B. Tech Computer Science and Engineering (Artificial Intelligence and Data Science)
Modified Scheme of Studies/Examination (w.e.f. Session 2023-24)
Semester VII

S.No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	HM-CS-AIDS-401A	Business Intelligence and Data Visualization	3:0:0	3	3	75	25	0	100	3
2	HSS-403A	Universal Human Values II: Understanding Harmony	3:0:0	3	3	75	25	0	100	3
3	OEC	OEC Elective*-II	3:0:0	3	3	75	25	0	100	3
4	PE	Elective* - I	2:0:0	2	2	75	25	0	100	3
5	PE	Elective* - II	2:0:0	2	2	75	25	0	100	3
6	HM-CS-AIDS-405A	Data Visualization Lab	0:0:2	2	1	0	40	60	100	3
7	PE-LA	Elective-I Lab	0:0:2	2	1	0	40	60	100	3
8	PC-CS-AIDS-409LA	Project**-I	0:0:10	10	5	0	100	100	200	3
9	PC-CS-AIDS-413A	Industrial Training***	0	0	3	0	100	0	100	0
		Total		**27**	**23**	**375**	**405**	**220**	**1000**	24

Code	PE- Elective* - I	Code	PE- Elective* - II
PE-CS-AIDS-415A	ANN and Deep Learning	PE-CS-AIDS-423A	High Performance Computing
PE-CS-AIDS-417A	Data Mining & Predictive Modelling	PE-CS-AIDS-425A	Human AI Interaction
PE-CS-AIDS-419A	Predictive Analysis	PE-CS-AIDS-427A	Software Testing
PE-CS-AIDS-421A	Advance Computer Architecture	PE-CS-AIDS-429A	Natural Language Processing

Code	OEC Elective*-II	Code	PE-LA-Elective*-I Lab
OE-CS-AIDS-401	Cyber Law and Ethics	PE-CS-AIDS-415LA	ANN and Deep Learning Lab
OE-CS-AIDS-403	Probability for Data Science	PE-CS-AIDS-417LA	Data Mining & Predictive Modelling Lab
OE-CS-AIDS-405	Cluster Computing	PE-CS-AIDS-419LA	Predictive Analysis Lab
OE-CS-AIDS-407	Microprocessor	PE-CS-AIDS-421LA	Advance Computer Architecture Lab

Note:
*The students will choose any two departmental Electives courses and One Open Elective course out of the given elective list in VII Semester.

**Project should be initiated in the beginning of 7th semester, and should be completed by the end of 7th semester with good Report and power-point Presentation etc.

***4-6 weeks hand on training completed after 6th Semester Exams

HM-CS-AIDS-401A	Business Intelligence and Data Visualization						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	This course introduces basic BI technologies. BI With data mining, it is possible to better manage product warranties, predict purchases of retail stock, unearth fraud, determine credit risk, and define new products and services.						
Course Outcomes							
CO1	Students will learn the principles and best practices for how to use data in order to support fact-based decision making.						
CO2	Emphasis will be given to applications in marketing, where BI helps in the Businesses.						
CO3	BI helps performing for sales analysis and in application domains						
CO4	Practical experience will be gained by developing a BI project (case-study) with leading BI software.						

Unit-I

An Overview of Business Intelligence: Analytics and Decision Support A Framework for Business Intelligence (BI). Intelligence Creation Use and BI Governance. Transaction Processing Versus Analytic Processing. Successful BI Implementation. Analytics Overview. Brief introduction to Big Data Analytics.

Unit-II
Data Warehousing: Data Warehousing Process Overview. Data Warehousing Architectures. Data Integration and the Extraction, Transformation, and Load Processes. Data Warehouse Development. Data Ware housing Implementation Issues. Real-Time Data Warehousing. Data Warehouse Administration, Security Issues and Future Trends

Unit-III
Big Data and Analytics: Definition of Big Data. Fundamentals of Big Data Analytics. Big Data Technologies. Data Scientist. Big Data and Data Warehousing. Big Data Vendors. Big Data and Stream Analytics. Applications of Stream Analytics

Unit-IV
Data Visualization: Business Reporting, Visual Analytics and Business Performance Management Business Reporting Definitions and Concepts. Data and Information Visualization. Different Types of Charts and Graphs. The Emergence of Data Visualization and Visual Analytics. Performance Dashboards. Business Performance Management. Performance Measurement. Balanced Scorecards. Six Sigma as a Performance Measurement

System

Suggested Books:

The Visual Display of Quantitative Information by Edward R. Tufte
Business Intelligence: Making Better Decisions Faster by Elizabeth Vitt , Michael Luckevich, Stacia Misner
Business Intelligence Competency Centers: A Team Approach to Maximizing Competitive Advantage (Hardcover)by Gloria J. Miller

HSS-403A	Universal Human Values II: Understanding Harmony						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hours
Purpose	Purpose and motivation for the course, recapitulation from Universal Human Values-I						
Course Outcomes (CO)							
CO1	Development of a holistic perspective based on self-exploration about						
CO2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.						
CO3	Strengthening of self-reflection.						
CO4	Development of commitment and courage to act.						

