SHRI SHANKARACHARYA TECHNICAL CAMUS
BHILAI (C.G.)
(An Autonomous Institution)

SCHEME OF TEACHING AND EXAMINATION
B.Tech. (Artificial Intelligence and Machine Learning) (Fifth Semester)
Computer Science & Engineering

Sl. No.	Board of Studies (BOS)	Courses	Course Code	Period per Week			Scheme of Examination			Total Marks	Credit
							Theory/Lab				
				L	T	P	ESE	CT	TA		
1	Computer Science & Engineering	Theory of Computation	CS110501	2	1	-	100	20	30	150	3
2	Computer Science & Engineering	Computer Network	CS110502	2	1	-	100	20	30	150	3
3	Computer Science & Engineering	Data Science & Modeling	CS110503	2	1	-	100	20	30	150	3
4	Computer Science & Engineering	Artificial Intelligence Machine Learning	CS110504	2	1	-	100	20	30	150	3
5	Computer Science & Engineering	Professional Elective-I		2	1	-	100	20	30	150	3
6	Computer Science & Engineering	Computer Network Lab	CS110591		-	2	25	-	25	50	1
7	Computer Science & Engineering	Data Science & Modeling Lab	CS110592		-	2	25	-	25	50	1
8	Computer Science & Engineering	Artificial Intelligence Lab	CS110593		-	2	25	-	25	50	1
9	Computer Science & Engineering	Minor Project-I	CS110594		-	2	25	-	25	50	1
10	Computer Science & Engineering	Practical Training/Internship (Reports and Seminar)	CS110595		-	2	-	-	25	25	1
11	Computer Science & Engineering	Constitution of India	CS110596		-	-	-	-	25	25	-
Total				**13**	**2**	**10**	**600**	**100**	**300**	**1000**	**20**

L-Lecture T- Tutorial P-Practical
CT- Class Test TA- Teachers Assessment ESE- End Semester Exam

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Chairman (AC)	Chairman (BoS)	Date of Release	Version	

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Table-I (Professional Elective-I)

Sl. No.	Board of Studies (BOS)	Courses (Subject)	Course Code	Credit
1	Computer Science & Engineering	Artificial Neural Network	CS110521	3
2	Computer Science & Engineering	Introduction to Game Theory	CS110522	3
3	Computer Science & Engineering	Management Information System	CS110523	3
4	Computer Science & Engineering	Introduction to Statistical Learning	CS110524	3
5	Computer Science & Engineering	E-Commerece	CS110525	3

L-Lecture T- Tutorial P-Practical
CT- Class Test TA- Teachers Assessment ESE- End Semester Exam

Subject Code CS110501	Theory Of Computation	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
Formal languages and automata theory deals with the concepts of automata, formal languages, Grammar, computability and decidability. The reasons to study Formal Languages and Automata Theory are Automata Theory provides a simple, elegant view of the complex machine that we call a computer .More precisely, the objectives are: • To give an overview of the theoretical foundations of computer science from the perspective of formal languages. • To illustrate finite state machines to solve problems in computing. • To explain the hierarchy of problems arising in the computer sciences. • To familiarize Regular grammars, context frees grammar. • To solve various problems of applying normal form techniques, push down automata and Turing Machines	On successful completion of the course, the student will be able to: **CO1**.Design finite automata to accept a set of strings of a language. **CO2**.Determine whether the given language is regular or not. . **CO3**.Design context free grammars to generate strings of context free language. **CO4**.Design push down automata and the equivalent context free grammars and Design Turing machine. **CO5**.Distinguish between computability and non-computability, Decidability and un-decidability.

UNIT – I:The Theory Of Automata **CO1**

Introduction to automata theory, Examples of automata machine, Finite automata as a language acceptor and translator, Deterministic finite automata. Non-deterministic finite automata, finite automata with output (Mealy Machine. Moore machine), Finite automata with Epsilon moves, Minimizing number of states of a DFA, My hill Nerode theorem, Properties and limitation of FSM, Application of finite automata. **[8Hrs.]**

UNIT – II: Regular Expressions **CO2**

Alphabet, String and Languages, Regular expression, Properties of RegularExpression, Finite automata and Regular expressions, Arden's Theorem, Regular Expression to DFA conversion &vice versa. Pumping lemma for regular sets, Application of pumping lemma, Regular sets and Regular grammar, Closure properties of regular sets. Decision algorithm for regular sets and regular grammar.

