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

E-Resources:

1. <http://cognet.mit.edu/book/introduction-to-neural-networks>
2. <https://www.udemy.com/course/deep-learning-convolutional-neural-networks-theanotensorflow>
3. <https://www.coursera.org/learn/neural-networks-deep-learning>

Research Methodology and IPR	
Code:23AM115	Credits: 2
Instruction : 2 Periods/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

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

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. 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.

SYLLABUS:

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

Unit-II: Effective literature studies approaches, analysis Plagiarism, Research ethics, 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-III: 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-IV: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit-V: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, 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. *Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.*
6. *T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008*

MACHINE LEARNING USING PYTHON LAB	
Code: 23AM116	Credits : 2
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites: C and data Structures

Course objectives:

1. Learn to manipulate data to apply ML algorithms using Numpy, Pandas, Matplotlib and SciKit Learn
2. Solve real world problems using ML Techniques.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Manipulate basic functions in Numpy, Pandas, Matplotlib SciKit Learn
2.	Apply the concepts of Regression (Linear, Quadratic and Logistic) to predict dependent variables.
3.	Feature recognition and classification using SVM, DT and RF techniques.
4.	Testing & validating ML models and evaluation of accuracy measures.

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	2	2	3	3
2	2	2	2	3	3
3	2	2	2	3	3
4	2	2	2	3	3

List of Experiments

1. Implement the matrices operations using both Numpy and pandas
2. Using matplotlib perform data visualization on the standard dataset
3. Implement Linear Regression using ordinary least square(OLS) and Gradient Descent methods
4. Implement quadratic Regression
5. Implement Logistic Regression
6. Evaluate performance measures on regression models (Linear, quadratic and Logistic).
7. Implement classification using SVM
8. Implement Decision Tree learning
9. Implement Bagging using Random Forests
10. Implement K-means Clustering to Find Natural Patterns in Data
11. Implement DBSCAN clustering
12. Implement Gaussian Mixture Model
13. Solve the curse of dimensionality by implementing PCA algorithm on a high dimensional
14. Comparison of Machine Learning algorithms

Text Books:

1. AurelionGeron, “Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems”, 2/e, O’Reilly Media, 2019.
2. Sebastian Raschka, “Python Machine Learning” Packt Publishing 2015.

Reference Books:

1. Tom M. Mitchell, “Machine Learning” First Edition by Tata McGraw- Hill Education.
2. Ethem Alpaydin, “Introduction to Machine Learning ” 2nd Edition, The MIT Press, 2009

Web Resources:

1. <https://nptel.ac.in/courses/106106139>
 2. <https://www.youtube.com/watch?v=PPLop4L2eGk>
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INFORMATION SECURITY LAB	
Code:23AM117(A)	Credits : 2
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Pre-Requisites:

1. Basic knowledge of Cryptography
2. Basic knowledge of Packet Capturing
3. Exposure to Problem solving techniques and programming skills

Course Objectives:

1. Introducing different tools related to Network Security.
2. Introducing tools related to Information Security.

By the end of the course, the student will be able to:

1.	Demonstrate the buffer overflow and format string attacks.
2.	Analyse the packets captured using Wireshark.
3.	Demonstrate the tools nmap and IPTables for network security.
4.	Detect and implement SQL Injection attacks.

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	1	1	1	2	2
2	2	1	1	1	1
3	1	2	1	2	1
4	1	1	1	1	2

EXPERIMENTS

- | | |
|--|------|
| 1. Understanding the buffer overflow and format string attacks. | CO-1 |
| 2. Demonstrate the transposition and substitution ciphers. | CO-1 |
| 3. To analyse the network packets using Wireshark. | CO-2 |
| 4. Sniffing networks and analysis of TCP/IP using Wireshark . | CO-2 |
| 5. Implement Testing for SQL Injection and detect it. | CO-4 |
| 6. To perform the web penetration testing using BURPSUITE. | CO-4 |
| 7. Use 'nmap' tool to perform vertical and horizontal scanning for | |
| 8. checking open and closed ports. | CO-3 |
| 9. Configuring IP Tables in Linux and setting the filtering rules. | CO-3 |

Case Study:

- 1. Use nmap commands for performing the following experiments: CO-3**
- Use ping sweeping to determine which hosts are running.
 - Check for vulnerable services available using TCP connect scans.
 - Perform OS Fingerprinting to determine the OS of target machine.
 - Choose different options under each category according to your creativity.

TEXTBOOKS:

- The Complete Reference Network Security By Robert Bragg, Mark Rhodes Ousley, Keith Strassberg, 1st Edition, McGraw Hill India (2004)Publication
- The Unofficial Guide to Ethical Hacking by Ankit Fadia, Second edition(2006), LaxmiPublications.
- Network Security Tools Writing, Hacking, and Modifying Security Tools by Nitesh Dhanjani, Justin Clarke, 2013 Edition, Publisher: O'Reilly Media.
- Linux and UNIX Security Portable Reference Book by Nitesh Dhanjani, 1st Edition, McGrawHill.

REFERENCE BOOKS:

- Network Security Tools Writing, Hacking, and Modifying Security Tools ByNiteshDhanjani, Justin Clarke, 2nd Edition, Publisher: O'Reilly Media

WEB RESOURCES:

- <https://www.udemy.com/courses/it-and-software/network-and-security>
- <https://online.stanford.edu/course/network-security>
- <http://index-of.es/EBooks/SQLInjectionAttacksandDefense.pdf>

DATA ANALYTICS LAB	
Code:23AM117(B)	Credits : 2
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites:

- Basic knowledge on Probability and statistics.
- Basics of Python Programming.

Course Objectives:

- To train the students to apply the principles of data analytics to analyze and effectively visualize the data.
- Train the students to gain the knowledge of computational statistical approaches and their application to a variety of datasets.
- Practical way of Understanding the nature of analysis of variance and Multivariate statistical models.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Explore Pandas, matplotlib and seaborn packages. Write example programs to visualize the data.
2	Work with Linear Regression and Multiple Regression models in Python
3	Understanding of the ANOVA that can used to test a given hypothesis and to verify the experimental results are significant.
4	Work with multivariate statistical methods in Python and interpret the results.