Module 1: Course Introduction-Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process;' Natural Acceptance' and Experiential Validation-as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility-the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. UnderstandingHappinessandProsperitycorrectly-Acriticalappraisalofthecurrentscenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence)rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being-Harmony in Myself!

1. Understanding human being as a co-existence of the sentient'I'and the material'Body'
2. Understanding the needs of Self('I') and 'Body'-happiness and physical facility
3. Understanding the Body as an instrument of 'I'(I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I'and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring healthvs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal

values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness(trust)and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence-Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Inter connectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used) pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order: a.At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
7. Sumup.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg.to discuss the conduct as an engineer or scientist etc.

READINGS:

TextBook

1. Human Values and Professional Ethics by RRGaur, R Sangal, GP Bagaria, Excel Books, New Delhi,2010

Reference Books

1. Jeevan Vidya: E k Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
2. Human Values, A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
5. Small is Beautiful-E.F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj-Pandit Sunder lal
9. Rediscovering India –by Dharampal
10. Hind Swaraj or Indian Home Rule-by Mohandas K.Gandhi
11. India Wins Freedom-Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland (English)
13. Gandhi-Romain Rolland (English)

MODE OF CONDUCT

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to

his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to atleast one 8-day FDP on Universal Human Values is deemed essential.

ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:
Assessment by
Faculty mentor: 5 marks
Self-assessment: 5 marks
Assessment by peers : 5 marks
Socially relevant project/Group Activities/Assignments: 10 marks
Semester End Examination: 75marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	OEC	**OEC Elective-II**	3:0:0	3	3	75	25	0	100	3

OE-CS-AIDS-401	Cyber Law and Ethics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hours
Purpose	To gain a broad understanding in order to get cyber law and ethics.						
Course Outcomes (CO)							
CO 1	To facilitate the basic knowledge of cyber Law.						
CO 2	To learn about how to maintain the Confidentiality, Integrity and Availability of information technology act.						
CO 3	To get enable to fix the various Cyber Law and Related Legislation.						
CO 4	To deal with the Cyber Ethics.						

Unit-1: Introduction to Cyber Law
Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Unit-2: Information Technology Act
Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Unit-3: Cyber Law and Related Legislation
Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

Unit-4: Cyber Ethics
The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.
Suggested Books:
1. Cyber Security : Understanding Cyber Crimes , Computer Forensics and Legal
Perspectives By Nina Godbole, Sunit Belapur , Wiley
2. Understanding cybercrime: phenomena , and legal challenges response, ITU 2012.

OE-CS-AIDS-403	Probability for Data Science						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To understand the foundations of probability and its relationship to statistics and data science.						
Course Outcomes (CO)							
CO1	Understand the mathematical framework for probability theory						
CO2	Understand various kinds of Random Variables that are fundamental to probabilistic modeling.						
CO3	To Learn Statistical Concept in Data Analytics						
CO4	Explore some introductory concepts from statistics that are helpful in analyzing data and machine learning.						

Unit I

Probability Theory: Counting, combinations, permutations, binomial and multinomial coefficients,Stirling's formula. Discrete probability spaces (with examples). Axiomatic definition of probability, inclusion-exclusion formula, independence, condition probability, Bayes' rule.

Unit II

Random variables: definition, distribution function and its properties, probability mass function (binomial, Bernoulli, Poisson, geometric), probability density function (uniform, exponential, Gaussian).Joint distributions, independence and conditioning of random variables. Function of random variables, change of variable formula.

Unit III

Measures of central tendency, dispersion and association – expectation, median, variance, standard deviation, mean absolute deviation, covariance, correlation and entropy (definitionand guidelines on how to choose a particular measure). Markov and Chebyshev inequalities, Notion of convergence in probability and distribution. Weak law of large numbers andcentral limit theorem (examples demonstrating the use of WLLN and CLT). Montecarlo methods (estimating value of e, π, simulation of birthday paradox). Poisson limit for rare events.