[7Hrs.]

UNIT – III: Grammars **CO3**

Definition and types of grammar, Chomsky hierarchy of grammar, Relation between types of grammars, Context free grammar, Left most & right most derivation trees, Ambiguity in grammar, Simplification of context free grammar, Chomsky Normal From, Greibach Normal From, properties of context free language, Pumping lemma for context free language, Decision algorithm for context tree language.**[7Hrs.]**

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UNIT – IV: Push Down Automata And Turing Machine **CO4**

Basic definitions, Deterministic push down automata and non-deterministic push down automata, Acceptance of push down automata, Push down automata and context free language, Turing machine model, Representation of Turing Machine, Construction of Turing Machine for simple problem's, Universal Turing machine and other modifications .Church's Hypothesis, , Halting problem of Turing Machine. **[7Hrs.]**

UNIT – V: Computability **CO5**

Introduction and Basic concepts, Recursive function, Partial recursive function, Initial functions, Composition of functions, Ackerman's function, Recursively Enumerable and Recursive languages,

Decidable and decidable problem, Post correspondence problem, Space and time complexity**. [7Hrs.]**

Text Books:

S.No.	Title	Author(s)	Publisher
1	Theory of Computer Science (Automata Language & Computation)	K.L.P. Mishra and N. Chandrasekran	PHI
2	Introduction to Automata theory. Language and Computation	John E. Hopcropt & Jeffery D. Ullman	Narosa, Publishing House

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Introduction to Languages and the Theory of Computation	John Martin,	Tata McGraw Hill.
2	Introduction to Formal Languages Automata Theory and Computation	Kamala Krithivasan, Rama R	2nd Edition, Pearson Education.

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Subject Code CS110502	Computer Network	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
To Provide students with 0an enhanced knowledge in Computer Networking. • Understanding concept of local area networks, their topologies, protocols and applications. • Understanding the different protocols, and network architectures. • To make students understand the basic model of data communication and various concepts of networking.	On completion of this course the student will be able to: **CO1:**Describe the basis and structure of an abstract layered Network protocol model. **CO2:** understand the working of network protocols. **CO3:** Students will have deep understanding of various protocols used at Data Link Layer and will be able to analyze the advantages and disadvantages of various available protocols for flow and error control. **CO4:**Students will be able to analyze various Ethernet standards and will be able to choose an appropriate standard according to requirement of LAN. **CO5:** Students will be able to use various network based applications.

UNIT – I : Introduction : **CO1**

History of Computer Network, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN, PAN,. Applications, networks architecture requirements, ISO-OSI, TCP/IP, XNS, IPX/SPX. **Physical Layer :** Transmission media, switching and encoding, asynchronous communications; Narrow band, broad band ISDN and ATM. Bandwidth calculation. **[8Hrs]**

UNIT – II : Data link layer : **CO2**

Design issues, framing, error detection and correction techniques with numerical, CRC, Elementary Protocol : stop and wait, Sliding Window, Slip, Data link layer in HDLC, ATM. Multiple Access Protocols, Link Layer Addressing, ARP, DHCP, Ethernet devices – Hubs, Bridges, and Switches. **Medium Access sub layer :** ALOHA, MAC addresses, CSMA, CSMA/CD. IEEE 802.XStandardEthernet,wireless LAN.

[8Hrs]

UNIT – III : Network Layer : **CO3**

Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks, Router, Routing Table, Internet Protocol (IP) – IPv4 and IPv6 , ICMP, Link State Routing , Distance Vector Routing, Hierarchical Routing , RIP, OSPF, BGP, Broadcast and Multicast Routing , MPLS, Mobile IP, IP sec. IPv4 : Classes, Classless, Subneting, Super netting and its numerical. **[8Hrs]**

UNIT – IV : Transport Layer : **CO4**

Transport Layer Services – Multiplexing and Demultiplexing, UDP –Go Back-N and Selective Repeat**. Connection-Oriented Transport**: TCP, Segment Structure, RTT estimation, Flow Control, Connection Management, Congestion Control, TCP Delay Modeling, SSL and TLS. QoS architecture models: IntServ vs DiffServ. **[8Hrs]**