Co-Po Mapping

CO	PO			PSO	
	1	2	3	1	2
1	2	1	2	1	1
2	3	1	3	-	1
3	2	1	2	2	-
4	3	1	3	1	1

List of Experiments

1. Write a Program in Python to Manipulate, Aggregate and Analyze data using Numpy.
2. Write a Program in Python to Handle and Analyze data using Pandas.
3. Apply basic statistical methods on Sample Datasets like Mushroom (Data sets from <https://www.kaggle.com/datasets>, <https://archive.ics.uci.edu/ml/datasets.php> etc.,)
4. Working with matplotlib and seaborn packages in Python.
5. Write a Program in Python to add an indeed field, changing misleading data fields, Re-expressing categorical data as numerical data, standardizing numerical fields and identifying outliers for data preparation phase. for bank marketing data set.
6. (<https://www.kaggle.com/datasets/janiobachmann/bank-marketing-dataset>)
7. Write a Program in Python to Classifying MNIST digits using Logistic Regression
8. Write a Program in Python to predict House rent using linear regression.
9. Write a Program in Python to implement Correlation.
10. Write a Program to apply Multivariate analysis of variance and co-variance (MANOVA).
11. Write a Program to apply Analysis of Variance (one-way classification) in Python.
12. Write a Program to apply Analysis of Variance (two-way classification) in Python.
13. Write a Program to apply Linear Discriminant analysis for multivariate data.
14. Write a Program to apply Principle component analysis for multivariate data.
15. Implement Factor Analysis for multivariate data in Python.

Text Books:

1. Applied Univariate, Bivariate, and Multivariate Statistics Using Python, Daniel J. Denis, Wiley, First Edition.

Reference Books:

1. Applied Multivariate Statistical Analysis, Richard. A. Johnson and Dean.W. Wichern, Pearson Prentice Hall, 6th Edition, 2007.
2. An Introduction to Multivariate Statistical Analysis, T.W. Anderson, Wiley, 3rd Edition, 2003.

Web Resource:

- <https://www.westga.edu/academics/research/vrc/univariate-bivariate-analyses.php>

NEURAL NETWORKS LAB	
Code:23AM117(C)	Credits: 2
Instruction : 3 Periods/Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites: Mathematical Concepts like Statistics, Calculus, Linear Algebra and Probability

Course Objectives:

1. To understand the biological neural network and to model equivalent neuron models.
2. To understand the architecture, learning algorithms and issues of various Neural Network Architectures.
3. Provide application oriented knowledge to build neural networks for different problems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Design neural networks with different layers and appropriate activation functions.
2.	Identify the network errors and implement different optimization techniques.
3.	Apply the concepts of derivatives in implementing the backpropagation concept.
4.	Apply different optimizers, test and validate datasets along with regularization techniques.

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	1	3	2	2
2	2	1	2	1	2
3	2	1	2	1	3
4	3	1	3	2	2

LIST OF EXPERIMENTS

1. Creating a simple neuron (CO 1)
2. Adding different layers to the existing neuron (CO 1)
3. Working with activation functions (CO 1)
4. Calculating network error with loss (CO 2)
5. Implementing different optimizing techniques (CO 2)
6. Implementing derivatives for neural networks (CO 3)
7. Implementing backpropagation for neural networks (CO 3)
8. Implementing different optimizers for neural networks (CO 4)
9. Testing data, validating data (CO 4)
10. Training dataset, L1 and L2 Regularization (CO 4)

Text Books:

1. Neural Networks from Scratch in Python (Harrison Kinsley, Daniel Kukiela), 2020.

Reference Books :

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005.
2. Neural Networks in Computer Intelligence, Li Min Fu TMH 2003.
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

E-Resources:

1. <http://cognet.mit.edu/book/introduction-to-neural-networks>
2. <https://www.udemy.com/course/deep-learning-convolutional-neural-networks-theanotensorflow>
3. <https://www.coursera.org/learn/neural-networks-deep-learning>
4. https://github.com/Sentdex/nfns_book/tree/main/

Universal Human Values and Professional Ethics	
Code:23AM118	Credits: 0
Instruction : 2 Periods/Week	Sessional Marks : 50
End Exam : --	End Exam Marks : --

Course Objectives:

1. To create an awareness on Engineering Ethics and Human Values.
2. To instill Moral and Social Values and Loyalty
3. To appreciate the rights of others.
4. To create awareness on assessment of safety and risk

Course outcomes: By the end of the semester, the student will be able to:

CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Articulate what makes a particular course of action ethically defensible
CO4	Assess their own ethical values and the social context of problems
CO5	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
CO6	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research

SYLLABUS

Unit I: HUMAN VALUES

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully –Caring –Sharing –Honesty -Courage-Cooperation–Commitment – Empathy –Self Confidence -Character –Spirituality-Case Study.

LEARNING OUTCOMES:

1. learn about morals, values & work ethics.
2. learn to respect others and develop civic virtue.
3. develop commitment
4. learn how to live peacefully

Unit II: ENGINEERING ETHICS

Senses of ‘Engineering Ethics-Variety of moral issues –Types of inquiry –Moral dilemmas –Moral autonomy –Kohlberg’s theory-Gilligan’s theory-Consensus and controversy –Models of professional roles, Theories about right action-Self-interest -Customs and religion –Uses of Ethical theories – Valuing time –Case Study.

LEARNING OUTCOMES:

1. learn about the ethical responsibilities of the engineers.
2. create awareness about the customs and religions.
3. learn time management
4. learn about the different professional roles.

Unit III: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Social Experimentation –Similarities between standard and social Experimentations-Framing the problem –Determining the facts –Codes of Ethics – Clarifying Concepts –Application issues –Common Ground -General Principles –Utilitarian thinking respect for persons-Case study.

LEARNING OUTCOMES:

1. Demonstrate knowledge to become a social experimenter.
2. Provide depth knowledge on framing of the problem and determining the facts.
3. Provide depth knowledge on codes of ethics.
4. Develop utilitarian thinking

UNIT IV: ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK

Safety and risk –Assessment of safety and risk –Risk benefit analysis and reducing risk-Safety and the Engineer-Designing for the safety-Intellectual Property rights(IPR).