Unit IV

Statistics: Using probability to understand data (give real life examples). Frequentist approach - point and range estimates, confidence intervals, hypothesis testing p-values, significance level, power and t-test. Bayesian inference–maximum likelihood estimation. Regression

Textbooks:

Sheldon Ross, Introduction to Probability and Statistics for Engineers, 5/e (2014), Elsevier

Reference Books:
Morris H. DeGroot and Mark J. Schervish, Probability and Statistics (4/e)(2012), Addison-Wesley.
Blitzstein and Hwang, Introduction to Probability (2015), CRC Press.
William Feller, An Introduction to Probability, (3/e) (2008), Volume 1, Wiley.
Freedman, Pisani, Purves, Statistics (4/e)(2014), W. W. Norton & Company

OE-CS-AIDS-405	Cluster Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	The objective is to learn emerging techniques in Cluster Computing and its applications.						
Course Outcomes (CO)							
CO1	Remember and understand the basic concepts/Principles of distributed Systems						
CO2	Analyze the Various Concepts of Cluster Computing						
CO3	Able to describe different parallel processing platforms involved in achieving high performance computing						
CO4	Develop efficient and high-performance parallel programming.						

UNIT I

Basic concepts in Distributed Systems: Notion of time Distributed Mutual exclusion, Consensus, Failure models Paradigms for process interaction in distributed programs, Programming Paradigms, Shared memory, Message passing, Workflows.

UNIT II

Introduction to Cluster Computing, Cluster Middleware, Early Cluster Architecture and High Throughput Computing Clusters, Networking, Protocols and I/O for Clusters, Setting Up and Administering a Cluster, Overview of Cluster Computing, Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and Single System Image.

UNIT III

Cluster Technology for High Availability, Performance Models and Simulation, Process Scheduling, Resource Management and Scheduling, Programming, Environments and Tools, Load Sharing and Load Balancing, Distributed Shared Memory, Cluster Applications, Cluster Systems.

UNIT IV
Beowulf Cluster: The Beowulf Model, Application Domains, Beowulf System Architecture, Software Practices, Parallel Programming with MPL, Parallel Virtual Machine (PVM). System Infrastructure, Traditional paradigms for distributed computing, Web Services, Grid standards: OGSA and WSRF, Case Studies of Cluster Systems: COMPaS, NanOS and PARAM

TEXTBOOKS:

Rajkumar Buyya High Performance Cluster Computing: Architectures and Systems. Prentice-Hall India, 1999.

High Performance Cluster Computing: Architectures and Systems, Vol.1, Prentice Hall

Grid and Cluster Computing, Prabhu C.S.R,PHI Learning Private Limited

In search of clusters(2nded.),Gregory F.P fister,IBM, Austin,TX,Prentice-Hall

Distributed and Cloud Computing, First Edition, Geoffrey C.Fox, Kai Hwang, Jack J. Dongarra, Elsevier India Pvt. Ltd.-New Delhi

Laurence T.Yang, Minyi Guo – High Performance Computing Paradigm and Infrastructure John Wiley

OE-CS- AIDS-407	Microprocessor						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3Hour
Purpose	To learn the architecture and programming of Intel family microprocessors and its interfacing.						
Course Outcomes							
CO1	To study the Architecture of 8086 microprocessors						
CO2	To implement the interfacing of memories to 8086 Microprocessor						
CO3	To learn and analyze the instruction set of 8086 Microprocessor and implementation of assembly language programming of 8086 Microprocessor.						
CO4	To design and implement the interfacing of interrupts, basic I/O and DMA with 8086 Microprocessor						

Unit I

8086 CPU ARCHITECTURE: 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

UNIT-II

Main Memory System Design: Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS/PROMS. Interfacing and refreshing DRAMS.

UNIT-III

8086 Instruction Set: Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives.
8086 Programming Techniques: Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions.

UNIT-IV

Basic I/O Interface: Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086.ADCs and DACs, - types, operation and interfacing with 8086. Interfacing Keyboards, alphanumeric displays, multiplexed displays, and step per motor, optical encoder with 8086.
Interrupts and DMA: 8086 Interrupt mechanism; interrupt types and interrupt vector table. Applications of interrupts, Intel's 8259. DMA operation. Intel's 8237.

Suggested Books:

Barry B. Brey ," The Intel Microprocessor 8086/8088,80186",Pearson Education, Eighth Edition, 2009

D.V. Hall, Microprocessors and Interfacing, Mc Graw Hill2nded.

Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI, 2005

Kenneth Ayala ,"The 8086 Microprocessor: Programming & Interfacing the PC", Cengage Learning,

Indian Edition, 2008

KipIrvine ,"Assembly language for IBM PC", PHI, 2nd Edition, 1993

Peter Abel, " Assembly language programming", Pearson Edu,5th Edition, 2002

Uffenback, "The 8086 Family Design" PHI, 2nd Edition.