UNIT – V : Presentation Layer protocols : **CO5**

AFP, ICA, LPP, NCP, NDR, Telnet. **Session Layer protocols**: PAP, PPTP, RPC, SCP. **Application Layer**: Principles of Network Applications , The Web and HTTP, HTTPS, FTP, Electronic Mail, SMTP, IRC, Video Conferencing, MIME, DNS, Socket Programming with TCP and UDP. **Network Security:** Principles of Cryptography, Firewalls, Application Gateway, Attacks and Countermeasures. **[8Hrs]**

Text Books:

S.No.	Title	Author(s)	Publisher
1	Data Communications and Networking	Behrouz A. Forouzan	Third Edition TMH
2	Computer Networking: A Top-Down Approach Featuring the Internet	James F. Kurose and Keith W. Ross	Pearson Education, Third edition, 2006

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Computer Networks	Andrew S Tanenbaum	4th Edition. Pearson Education/PHI
2	An Engineering Approach to Computer Networks	S.Keshav	2nd Edition, Pearson Education

Subject Code CS110503	Data Science And Modeling	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
The objective of the course is aimed to Provide knowledge, insight into methods and tools for Preparation and Visualization of the data generated by modern information systems and also to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.	On successful completion of the course, the student will be able to: **CO1** Basic Concepts of Data Science **CO2** Understanding of reading data and manipulation **CO3** Understand data cleaning , dimensionality reduction **CO4** Understand and analyze data **CO5** Use visualization of data to capture data insight and build model

UNIT I : Introduction **CO1**

Introduction to data science, Evolution of Data science, Stages in Data science project, Facets of data, Data Science Project's Lifecycle, Web APIs, Open Data sources, Data APIs, Web Scrapping, Relational Databases access to process/access data **[8 Hrs.]**

UNIT II : Introduction to Programming **CO2**

Basic programming in python: list, string, dictionary, array and tuples. Indexing, slicing, iterating and other basic operations. Data Science Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK **Numpy:** creating arrays, arrays manipulation, reshape, dimension, broadcasting, reading and writing array data on files. **Pandas:** Series and Data frames. Reading files(.xlsx,.csv,.txt) in data frame. Row and index objects, function by elements, function by rows and columns, statistical functions, sorting and ranking, correlation and covariance **[7 Hrs.]**

UNIT III: Data cleaning and preprocessing **CO3**

Data Collection strategies: web scrapping tools, handling missing values; Data imputation techniques, data transformation techniques: Data Smoothing, Attribution Construction, Data Generalization ,Data Aggregation, Data Discretization, Data Normalization. Data Reduction techniques: Dimensionality reduction, Numerosity reduction, data cube aggregation, data compression, discretization operation.. **[7 Hrs.]**

UNIT IV Exploratory data analysis **CO4**

Exploratory Analysis: Introduction to statistics used in data science, Central tendencies and distributions, Variance Descriptive-Mean, Standard Deviation, Skewness and Kurtosis, statistical summary of categorical and numerical data, data dispersion: range , interquartile range ,variance, standard deviation, coefficient of variation. data distribution: Continuous and Normal distributions.

Frequency table: two-way table with joint, conditional and marginal probability. Pearson correlation.**[7 Hrs.]**

UNIT V: Data Visualization and model building **CO5**

Introduction, Types of data visualization, A Simple Interactive Chart, Set the Properties of the Plot, matplotlib, Bar chart, scatter chart histogram, pie chart Working with Multiple Figures and Axes, Adding Text, adding a Grid, adding a Legend, Saving the Charts. Seaborn library: Box and Whiskers plot for numerical and categorical variables, grouped plotting. Pairwise plot. Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning. Building a basic model with supervised machine learning algorithm: linear regression, logistic regression, support vector **[7 Hrs.]**

Text Books:

S.No.	Title	Author(s)	Publisher
1	Data Science from Scratch: First Principles with Python	Joel Grus	O'Reilly Media
2	Doing Data Science, Straight Talk From The Frontline	Cathy O' Neil and Rachel Schutt	O'Reilly
3	Mining of Massive Datasets	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman	Cambridge University Press