LEARNING OUTCOMES:

1. create awareness about safety, risk & risk benefit analysis.
2. engineer's design practices for providing safety.
3. provide knowledge on Intellectual Property Rights.

UNIT V: GLOBAL ISSUES

Globalization –Cross culture issues-Environmental Ethics –Computer Ethics –Computers as the instrument of Unethical behavior –Computers as the object of Unethical acts –Autonomous Computers-Computer codes of Ethics –Weapons Development -Ethics and Research –Analyzing Ethical Problems in research- Case Study.

LEARNING OUTCOMES:

1. Develop knowledge about global issues.
2. Create awareness on computer and environmental ethics.
3. Analyze ethical problems in research.
4. Give a picture on weapons development.

Text Books:

1. *M.Govindarajan, S.Natarajanad, V.S.SenthilKumar “Engineering Ethics includes Human Values” -PHI Learning Pvt. Ltd-2009*
2. *Harris, Pritchard and Rabins “Engineering Ethics”, CENGAGE Learning, India Edition, 2009.*
3. *Mike W. Martin and Roland Schinzinger “Ethics in Engineering” Tata McGraw-Hill–2003.*
4. *Prof.A.R.Aryasri, DharanikotaSuyodhana “Professional Ethics and Morals” Maruthi Publications.*
5. *A.Alavudeen, R.KalilRahman and M.Jayakumaran “Professional Ethics and Human Values” – Laxmi Publications.*
6. *Prof.D.R.Kiran “Professional Ethics and Human Values”*
7. *PSR Murthy “Indian Culture, Values and Professional Ethics” BS Publication*

SEM-II

DEEP LEARNING	
Code:23AM121	Credits: 3
Instruction : 3 Periods/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Mathematical Concepts like Statistics, Calculus, Linear Algebra and Probability.

Course Objectives:

1. Introduce the basics of Deep neural networks
2. Cover various deep learning algorithms, such as convolutional neural networks (CNNs), recurrent neural networks (RNNs)
3. Familiarize students with popular deep learning frameworks and libraries like TensorFlow, PyTorch, and Keras, enabling them to implement deep learning models effectively.
4. Teach students how to train deep neural networks using various optimization techniques, weight initialization, regularization, and hyperparameter tuning.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Identify the importance for Deep Learning Algorithms and Categorize different real world problems
2.	Identify the need for Multilayer Perceptrons and analyze how backpropagation works.
3.	Identify the need for convolutional neural network and Examine the Various Architectures of Convolution Neural Network.
4.	Examine the Various Architectures of Recurrent Neural Networks.
5.	Identify the need for Modern Recurrent Neural Networks and Apply machine translation using different architectures.

Mapping of Course Outcomes with Program Outcomes:

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	2	-	2	2	2
2	3	1	2	2	2
3	3	1	3	2	3
4	3	1	3	2	3
5	3	1	3	2	3

SYLLABUS

UNIT- I

10 Periods

Introduction to Deep Learning: A Motivating Example, Key Components, Kinds of Machine Learning Problems, Roots, The Road to Deep Learning, Success Stories, The Essence of Deep Learning, Activation Functions.

UNIT-II:

12 Periods

Multilayer Perceptrons: Introduction to Multilayer Perceptrons, implementation of Multilayer Perceptrons, Forward Propagation, Backward Propagation and Computational Graphs, Numerical Stability and Initialization, Generalization in Deep Learning, Dropout, Predicting House Prices on Kaggle.

UNIT-III:

12 Periods

Convolution Neural Network: From Fully-Connected Layers to Convolutions, Convolutions for Images, Padding and Stride, Multiple Inputs and Outputs Channels, Pooling, Different Deep Convolutional Neural Network Architectures-LeNet, AlexNet, VGG

UNIT-IV:

13 Periods

Recurrent Neural Networks: Working with Sequences, Converting Raw Text into Sequence Data, Language Models, Recurrent Neural Networks, Recurrent Neural Network Implementation from scratch, Concise Implementation of Recurrent Neural Networks, Backpropagation through Time.

UNIT-V:

13 Periods

Modern Recurrent Neural Networks: Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), Deep Recurrent Neural Networks, Bidirectional Recurrent Neural Networks, Machine Translation and the Dataset, The Encoder-Decoder Architecture, Encoder-Decoder Seq2Seq for Machine Translation.

Text Books:

1. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, “Dive into Deep Learning”, 2021

Reference Books:

1. Satish Kumar, “Neural Networks: A Classroom Approach”, Tata McGraw-Hill Education, 2004.
2. Simon Haykin, “Neural Networks-A comprehensive Foundation” Second edition
3. Charu C. Aggarwal, “Neural Networks and Deep Learning-A Textbook”, Springer, 2018.

E-Resources:

1. <https://www.analyticsvidhya.com/blog/2021/10/a-comprehensive-guide-on-deeplearning-optimizers/>
2. <https://www.analyticsvidhya.com/blog/2018/04/fundamentals-deep-learningregularization-techniques/>
3. <https://www.analyticsvidhya.com/blog/2021/05/a-comprehensive-tutorial-on-deeplearning-part-1/>
4. <https://viso.ai/deep-learning/deep-reinforcement-learning/>
5. Michael Nielsen, Neural Networks and Deep Learning, <http://neuralnetworksanddeeplearning.com/>
6. Introduction to Deep Learning, MIT 6.S191 Alexander Amini January 28, 2019, <http://introtodeeplearning.com/>

COMPUTATIONAL INTELLIGENCE	
Code:23 AM122	Credits: 3
Instruction : 3 Periods /Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Some programming skills and a good background in Statistics, Probability, and discrete mathematics probability will be very helpful.

Course Objectives:

- 1 Students will realize the importance and challenges.
- 2 Student will learn the basic concepts of fuzzy
- 3 Student can acquire the knowledge on different algorithms.
- 4 Student will able to choose optimization algorithm for different problems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Discuss the paradigm, approaches and applications with challenges
2.	Explore fuzzy logic and its mechanisms.
3.	Apply the algorithms and design strategies to solve problems
4.	Analyze the Evolutionary Computation algorithms in different domains
5.	Illustrate the collaborative and agglomerative combinations.