Walter A Triebel and Avtar Singh; The 8088 and 8086 Microprocessors

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	**PE**	**Elective - I**	2:0:0	2	2	75	25	0	100	3

Code	PE- Elective - I
PE-CS-AIDS-415A	ANN and Deep Learning
PE-CS-AIDS-417A	Data Mining & Predictive Modelling
PE-CS-AIDS-419A	Predictive Analysis
PE-CS-AIDS-421A	Advance Computer Architecture

PE-CS-AIDS-415A	ANN and Deep Learning						
L	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	0	0	2	75	25	100	3 hrs
Purpose	Purpose To provide knowledge of various artificial neural networks and deep learning algorithms for optimization						
Course Outcomes (CO)							
CO 1	To learn the basics of artificial neural networks concepts, various neural networks architecture						
CO 2	To explore knowledge of special types of Artificial neural networks						
CO 3	To understand the basics of Deep learning and its applications						
CO 4	To imprise about the different deep learning algorithms and their applications to solve real world problems.						

UNIT-I

Artificial Neural Networks: Human brain, Model of an artificial neuron, Basic concepts of neural networks, fundamentals of biological neural network and artificial neural network, evolution of neural networks, Characteristics of Neural Networks, learning methods-supervised, unsupervised and reinforcement, taxonomy of neural network architectures, terminologies-weights, bias, threshold, learning rate, applications of Neural Networks.

Unit-II

Supervised and Unsupervised Neural Networks: Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization. Hebb network theory and training algorithm, perceptron networks architecture and training algorithms, Back Propagation networks architecture and Training Algorithms, Associative Memory network architecture and Training Algorithms, Hopfield networks architecture and Training Algorithms, Counter Propagation networks architecture and Training Algorithms, adaptive resonance theory networks architecture and Training Algorithms. Probabilistic Neural Network: Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders

Unit-III

Advanced neural networks: Kohonan self organising feature, maps architecture and training algorithm, learning vector quantization architecture and training algorithm, boltzman machine, cognitron network, neocognitron network, optical neural networks electro-optical multipliers and holographic correlators. Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

Unit-IV

Deep learning: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. Deep Learning research: Object recognition, sparse coding, computer vision, natural language processing Machine learning basics, simple machine learning algorithms-linear regression, underfitting and overfitting challenges in machine learning, supervised learning approach for support vector machine, Deep Forward Networks, Convolutional networks, deep recurrent networks, deep boltzmann machine, applications in speech recognition and natural language processing. Deep Feed Forward network, regularizations, and training deep models, Deep Belief Network..Deep Learning Tools: Caffe, Theano, Torch.

Suggested Books:
1. Li Min Fu, "Neural Networks in Computer Intelligence", McGraw-Hill, Inc. 2012.
2. S N Sivanandam, "Neural Networks using MATLAB 6.0", TMH, 4th Reprint 2015.
3. S N Sivanandam, "Principles of Soft Computing", 2ND Edition, Wiley, Reprint 2014.
4. Freeman J.A. & D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, 2014.
5. Deep Learning (Ian J. Goodfellow, Yoshua Bengio and Aaron Courville), MIT Press, 2016.
6. Deep Learning with Python: A Hands-On Introduction by Ketkar, Apress
7. T2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

PE-CS-AIDS-417A	Data Mining & Predictive Modelling						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs.**
Purpose	The objective of this course is to provide the in- depth coverage of data mining and modelling aspects along with its implementation						
Course Outcomes							
CO 1	Understand the fundamental concept of Data Mining.						
CO 2	Learn Data Mining techniques for Prediction and Forecasting.						
CO 3	Compare the underlying Predictive Modelling techniques.						
CO 4	Select appropriate Predictive Modelling approaches to identify cases and apply using a suitable package such as SPSS modeler .						

Unit-I:
Introduction to Data Mining, concepts of Data mining, Technologies used, Data Mining Process, KDD process models, Mining on various kinds of data, Classification of Data Mining Systems, Application of Data Mining and challenges of Data Mining.

Unit-II:
Data Mining Techniques: Statistical Perspective on Data Mining, Similarity Measures, Clustering- Requirement for Cluster Analysis, Clustering Methods, Decision Tree- Decision Tree Induction, Attribute Selection Measures, Tree Pruning. Association Rule Mining: Frequent Item-set Mining using Apriori Algorithm, Nearest Neighbour Classification: Performance of Nearest Neighbour Classifiers.

Unit-III:
Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

Unit-IV:
Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

Text books:
J Hanes, M. Kamber, Data Mining Concepts and Techniques, Elsevier India.
Predictive & Advanced Analytics (IBM ICE Publication)

G.S. Linoff, M.J.A. Berry, Data Mining Techniques, Wiley India Pvt. Ltd.
Berson, S.J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw-Hill

PE-CS-AIDS-419A	Predictive Analysis						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	75	25	100	3 Hrs.
Purpose	Predictive analytics is emerging as a competitive strategy across many business sectors and can set apart high performing companies. It aims to predict the probability of the occurrence of a future event such as customer churn, loan defaults, and stock market fluctuations leading to effective business management.						
Course Outcomes							
CO1	Understand how to use predictive analytics tools to analyze real-life business problems.						
CO2	Demonstrate case-based practical problems using predictive analytics techniques to interpret model outputs.						
CO 3	Learn regression, logistic regression, and forecasting using software tools such as MS Excel, SPSS, and SAS.						
CO4	Understand to Forecasting, Time Series Analysis and develop the Model.						