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Machine Learning	Jeeva Jose	Khanna Publishers
2	Data Sciences	Jain V.K	Khanna Publishers
3	Big Data and Hadoop	Jain V.K	Khanna Publishers
4	Machine Learning	Chopra Rajiv	Khanna Publishers
5	Practical Statistics for Data Scientists	Peter Bruce, Andrew Bruce, Peter Gedeck	O'Reilly

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Subject Code CS110504	Artificial Intelligence Machine Learning	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
The objective of this course is to familiarize the prospective engineers with different kinds of Learning techniques and get acquainted with the basics of machine learning methods and model validation methods and ways to measure their accuracy.	On successful completion of the course, the student will be able to: **CO1** : Get deep insight of AI and its problem Solving techniques. **CO2**: Represent information or knowledge through various representation techniques. **CO3** : Understand various classification and Regression techniques **CO4** : Understand various clustering methodologies and its evaluation process **CO5** : Validate, understand and analyze the different Machine learning curves and performance evaluation methods

Unit I : Introduction to Artificial Intelligence **[CO1]**

Introduction: Defining Artificial Intelligence and its applications

Problem Solving techniques: Blind Search: Depth First and Breadth Search**,** heuristic search: Best first search, A* search, AO* Search, Constraint satisfaction problem, Min-Max Search, Alpha-Beta Pruning **[7 Hrs]**

Unit II : Knowledge Representations **[CO2]**

Logic: Predicate Logic, Resolution in predicate logic, Other ways of knowledge representation: Brief Introduction of semantic nets, frame, conceptual dependency, Scripts

Planning: Goal Stack and Partial Order Planning **[7 Hrs]**

Unit III: Machine Learning and Supervised Learning **[CO3]**

Machine Learning Introduction: What Is Machine Learning?, How Do We Define Learning?, Applications of ML, Aspects of developing a Learning system: training data, Concept representation, function approximation, Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning

Supervised Learning : Source of uncertainty, Entropy and Information Gain, K Nearest Neighbor- Challenges in KNN, Application of KNN, Decision trees – ID3, Classification and Regression Trees, Translating Decision tress into rules, Rule Based Classification, Over fitting, noisy data and pruning, Linear Regression, Logistic Regression, Support Vector Machine (SVM) **[8 Hrs]**

Unit IV : Unsupervised Learning **[CO4]**

Partition Based Clustering, K – Means, K- Medoids, Hierarchical Clustering, Agglomerative, Divisive, Distance Measure, DBSCAN, Density Based Clustering, Evaluation of Clustering methods. **[7 Hrs]**

Unit V: Validations **[CO5]**

Validation Techniques, Need for Cross Validation, K-fold validation, Validation and Test Dataset, Evaluation Measures: SSE, MME, R2, Confusion Matrix – Recall, Precision, Accuracy, F-Measure, Learning Curves : ROC and AUC curve. **[7 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Artificial Intelligence	Elaine Rich and Kevin Knight	Tata McGraw Hill
2	Introduction to Machine Learning with Python	Aurelien Geron	Oreilly
3	Machine Learning for Absolute Beginners: A Plain English Introduction	Oliver Theobald	Scatterplot Press
4	Machine Learning Simplified: A gentle introduction to Supervised Learning	Andrew Wolf	Leanpub

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Introduction to Artificial Intelligence and Expert Systems	Dan W.Patterson	Prentice Hall of India.
2	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems (First Edition)	Aurelien Geron	O'Reilly Media
3	Dive into Deep Learning	Aston Zhang, Zachary C. Lipton, Mu Li, and	E-Books

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		Alexander J. Smola	
4	Machine Learning for Humans	Vishal Maini ,Samer Sabri	E-Books

Subject Code CS110591	Computer Network Lab	L =0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	-	25	50	3 Hours

Course Objectives	Course Outcomes
To Provide students the basic knowledge of Computer Networking, tools used, their purpose and their connectivity based on requirements.	On completion of this course the student will be able to setup and configure various networking hardware and software. They will also be able to identify the basic faults and can resolve.