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	-	2	1	1
2	3	1	3	2	2
3	3	1	3	2	2
4	3	1	3	2	2
5	3	1	2	2	1

SYLLABUS

UNIT- I

12 Periods

Introduction to Computational Intelligence:

Computational Intelligence, paradigms of Computational Intelligence, Approaches to computational intelligence, Synergies of Computational Intelligence Techniques, Applications of Computational Intelligence, and grand challenges of Computational Intelligence.

UNIT-II:

14 Periods

Introduction to fuzzy logic: Fuzzy logic, fuzzy sets, member functions, Features of MFs, Operations of Fuzzy sets, Linguistic Variables, Fuzzy Relations, Fuzzy If-Then Rules, Fuzzification, Defuzzification, and Inference Mechanism.

UNIT-III:

12 Periods

Fuzzy Systems and Applications:

Fuzzy system, Fuzzy Modelling, Fuzzy control, Design of Fuzzy Controller, Modular Fuzzy Controller.

Neural Network Systems and Applications:

Learning Neural Networks, Recurrent Neural Networks, System Identification and Control, neural networks for control

UNIT-IV:

12 Periods

Evolutionary Computation: Evolutionary Computation, Terminologies of Evolutionary computing, Genetic Operators, Performance Measure of EA, Evolutionary Algorithms

Evolutionary Systems:

Multi-objective Optimization, Co-evolution, parallel Evolutionary Algorithms

UNIT-V:

12 Periods

Evolutionary Fuzzy Systems:

Evolutionary Adaptive Fuzzy Systems, Objective Functions and evaluation, and Fuzzy Adaptive Evolutionary Algorithms

Evolutionary Neural Network:

Support Combinations, Collaborative combinations, amalgamated combinations.

Text Books:

1. Nazmul Siddique, Hojjat Adeli, Computational intelligence, 2013, Wiley.
2. Rudolf Kruse, Christian Borgelt, Frank Klawonn, Christian Moewes, Matthias Steinbrecher, Pascal Held, Computational Intelligence A Methodological Introduction, 2013, Springer.

Reference Books:

1. Amit Konar, Computational Intelligence Principles, Techniques and Applications, 2006, Springer

INFORMATION RETRIEVAL SYSTEM	
Code:23AM123 (A)	Credits: 3
Instruction : 3 Periods/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Data Structures, Relational Database Systems.

Course Objectives:

1. Student will able to choose appropriate design strategies for different problems.
2. Study fundamentals of DBMS, Data Warehouse and Digital Libraries.
3. Learn various pre-processing techniques and indexing approaches in text mining
4. Understand various clustering approaches and similarity measures
5. Study various search techniques in information retrieval systems
6. Explore various cognitive approaches used in text retrieval systems and evaluation approaches

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Demonstrate the functional overview and capabilities of the Information Retrieval System.
2.	Apply indexing and various types of data structures for Information Retrieval.
3.	Demonstrate and analyze the Automatic Indexing and Clustering.
4.	Explain different user search techniques.
5.	Describe the Text Searching Techniques and measures that can be used in evaluating Information Retrieval Systems

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	-	2	2	1
2	2	1	3	2	2
3	3	2	3	2	2
4	2	2	1	1	2
5	2	1	2	2	3

SYLLABUS

UNIT- I

10 Periods

Introduction:

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management System, Digital Libraries and Data Warehouses. Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities.

UNIT-II:

10 Periods

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction. Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

UNIT-III:

10 Periods

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages. Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.

UNIT-IV:

10 Periods

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext.

UNIT-V:

10 Periods

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

Text Books:

1. Kowalski, Gerald, Mark T May bury: Information Storage and Retrieval Systems: Theory and Implementation, Second Edition, Kluwer Academic Press, 2002.

Reference Books :

1. Finding Out About: Search Engine Technology from a cognitive Perspective, by Richard, K. Belew, Cambridge University Press, 2000. (for Case Studies)
 2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval data Structures and Algorithms, Prentice Hall, 1992.
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INTERNET OF THINGS AND DRONES	
Code:23AM123(B)	Credits: 3
Instruction:3 Periods /Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Micro Processor and Micro Controller programming, Fundamentals of IoT and Robotics

Course Objectives:

1. Assess the genesis and impact of IoT applications, architectures in real world.
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT.
4. The main objective of this course is to understand the basics of Unmanned Arial Vehicles (Drones) and its connected sensor through various applications.
5. The course imparts the working principle of the drone and explains the components that are used to build the drone devices

Course Outcomes:

By the end of the course, the student will be able to:	
1	Discuss the foundations of IoT, challenges and issues, architectures and its functionality
2	Apply and use of Sensors, actuators and its connected components in designing models
3	Explain various protocols and configurations of IoT and discuss different layers and its protocols.
4	Describe the development of unmanned aircraft systems (UAS) and design and fabrication of Drones
5	Describe drone concepts, terminology and vocabulary

Mapping of Course Outcomes with Program Outcomes:

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	1	-	1	1	1
2	2	1	3	3	3
3	2	1	2	2	2
4	3	1	2	2	3
5	2	-	2	2	2

SYLLABUS

UNIT I

10 Periods

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT II

10 Periods

Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT III

10 Periods

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT IV: INTRODUCTION TO DRONE TECHNOLOGY

10 Periods

Introduction - Basics of Flights, Different types of flight vehicles, Components and functions of an airplane, Forces acting on Airplane, Physical properties and structure of the atmosphere, UAV (Unmanned Aerial Vehicle- Drone), Definition, History of UAV , Characteristics of UAV, Applications of UAV (Defence, Civil, Environmental monitoring), Difference between Aircraft and UAV

UNIT V: (COMPONENTS OF DRONES) - DRONE DESIGN AND FABRICATION

10 Periods

Types of Drones, Components of a Drone, Frames: Lightweight and sold material, Working principles of Electromagnetic Motors, Types of Motors (Brushed DC motor, Brushless DC motor, Induction Motor), Microcontroller/microprocessor (Arducopter Flight Controller), Working principles of Electromagnetic radiations, Radio Transmitter and Receiver, Li-ion Battery, Electric Speed Controller, Global Positioning System, Camera