Unit-I
Introduction to Analytics: Analytics in Decision Making, Descriptive Analytics, Probability Distribution, Hypothesis Testing, Analysis of Variance, Game changers &Innovators, Predictive Analytics.

Unit-II
Simple Linear Regression (SLR): Introduction to Regression, Model Development, Model Validation, Multiple Linear Regression, Estimation of Regression Parameters, Model Diagnostics, Dummy, Derived & Interaction Variables, Multi-collinearity, Model Deployment.

Unit-III
Logistic Regression: Discrete choice models, Logistic Regression Estimation of Parameters, Logistic Model Interpretation, Logistic Model Diagnostics, Logistic Model Deployment, Decision Trees and Unstructured data analysis, Chi-Square Automatic Interaction Detectors (CHAID), Classification and Regression Tree (CART), Analysis of Unstructured data, Naive Bayes algorithm.

Unit-IV

Forecasting and Time series Analysis: Forecasting, Time Series Analysis, Additive & Multiplicative models, Exponential smoothing techniques, Forecasting Accuracy, Auto regressive and Moving average models, Case Study on Forecasting.

Suggested Books:
C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006
L.Wasserman-All of statistics

PE-CS-AIDS-421A	Advance Computer Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hour**
Purpose	To enable students to learn various computational models, design paradigms of advanced computer architecture, parallelism approaches and techniques for static and dynamic interconnections.						
Course Outcomes (CO)							
CO1	Classify and interpret various paradigms, models and micro-architectural design of advanced computer architecture as well as identify the parallel processing types and levels for achieving optimum scheduling						
CO2	Identify the roles of VLIW & superscalar processors and branch handling techniques for performance improvement						
CO3	Analyze and interpret the basic usage of various MIMD architectures and relative importance of various types of static and dynamic connection networks for realizing efficient networks.						
CO4	Examine the various types of processors and memory hierarchy levels and cache coherence problem including software and hardware-based protocols to achieve better speed and uniformity.						

Unit-I

Computational Model: Basic computational models, evolution and interpretation of computer architecture, concept of computer architecture as a multilevel hierarchical framework, classification of parallel architectures, Relationships between programming languages and parallel architectures. Parallel Processing: Types and levels of parallelism, Instruction Level Parallel (ILP) processors, dependencies between instructions, principle and general structure of pipelines, performance measures of pipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, Code Scheduling for ILP Processors - Basic block scheduling, loop scheduling, global scheduling.

Unit-II

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – parallel decoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequential consistency of instruction execution and exception processing, comparison of VLIW & superscalar processors. Branch Handling: Branch problem, Approaches to branch handling – delayed branching, branch detection and prediction schemes, branch penalties, multiway branches, guarded execution.

Unit-III

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CCNUMA & COMA models, problems of scalable computers. Static connection networks: Linear array, ring, chordal ring, barrel shifter, star, tree, mesh and torus, fat Tree, systolic array, barrel shifter, hypercubes and Cube connected cycles. Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & split transaction buses, arbiter logics, crossbar networks, multistage networks, omega networks, butterfly.

UNIT – IV

Processors and Memory Hierarchy: Advanced processor technology, memory hierarchy technology and virtual memory technology. Cache Coherence and Synchronization Mechanisms: Cache coherence problems, hardware-based protocols – snoopy cache protocols, directory schemes, hierarchical cache coherence protocols, software-based protocols.

Reference Books:

1. D.Sima, T.Fountain, P.Kasuk, Advanced Computer Architecture-A Design Space Approach, Pearson Education.
2. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture-Parallelism, Scalability, Programmability, McGraw Hill.
3. M.J. Quinn, Parallel Computing: Theory and Practice, Second Edition, McGraw Hill.
4. J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative approach, Morgan Kaufmann/Elsevier.
5. T.G. Lewis and H. EI- Rewini, Introduction to parallel computing, Prentice Hall.
6. Nicolas Carter, Computer Architecture, McGraw Hill.

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PE	**Elective - II**	2:0:0	2	2	75	25	0	100	3

Code	PE- Elective - II
PE-CS-AIDS-423A	High Performance Computing
PE-CS-AIDS-425A	Human AI Interaction
PE-CS-AIDS-427A	Software Testing
PE-CS-AIDS-429A	Natural Language Processing

PE-CS-AIDS-423A	High Performance Computing						
L	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	75	25	100	3 hrs
Purpose	The design of high-performance computing (HPC) systems for compelling vision for how computation can seamlessly scale from a single processor to virtually limitless computing power						
Course Outcomes (CO)							
CO 1	To study the need for HPC and parallelism						
CO 2	To study parallel models of computation such as dataflow, and demand-driven computation.						
CO 3	To study state of the art processor architectures						
CO 4	To program and accelerate applications on the new high performance computing devices, we must understand both the computational architecture and the principles of program optimization						

Unit-1
Parallel Processing Concepts; Levels and model of parallelism: instruction, transaction, task, thread, memory, function, data flow models, demand-driven computation. Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc), Parallel architectures: N-wide superscalar architectures, multi-core, multi-threaded, server and cloud.