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).
3. Mohammad H. Sadraey, Unmanned Aircraft Design A Review of Fundamentals, MORGAN & CLAYPOOL PUBLISHERS, 2017

Reference Books:

1. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0
2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017
3. Andrew J. Keane and James P. Scanlan, Small Unmanned Fixed-wing Aircraft Design: A Practical Approach,

ONLINE WEB RESOURCES:

<https://www.coursera.org/specializations/iot>

[https://dgt.gov.in/sites/default/files/DRONE%20TECHNICIAN%20NSQF%20LEVEL 4. pdf](https://dgt.gov.in/sites/default/files/DRONE%20TECHNICIAN%20NSQF%20LEVEL%204.pdf)

PATTERN RECOGNITION	
Code:23 AM123 (C)	Credits:3
Instruction: 3 Periods/Week	Sessional Marks: 40
Final Exam: 3 Hours	End Exam Marks: 60

Pre requisites: Number Theory and Linear Algebra, Data Structures, Artificial Intelligence

Course Objectives: To analyze and apply the foundations of pattern recognition, various classification and clustering techniques, ensemble classifiers used in Pattern Recognitions

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Discuss the basic foundations of Pattern Recognition, mathematical concepts and Bayesian decision theory and parameter estimation methods
2.	Illustrate data transformation and dimensionality reduction techniques
3.	Describe probability density functions
4.	Apply linear classifiers
5.	Apply non-linear classifiers

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	1	1	1	2
2	2	1	2	2	3
3	1	1	2	3	3
4	2	1	2	3	3
5	2	1	2	3	3

SYLLABUS

UNIT-I

10 Periods

Introduction: Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions.

UNIT- II

10 Periods

Data Transformation and Dimensionality Reduction: Introduction, Basis Vectors, The Karhunen Loeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introduction only). Nonlinear Dimensionality Reduction, Kernel PCA.

UNIT-III

10 Periods

Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture Models, Naive-Bayes Classifier, The Nearest Neighbor Rule.

UNIT-IV

10 Periods

Linear Classifiers: Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate.

UNIT-V

10 Periods

Nonlinear Classifiers: The XOR Problem, The two Layer Perceptron, Three Layer Perceptron, Back propagation Algorithm, Basic Concepts of Clustering, Introduction to Clustering , Proximity Measures.

Text Books:

Pattern Recognition: Sergios Theodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Paper Back), 4th edition.

Reference Books:

1. The Elements of Statistical Learning: Trevor Hastie, Springer-Verlag New York, LLC (Paper Back), 2009.
2. Pattern Classification: Richard O. Duda, Peter E. Hart, David G. Stork. John Wiley & Sons, 2012.

ARTIFICIAL INTELLIGENCE IN ROBOTICS	
Code:23 AM124(A)	Credits: 3
Instruction: 3 Periods / Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisite:

- 1 Basic Engineering Mathematics, Kinematics of Machinery, Basic Electrical and electronics engineering

Course Objectives:

- 1 The objective of this course is to impart knowledge about robots for their control and design in various industrial and general applications

Course Outcomes:

At the end of the course the student will be able to:	
CO-1	Explain the anatomy of robots, workspaces, robot types, end effector functions, and principles of actuation and drive systems.
CO-2	Apply kinematics, DH parameters, obstacle-aware trajectory planning, and control systems for accurate, adaptable, and safe robot motion.
CO-3	Describe various sensors, feedback systems and image processing techniques in robot.
CO-4	Apply programming languages to develop robotic systems and control their behavior.
CO-5	Comprehend the application of AI and ML concepts for operation of robots

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	-	2	2	2
2	2	1	3	2	3
3	2	-	2	2	2
4	2	1	3	2	3
5	1	-	2	2	2

SYLLABUS

UNIT - I

10 Periods

Basics of Robotics

Definition and scope of robotics, Historical overview of robotics, Laws of robotics, overview of robotic systems and components, Robot workspaces and configurations, Types of robots and their applications, End effectors and grippers for different tasks and selection criteria. Actuation and drive systems in robot

UNIT - II

10 Periods

Kinematics and Control of Robot

Kinematics: Scaling, Rotation and homogenous transformation matrix, Forward kinematics and inverse kinematics, Denavit Hartenberg (DH) parameters,

Trajectory planning: Trajectory planning and path generation for robot motion- steps in trajectory planning, Joint Space Techniques, Cartesian Space Techniques.

Robot Control: P,I,D, PD, PI, PID control, adaptive control.

UNIT - III

10 Periods

Sensors and Computer Vision in Robot

Feedback System: Open and closed loop feedback systems.

Robot sensors: Sensor types and characteristics (Range, proximity, vision, force and torque), Sensor fusion and filtering techniques.

Computer Vision in Robotics: Image processing and feature extraction, Object detection, tracking, and recognition, Visual servoing and robot vision applications.

UNIT - IV

10 Periods

Robotic Programming and simulation

Programming languages for robotics (C++, Python, ROS), Behavior-based programming and robot architectures, Robot simulation and visualization tools.

Applications: Robotics at Agriculture, Automotive, Supply Chain, Healthcare, Warehouses - material Transfer, Material handling, loading and unloading; Processing - spot and continuous welding

UNIT - V

10 Periods

AI Powered Robotics

AI and Machine Learning for Robotics: Reinforcement learning for robot control, Deep learning in perception and decision-making,

Advanced Topics in Robotics: Human-robot interaction and collaboration, Mobile robots and navigation, Swarm robotics and multi-robot systems.

TEXT BOOKS:

1. Robert J. Schilling, "Fundamentals of Robotics Analysis and Control", PHI Learning,
2. Francis X. Govers , "Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques".
3. Groover M P, "Industrial Robotics", Pearson Edu.
4. Mittal R K & Nagrath I J, "Robotics and Control", TMH.

REFERENCE BOOKS:

1. Fu K S, Robotics, McGraw Hill.
2. Rich and Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2014.

WEB RESOURCES:

- 1 <http://ecoursesonline.iasri.res.in/course/view.php?id=82>
- 2 https://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html
- 3 https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
- 4 <https://www.iiitdmj.ac.in/ict.iiitdmj.ac.in/summer-courses-2020/R-AI/>
- 5 https://ocw.snu.ac.kr/sites/default/files/NOTE/Chap12_Robot%20programming%20languages.pdf
- 6 <https://www.plyrotech.com/blog/artificial-intelligence-machine-learning-and-robotics/#:~:text=Robotic%20Process%20Automation%20is%20an,scale%20Internet%20companies%20are%20built.>

NO SQL	
Code:23 AM124(B)	Credits:3
Instruction : 3 Periods /Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks :60

Prerequisites:

1. Knowledge on Relational Database management systems.

Course Objectives:

- 1 Distinguish and describing how NoSQL databases differ from relational databases from theoretical perspective.
2. Explore the origins of NoSQL databases and the characteristics .
3. Demonstrate competency in selecting a particular NoSQL database for specific usecases.
4. Demonstrate Document databases with MongoDB.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Compare and contrast the uses of relational RDBMSs and NoSQL systems for different types of data and applications.
2.	Differentiate various data models.
3.	Recognize Key value Databases and document databases.
4.	Create a sample database using NoSql.
5.	Apply the Query concepts in MongoDB database

Mapping of course outcomes with program outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	1	-	1	2	1
2	2	1	2	2	2
3	2	1	2	1	2
4	2	1	3	2	3
5	3	1	3	2	3

SYLLABUS

UNIT-I :

10 Periods

Why NoSQL?

The value of relational databases – Impedance mismatch – Application and integration databases – Attack of the cluster.

UNIT-II :

10 Periods

Aggregate Data Models :

Aggregates - Example of Relations and Aggregates – Consequences of Aggregate Orientation -Key-Value and Document Data Models - Column-Family Stores

More Details on Data Models :

Relationships - Graph Databases – Schema less Databases - Materialized Views - Modeling for Data Access.

UNIT –III :

10 Periods

Distribution Models :

Single Server – Sharding - Master-Slave Replication - Peer-to-Peer Replication – Combining Sharding and Replication

Consistency:

Update Consistency - Read Consistency - Relaxing Consistency - The CAP Theorem - Relaxing Durability.

UNIT-IV :

10 Periods

Key-Value Databases:

What Is a Key-Value Store - Key-Value Store Features – Consistency – Transactions - Query Features - Structure of Data – Scaling - Suitable Use Cases - Storing Session Information - User Profiles, Preferences - Shopping Cart Data - When Not to Use - Relationships among Data - Multioperation Transactions - Query by Data - Operations by Sets.

UNIT-V :

10 Periods

Document Databases:

What Is a Document Database? – Features – Consistency – Transactions – Availability - Query Features – Scaling - Suitable Use Cases - Event Logging - Content Management Systems - Blogging Platforms - Web Analytics or Real-Time Analytics - E-Commerce Applications - When Not to Use - Complex Transactions Spanning Different Operations - Queries against Varying Aggregate Structure.

Text Book:

1. Pramod J.Sadalag and Martin Fowler,” NoSQL Distilled, A Brief Guide to the EmergingWorld of Polyglot Persistence” ,1st Edition, Addison Wesley
2. David Hows, Eelco Plugge, Peter Membrey , and Tim Hawkins, “The definitive guide toMongoDB”, “A complete guide to dealing with big data using MongoDB”. 1st Edition, Apress

Reference Books:

1. Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
2. Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

Web Resources:

1. <http://allvidelectures.com/courses/course/96uv57kBOZ>.
2. <https://university.mongodb.com/>

NATURAL LANGUAGE PROCESSING	
Code:23 AM124 (C)	Credits : 3
Instruction : 3 Periods /Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Mathematical Concepts like Calculus, Linear Algebra and Probability.

Course Objectives:

1. To understand the steps involved in Natural language processing
2. To learn about the lexical, syntactic and semantic analysis of natural language processing
3. To explore the various parsing techniques for natural languages
4. To understand the statistical models for Natural language processing
5. To learn about the various applications involved in Natural language processing

Course Outcomes:

By the end of the course, the student will be able to:

1.	Justify the various steps necessary for processing natural language
2.	Suggest appropriate lexical and parsing techniques for a given natural language
3.	Apply appropriate statistical models for a given natural language application
4.	Modify existing algorithms to suit any natural language for processing
5.	Suggest appropriate pre-processing steps essential for the various applications involving natural language processing

CO-PO Mapping:

CO	PO			PSO	
	1	2	3	1	2
1	2	1	2	3	2
2	2	1	3	2	3
3	3	1	3	2	3
4	3	-	3	3	2
5	3	1	3	3	3

SYLLABUS

UNIT-I

10 periods

Lexical Analysis - Regular expression and Automata for string matching - Words and Word Forms - Morphology fundamentals - Morphological Diversity of Indian Languages - Morphology Paradigms - Finite State Machine / Transducers Based Morphology - Automatic Morphology Learning - Parts of Speech - N-gram Models –

UNIT- II

10 periods

Biology of Speech Processing - Place and Manner of Articulation - Word Boundary Detection - Argmax based computations - HMM and Speech Recognition - Text to Speech Synthesis - Rule based- Concatenative based approach.

UNIT-III

10 periods

Theories of Parsing - Parsing Algorithms – Earley Parser - CYK Parser - Probabilistic Parsing - CYK - Resolving attachment and structural ambiguity - Shallow Parsing - Dependency Parsing - Named Entity Recognition - Maximum Entropy Models - Conditional Random Fields.

UNIT-IV

10 periods

Meaning: Lexical Knowledge Networks - Wordnet Theory - Indian Language Wordnets and Multilingual Dictionaries - Semantic Roles - Word Sense Disambiguation - WSD and Multilinguality - Metaphors - Coreference and Anaphora Resolution.