Unit-2
Parallel Programming with CUDA, Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee

Microarchitecture and Intel Nehalem microarchitecture), Memory hierarchy and transaction specific memory design, Thread Organization. Fundamental design issues in HPC: Load balancing, scheduling, synchronization and resource management; Operating systems for scalable HPC; Parallel languages and programming environments; OpenMP, Pthread, MPI, java, Cilk

Unit-3
Fundamental Design Issues in Parallel Computing: Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms onto Parallel Architectures, and Performance Analysis of Parallel Algorithms. Scalable storage systems: RAID, SSD cache, SAS, SAN; HPC based on cluster, cloud, and grid computing: economic model, infrastructure, platform, computation as service; Accelerated HPC: architecture, programming and typical accelerated system with GPU, FPGA, Xeon Phi, Cell BE; Power-aware HPC Design: computing and communication, processing, memory design, interconnect design, power management.

Unit-4
Performance analysis of parallel algorithms, Fundamental Limitations Facing Parallel Computing, Fundamental limitations in HPC: bandwidth, latency and latency hiding techniques, Tolerating Techniques and their limitations, Benchmarking HPC: scientific, engineering, commercial applications and workloads, Power-Aware Computing and Communication, Power-aware Processing Techniques, Power-aware Memory Design, Power-aware Interconnect Design, Software Power Management. Advanced Topics: Petascale Computing, Optics in Parallel Computing, Quantum Computers, Recent developments in Nanotechnology and its impact on HPC

Suggested Books:
Georg Hager and Gerhard Wellein. Introduction to High Performance Computing for Scientists and Engineers (1st ed.). CRC Press, Chapman &amp; Hall/CRC Computational Science, India, 2010.
Vipin Kumar , Ananth Grama , Anshul Gupta , George Karypis. Introduction to Parallel Computing (2nd ed.). Pearson India . 2003.
John L. Hennessy and David A. Patterson. Computer Architecture: A Quantitative Approach (5th ed.). Elsevier India Pvt. Ltd. 2011.
David B. Kirk and Wen-mei W. Hwu. Programming Massively Parallel Processors: A Hands-On Approach (1st ed.). Elsevier India Pvt. Ltd. 2010.
Michael T. Heath. Scientific Computing: An Introductory Survey (2nd ed.). McGraw Hill Education (India) Private Limited, 2011

PE-CS-AIDS-425A	Human AI Interaction						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	75	25	100	3 Hrs.
Purpose	This course concerns critical and responsible design, development and evaluation of AI technologies with a focus on human-AI-interaction. The aim of this module is to provide students with a cross-disciplinary background and the advanced skills of utilizing and critically evaluating the impact of Human-AI concepts and technologies within their ecosystems.						
Course Outcomes (CO)							
CO1	To have a broad foundational understanding of types and techniques in AI/ML						
CO2	To be able to demonstrate good understanding of the potential use cases and benefits of artificial intelligence (AI) technologies						
CO3	To have a critical understanding of the ethical, social and legal implications of AI applications on human life and work						
CO4	To be able to understand appropriate design, development and research methods for human-AI interaction						

Unit 1

Introduction to advanced automation, Introduction to Human-AI Interaction, Human Needs, Perceptions, and Experiences of Using AI, personalization, adaptive systems, prediction/forecasting, cognitive services, qualitative analysis (visual and natural language processing), hybrid intelligence systems, black boxing, Concrete Human-AI Interaction Designs

Unit 2

Intelligence, problem solving & decision making in humans and machines, Designing interactions with applied artificial intelligence, machine learning (ML) & recommender systems, AI interaction and experience design and development, Augment AI to Cope with Limitations of Human Users, Concrete Human-Interaction Designs

Unit 3

Human-AI benefits, victims & disasters, Understandable / relatable AI, Ethical & responsible AI, Human-AI ecosystems &markets, Interpretability and Explainability, AI Ethics, Fairness, and Equity Human-AI Co-creation in Different Domains, Interactive Visual Analytics for Machine Learning

Unit 4

Case studies: in autonomous agriculture, manufacturing, transportation, finance, healthcare, security, social media, gaming

Suggested Books:
Explainable Human-AI Interaction: A Planning Perspective (Synthesis Lectures on Artificial Intelligence and Machine Learning, Anagha Kulkarni, Sarath Sreedharan ,January 2022, Synthesi Publishers.
Human-AI Interaction: How We Work with Artificial Intelligence, Readyai , January 2021

PE-CS-AIDS- 427A	Software Testing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	75	25	100	3 Hrs.
Purpose	**To provide an understanding of concepts and techniques for testing software and assuring its quality.**						
	Course Outcomes						
CO 1	Expose the criteria and parameters for the generation of test cases.						
CO 2	Learn the design of test cases and generating test cases.						
CO 3	Be familiar with test management and software testing activities and V&V activities.						
CO 4	Be exposed to the significance of software testing in web and Object orient techniques.						