UNIT-V

10 periods

Applications: Sentiment Analysis - Text Entailment - Machine Translation - Question Answering System - Information Retrieval - Information Extraction - Cross Lingual Information Retrieval (CLIR)

TEXT BOOKS:

1. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, First Edition, O'reilly, 2009

REFERENCE BOOKS:

1. Yoav Goldberg, University of Toronto, Neural Network Methods for Natural language Processing, Morgan & Claypool, 2017
2. Christopher D. Manning, and Hinrich Schütze. Foundations of statistical natural language processing. First Edition, MIT press, 1999

E-Resources:

1. <https://www.coursera.org/learn/language-processing>
2. <https://www.nltk.org/book/>

DEEP LEARNING LAB	
Code:23AM125	Credits: 2
Instruction : 3 Periods/Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites:

1. Mathematical Concepts like Statistics, Calculus, Linear Algebra and Probability.

Course Objectives:

1. Introduce the basics of Deep neural networks
2. Cover various deep learning algorithms, such as convolutional neural networks (CNNs), recurrent neural networks (RNNs)
3. Familiarize students with popular deep learning frameworks and libraries like TensorFlow, PyTorch, and Keras, enabling them to implement deep learning models effectively.
4. Teach students how to train deep neural networks using various optimization techniques, weight initialization, regularization, and hyperparameter tuning.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Build a neuron from the scratch, Understand and implement the concepts of neural networks using pytorch, tensorflow and keras
2.	Implement different activation functions and loss function
3.	Implement the concepts of different gradient descent approaches and accuracy measures.
4.	Perform Image classification and word embeddings.

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	1	3	2	2
2	3	1	2	2	2
3	3	1	3	3	3
4	3	2	3	3	2

LIST OF EXPERIMENTS

1. Realizing logistic regression as a neuron (use insurance dataset) (CO 1)
2. Installing tensorflow on local machine, differentiating pytorch, tensorflow and keras (CO 1)
3. Build a neural network in tensorflow and python for handwritten digits classification (CO 1)
4. Implementing different activation functions. (CO 2)
5. Implement matrices, loss function. (CO 2)
6. Implement Gradient Descent For Neural Network(CO 3)
7. Implement Stochastic gradient descent, batch gradient descent and mini batch gradient descent for a neural network. (CO 3)
8. Case study of customer churn prediction using a dataset from Kaggle. (CO 3)
9. Implementing the concepts of true positive, false positive, true negative, false negative, precision and recall, F1 score. (CO 3)
10. Image classification using CIFAR10 dataset in tensorflow using CNN(CO 4)
11. Computing word embeddings(CO 4)
12. Implement word2vec model in python gensim library for amazon product reviews(CO 4)

Text Books:

1. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, "Dive into Deep Learning", 2021

Reference Books :

1. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Education, 2004.
2. Simon Haykin, "Neural Networks-A comprehensive Foundation" Second edition
3. Charu C. Aggarwal, "Neural Networks and Deep Learning-A Textbook", Springer, 2018.

E-Resources:

1. https://www.youtube.com/playlist?list=PLeo1K3hjS3uu7CxAacxVndI4bE_o3BDtO
2. <https://www.analyticsvidhya.com/blog/2018/04/fundamentals-deep-learning-regularization-techniques/>
3. <https://www.analyticsvidhya.com/blog/2021/05/a-comprehensive-tutorial-on-deeplearning-part-1/>
4. <https://viso.ai/deep-learning/deep-reinforcement-learning/>
5. Michael Nielsen, Neural Networks and Deep Learning, <http://neuralnetworksanddeeplearning.com/>
6. Introduction to Deep Learning, MIT 6.S191 Alexander Amini January 28, 2019, <http://introtodeeplearning.com/>

ARTIFICIAL INTELLIGENCE IN ROBOTICS LAB	
Code:23 AM126(A)	Credits: 2
Instruction:3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Cycle – I

1. Introduction to Robot Analyzer Software
2. Perform the Forward kinematics of a 2-DOF planar robot, 3-DOF anthropomorphic arm & a 3-DOF wrist and KUKA KR5 Arc Robot.
3. Perform the Inverse kinematics of a 2-DOF planar robot, 3-DOF anthropomorphic arm & a 3-DOF wrist and KUKA KR5 Arc Robot.
4. Workspace Analysis of a 6 axis Robot
5. Inverse and Forward Dynamics of Robots
6. Creating Robot Joint Trajectories

Cycle – II

1. Introduction to Firebird V wheeled Robot- sensors actuator
2. IO Buzzer Programming using embedded C
3. Motion Control of Firebird V
4. Velocity Control of Firebird V using PWM
5. LCD Interfacing for Firebird V
6. Programming Firebird V to Follow the White Line

TEXT BOOKS:

1. Robert J. Schilling, “Fundamentals of Robotics Analysis and Control”, PHI Learning,
2. Francis X. Govers , “Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques”.
3. Groover M P, “Industrial Robotics”, Pearson Edu.
4. Mittal R K & Nagrath I J, “Robotics and Control”, TMH.

REFERENCE BOOKS:

1. Fu K S, Robotics, McGraw Hill.
2. Rich and Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2014.

WEB RESOURCES:

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=82>
2. https://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html
3. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
4. <https://www.iiitdmj.ac.in/ict.iiitdmj.ac.in/summer-courses-2020/R-AI/>
5. https://ocw.snu.ac.kr/sites/default/files/NOTE/Chap12_Robot%20programming%20languages.pdf
6. <https://www.plyrotech.com/blog/artificial-intelligence-machine-learning-and-robotics/#:~:text=Robotic%20Process%20Automation%20is%20an,scale%20Internet%20companies%20are%20built.>

No SQL LAB	
Code:23 AM126(B)	Credits : 2
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites: DBMS

Course Objectives:

- Distinguish and describing how NoSQL databases differ from relational databases from theoretical perspective.
- Explore the origins of NoSQL databases and the characteristics.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Apply Neo4J techniques for record data.
2.	Apply Redis techniques for key value databases.
3.	Apply Mongo DB techniques for Document stores.
4.	Apply Cassandra techniques for Column Family Stores.

Mapping of Course Outcomes with Program Outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	2	1	2	1	1
2	2	1	2	1	1
3	2	1	2	2	2
4	2	1	3	2	2

Experiment 1: Introduction / NoSQL Database:

Import the Hubway data into Neo4j and configure Neo4j. Then, answer the following questions using the Cypher Query Language:

- a) List top 10 stations with most outbound trips (Show station name and number of trips)
- b) List top 10 stations with most in bound trips (Show station name and number of trips)

Experiment 2: Key-Value Databases Redis Lab

Redis lab using sets ,lists,hashes

Experiment 3: Document Stores MongoDB Lab

Download a zip code dataset at <http://media.mongodb.org/zips.json> .Use mongo import to import the zip code dataset into Mongo DB. After importing the data, answer the following questions by using aggregation pipelines:

- a. Find all the states that have a city called "BOSTON". Find all the states and cities whose names include the string "BOST".
- b. Each city has several zip codes. Find the city in each state with the most number of zip codes and rank those cities along with the states using the city populations. Mongo DB can query on spatial information.