Unit-I

Introduction: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference between Verification and Validation, Definition of software testing, test cases, test oracles, testing process, limitations of testing.

Unit-II
Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.
Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

Unit-III
Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing and Slice based testing.
Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

Unit-IV
Overview of SQM: Concepts of Software Quality, quality attributes, software quality models: McCall, Boehm, ISO-9000, CMM.
Miscellaneous Topics: Stress testing, Adhoc testing, Buddy testing, Exploratory testing, Agile and extreme testing.

Suggested Books:

Naresh Chauhan, "Softearw Testing Principles and Practices" Oxford publications, 2012.

William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.

CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.

Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.

Louise Tamres, "Software Testing", Pearson Education Asia, 2002

Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.

Boris Beizer, "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.

K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.

Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.

PE-CS-AIDS-429A	Natural Language Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	75	25	100	3Hrs.
Purpose	To provide the understanding of the mathematical and linguistic foundations underlying approaches to the various are as in NLP.						
Course Outcomes (CO)							
CO1	Be familiar with syntax and semantics in NLP.						
CO2	To implement various concepts of knowledge representation using Prolog.						
CO3	To classify different parsing techniques and understand semantic networks.						
CO4	To identify/explain various applications of NLP.						

Unit-I

Basic Concepts: concept overview, key algorithms in the noisy channel paradigm. Fundamental components of Natural Language Processing: Lexicography, syntax, semantics, prosody, phonology, pragmatic analysis, world knowledge. Knowledge Representation schemes: Semantic net, Frames, Conceptual Dependency, Scripts.

Unit-II

Representing knowledge using rules: Logic Programming, Introduction to LISP and Prolog, Rules based deduction systems, General concepts in knowledge acquisition. **Syntax Analysis:** Formal Languages and grammars, Chomsky Hierarchy, Left- Associative Grammars, ambiguous grammars, resolution of ambiguities.

Unit-III

Computation Linguistics: Recognition and parsing of natural language structures- ATN and RTN, General Techniques of parsing-CKY, Earley and Tomitas algorithm. Semantics: Knowledge representation, semantics networks logic and inference pragmatics, graph models and optimization.

Unit-IV

Applications of NLP: Intelligent work processor, Machine translation, user interfaces, Man-Machine interfaces, natural language querying, tutoring and authoring systems, speech recognition, commercial use of NLP.

Suggested Books:
1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition",2ndedition, Pearson Edu.,2013.
2. James Allen," Natural Language Understanding", Pearson Education, Second Edition,2003.
3. Ivan Bratko, "Prolog: Programming for Artificial Intelligence",3rd Edition, Pearson

Education, Fifth Impression2009.

4. G.Gazder,"Natural Language processing in prolog",Addison Wesley,1989.

HM-CS-AIDS-405A	Data Visualization Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**MinorTest**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**

Purpose	This course will introduce the main concepts of visual analytics with a hands-on tutorial using Tableau, a leading self-service data visualization tool. Further, it aims at learning about how to create effective charts and interactive dashboards will provide the student a very useful skill applicable in many business scenarios.
Course Outcomes	
CO1	Understand and describe the main concepts of data visualization
CO2	Create ad-hoc reports, data visualizations, and dashboards using Tableau Desktop
CO3	Publish the created visualizations to Tableau Server and Tableau Public
CO4	Create Dashboard for real problems in Industry

Practical-1: Introduction to Tableau
• Course introduction
• Dataviz best practices
• Getting started with Tableau Desktop
• Connecting to the tutorial dataset
• Creating the first charts
• Filtering and sorting data

Practical-2: Common charts
• Creating common visualizations (bar charts, line charts etc.)
• Assembling a dashboard layout
• Using dashboard filters

Practical--3: Transform the data
• Dataviz best practices
 • Creating simple calculations in Tableau
• Using table calculations

Practical--4: Interactions
 • Interactivity with text and visual tooltips
• Interactivity with actions (filter, highlight, URL)
• Drilldown between dashboards

Practical--5: Advanced visualizations
• Dataviz best practices
 • Creating more advanced chart types
• Using multiple source tables

Practical--6: Data Storytelling

• Intro to data storytelling
• Creating a data story in Tableau
• Overview of the Tableau ecosystem
• Further learning opportunities

Practical-7: Implement binning visualizations for any real time dataset, Implement linear regression techniques.

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PE-LA	**Elective-I Lab**	0:0:2	2	1	0	40	60	100	3

PC-CS-AIDS-415 LA	**ANN and Deep Learning Lab**							
L	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**	
0	0	2	1	40	60	100	3 hrs	

Purpose	Purpose To provide knowledge of various artificial neural networks and deep learning algorithms for optimization

Course Outcomes (CO)

CO 1	To learn the basics of artificial neural networks concepts, various neural networks architecture
CO 2	To explore knowledge of special types of Artificial neural networks
CO 3	To understand the basics of Deep learning and its applications
CO4	To imprise about the different deep learning algorithms and their applications to solve real world problems.

Practical List:

1. To study about MATLAB.
2 Write a program to perform the basics matrix operations.
3 WAP to plot the Straight line.
   5. WAP to plot the Sine curve.
   6.
5. How the weight & bias value effects the output of neurons.
6. How the choice of activation function effect the output of neuron experiment with the following function purelin(n), bimary threshold(hardlim(n) haradlims(n)) ,Tansig(n) logsig(n)
7. How the weight and biased value are able to represent a decision boundary in the feature space.
8. How the Perceptron Learning rule works for Linearly Separable Problem.
9. How the Perceptron Learning rule works for Non-Linearly Separable Problem.
10. Write a program to draw a graph with multiple curve.

PC-CS-AIDS-417LA	Data Mining & Predictive Modelling LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	The objective of this course is to provide the in- depth coverage of data mining and modelling aspects along with its implementation						
Course Outcomes							
CO1	Understand the fundamental concept of Data Mining.						
CO2	Learn Data Mining techniques for Prediction and Forecasting.						
CO3	Compare the underlying Predictive Modelling techniques.						
CO4	Select appropriate Predictive Modelling approaches to identify cases and apply using a suitable package such as SPSS modeller.						

LIST OF EXPERIMENTS

1. Create an Employee Table with the help of Data Mining Tool WEKA.
2. Create a Weather Table with the help of Data Mining Tool WEKA.
3. Apply Pre-Processing techniques to the training data set of Weather Table
4. Apply Pre-Processing techniques to the training data set of Employee Table
5. Normalize Weather Table data using Knowledge Flow
6. Normalize Employee Table data using Knowledge Flow.
7. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree
8. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
9. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
10. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

PE-CS-AIDS- 419 LA	Predictive Analysis Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	Predictive analytics is emerging as a competitive strategy across many business sectors and can set apart high performing companies. It aims to predict the probability of the occurrence of a future event such as customer churn, loan defaults, and stock market fluctuations leading to effective business management.						
Course Outcomes							
CO1	Understand how to use predictive analytics tools to analyze real-life business problems.						
CO2	Demonstrate case-based practical problems using predictive analytics techniques to interpret model outputs.						
CO3	Learn regression, logistic regression, and forecasting using software tools such as MS Excel, SPSS, and SAS.						
CO4	Understand to Forecasting, Time Series Analysis and develop the Model.						

Practical List:

Practical 1: Implement case studies in Predictive Analytics in marketing using Python.

Practical 2: Implement case studies in Predictive Analytics in healthcare using Python.

Practical 3: Implement Classification Model using Python.

Practical 4: Implement Clustering Model using Python.

Practical 5: Implement Time Series Model using Python.

Practical 6: Forecasting patterns in weather using Python

Practical 7: Predicting performance in sports using Python

Practical 8: Predicting employee growth in HR using Python

Practical 9: Predicting maintenance in manufacturing using Python

Practical 10: Detecting sickness in healthcare using Python

Practical 11: Predicting buying behavior in retail using Python.

PE-CS-AIDS-421 LA	Advance Computer Architecture Lab							
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**		**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**		**60**	**100**	**3 Hrs.**
Purpose	To study various components of computer architecture.							
Course Outcomes								
CO1	To implement adder circuits using basic gates							
CO2	To understand the converter circuits using basic gates.							
CO3	To understand the working of Multiplexer							
CO4	To understand the various circuits for ALU, Datapath and control units.							

List of Experiments

1. To design the circuit of half adder.
2. To design the circuit of full adder.
3. To design the circuit of half subtractor.
4. To design the circuit of full subtractor.
5. To design an 8×1 Multiplexer.
6. To design a 4 bit combinational shifter.
7. To design a BCD adder.
8. To design a 4-bit adder subtractor.
9. To design an ALU.
10. To design 2:4 Decoder

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-409LA	Project-I	0:0:10	10	5	0	100	100	200	3

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-413A	Industrial Training	0	0	3	0	100	0	100	0