Experiment 4 :Column Family Stores Cassandra Lab

Create a any database for example that stores road cars. Cars have a manufacturer, a type. Each car has a maximum performance and a maximum torque value. Do the following: Test Cassandras replication schema and Consistency models.

Text Book:

1. Pramod J.Sadalag and Martin Fowler," NoSQL Distilled, A Brief Guide to the Emerging World of Polyglot Persistence" ,1st Edition, Addison Wesley
2. David Hows, Eelco Plugge, Peter Membrey , and Tim Hawkins, "The definitive guide to MongoDB", "A complete guide to dealing with big data using MongoDB". 1st Edition, Apress

Reference Books:

1. Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
2. Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

Web Resources:

1. <http://allvidelectures.com/courses/course/96uv57kBOZ>.
2. <https://university.mongodb.com/>

NATURAL LANGUAGE PROCESSING LAB	
Code:23 AM126 (C)	Credits : 2
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites:

1. Python Programming

Course Objectives:

1. To analyze the text syntactically and semantically
2. To Implement recurrent network for language models and Develop sentiment classification models and chatbot systems

Course Outcomes:

By the end of the course, the student will be able to:	
1	Analyze the text syntactically
2	Analyze the text content Semantically
3	Implement language models
4	Implement a sentiment classification

Mapping of course outcomes with program outcomes:

CO	PO			PSO	
	1	2	3	1	2
1	3	1	2	3	2
2	3	1	3	3	2
3	3	1	3	3	3
4	3	1	3	3	3

LIST OF EXPERIMENTS:

- | | |
|--|-----|
| 1. Convert the text into tokens and find the word frequency | CO1 |
| 2. Demonstrate a bigram and trigram language model | CO1 |
| 3. Perform Lemmatization and Stemming | CO1 |
| 4. Identify parts-of Speech using Penn Treebank tag set. | CO1 |
| 5. Implement HMM for POS tagging and Build a Chunker | CO1 |
| 6. Find the synonym of a word and antonym of a word using WordNet | CO2 |
| 7. Implement semantic role labeling to identify named entities | CO2 |
| 8. Implement POS tagging using LSTM | CO3 |
| 9. Implement Named Entity Recognizer | CO3 |
| 10. Develop a movie review system (sentiment analysis on movie data) | CO4 |

TEXT BOOKS:

1. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, First Edition, O'reilly, 2009

REFERENCE BOOKS:

1. Yoav Goldberg, University of Toronto, Neural Network Methods for Natural language Processing, Morgan & Claypool, 2017
2. Christopher D. Manning, and Hinrich Schütze. Foundations of statistical natural language processing. First Edition, MIT press, 1999

E-Resources:

1. <https://www.coursera.org/learn/language-processing>
2. <https://www.nltk.org/book/>

TEACHING AND LEARNING IN HIGHER EDUCATION	
Code:23 AM128	Credits: 0
Instruction: 2Periods / Week	Sessional Marks: 50
End Exam: -	End Exam Marks: -

Course Objectives:

1. Develop a comprehensive understanding of diverse teaching strategies, motivational factors, and learning styles to create engaging and effective learning environments.
2. Acquire the skills needed to design and implement well-structured curricula, assessments, and e-learning experiences while adhering to quality enhancement principles.
3. Cultivate the ability to foster student-centered learning through the application of various teaching methods, supporting computational thinking, and optimizing student support mechanisms.

By the end of the course, the student will be able to:

1.	Apply diverse teaching strategies that accommodate various learning styles and engage learners effectively.
2.	Design curricula using a learning outcomes approach that considers student motivation and aligns with credit level descriptors.
3.	Utilize technology-enhanced teaching strategies, including PowerPoint and e-learning platforms, to deliver engaging and impactful lessons.
4.	Design and implement effective assessment methods and contribute to quality enhancement through assessment and supervision.
5.	Create a student-centered learning environment by applying a variety of teaching methods, including practical work and computational thinking principles.

CO	PO			PSO	
	1	2	3	1	2
1	1	2	1	1	1
2	2	2	2	1	1
3	2	2	2	2	2
4	2	2	2	2	2
5	1	2	3	3	3

SYLLABUS

UNIT- I

6 Periods

Understanding student learning: Major views of learning, Approaches to study, the solo taxonomy of levels of understanding, threshold concepts, adult learning theory, experiential learning, and reflection, learning styles and related ideas, teaching for learning.

UNIT- II

6 Periods

Encouraging student motivation: amotivation and achievement motivation, motives and behavior, measuring student motivation, the development of motivation, encouraging student motivation.

Planning teaching and learning: a learning outcomes approach to curriculum design, credit level descriptors, curriculum design and development, evaluation.

UNIT- III

6 Periods

Lecturing to large groups: the outstanding lecture, lecturing to a varied student group, managing disruptive behavior, effective use of PowerPoint.

e-learning – an introduction: e-learning platforms, e-learning in practice, the role of the teacher in e-learning.

UNIT- I V

8 Periods

Assessing student learning: beliefs about assessment, purposes of assessment, principles of assessment design.

Supervising projects and dissertations: why projects and dissertations? The role of project and dissertation supervisor.

Teaching quality, standards and enhancement; the contemporary quality agenda, enhancing and managing quality: the role of the lecturer.

UNIT- V

8 Periods

Curriculum design and delivery : the lecture, enquiry-based learning, practical work, web-based laboratories ,assessment.

key aspects of teaching and learning in computing science: the academic aspect – computational thinking: curriculum, teaching programming, teaching methods, teaching large groups, group work, assessment, student support.

Textbooks:

1. Heather Fry, Steve Ketteridge ,Stephanie Marshall, “A Handbook for Teaching and Learning in Higher Education” 3rd Edition, Routledge Taylor & Fransis Group, New York and London.