List of Eexperiments

1. Introduction to cables, connectors and topologies.
2. Demonstration of Switch, Hub, Router and their uses and types.
3. Installation of UTP, Co-axial cable, Cross cable, parallel cable.
4. Case Study of Ethernet (10base5,10base2,10 base T)
5. Case Study of various Wireless technologies available.
6. Basic network command and Network configuration commands like ping, netstat, hostname, nslookup, route, arp, tracert, ipconfig, ARP etc.
7. To enable secured / unsecured file sharing, device sharing over network.
8. Installation and working of Remote Desktop and other third party related software's.
9. To setup IP and other values avoiding DHCP.
10. Use of Subnet mask to create two or more different logical network in same lab.
11. Installation and working with IIS Server.
12. Basic Configuration of Home Router/Modem
13. Introduction to Server administration.
14. Basic Chat Program in Java using TCP.
15. Basic Chat Program in Java using UDP.

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Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Networking Bible	Barrie Sosinsky		Wiley
2	Network Programmability and Automation	Jason Edelman		O′Reilly
3	Subnetting for Beginners: How to Easily Master Ip	Adam Vardy		Amazon
4	Networking Made Easy: Get Yourself Connected	James Berstein		

Subject Code CS110592	Data Science And Modeling Lab	L = 0	T = 0	P = 2	Credits =1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	-	25	50	3 hours

Course Objectives	Course Outcomes
The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.	On successful completion of the course, the student will be able to: **CO1** Basic Concepts of Data Science **CO2** Demonstrate understanding of the mathematical foundations needed for data science. **CO3** Collect, explore, clean, manage and manipulate data. **CO4** Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering. **CO5** Build data science applications using Python based toolkits.

List of Experiments

1. Write programs to understand the use of Matplotlib for Simple Interactive Chart, Set the Properties of the Plot, matplotlib and NumPy.
2. Write programs to understand the use of Numpy's Structured Arrays, Reading and Writing Array Data on Files.
3. Write programs to understand the use of Matplotlib for Working with Multiple Figures and Axes, Adding Text, Adding a Grid, Adding a Legend, Saving the Charts.
4. Write programs to understand the use of Matplotlib for Working with Line Chart, Histogram, Bar Chart, Pie Charts
5. Write programs to understand the use of Numpy's Shape Manipulation, Array Manipulation, vectorization.

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6. Write a program in Python to predict the class of the flower based on available attributes.
7. Write a program in Python to predict if a loan will get approved or not.
8. Write a program in Python to predict the traffic on a new mode of transport.
9. Write a program in Python to predict the class of user.
10. Write a program in Python to indentify the tweets which are hate tweets and which are not.
11. Write a program in Python to predict the age of the actors.
12. Mini project to predict the time taken to solve a problem given the current status of the user

Text Books:

S.No.	Title	Author(s)	Publisher
1	Python Crash Course: A Hands-On, Project-Based Introduction to Programming	Eric Matthes	William Pollock
2	Data Science from Scratch: First Principles with Python	Joel Grus	O'Reilly Media

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Machine Learning	Jeeva Jose	Khanna Publishers
2	Data Sciences	Jain V.K	Khanna Publishers
3	Fluent Python	Luciano Ramalho	O'Reilly Media
4	Machine Learning	Chopra Rajiv	Khanna Publishers

Subject Code CS110593	Artificial Intelligence and Machine Learning Lab	L = 0	T = 0	P = 2	Credits =1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	-	25	50	3 hours

Course Objectives	Course Outcomes
Implementing the various AI searching algorithms. Make use of Data sets in implementing the machine learning algorithms. Implement the machine learning concepts and algorithms in any suitable language of choice.	On successful completion of the course, the student will be able to: **CO1** Understand the implementation procedures for the machine learning algorithms. **CO2** Design python programs for various learning algorithms. **CO3** Apply appropriate data sets to the Machine Learning algorithms. **CO4** Identify and apply machine Learning algorithms to solve real world problems.

List of Experiments

1. Implement A* Search algorithm.
2. Implement AO* Search algorithm.
3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4. Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6. 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.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using

the k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

8. Write a program to implement the k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select the appropriate data set for your experiment and draw graphs.

Text Books:

S. No.	Title	Author(s)	Publisher
1	Python for Data Analysis	WesMc Kinney	O'Reilly

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Python Data Analytics	Fabio Nelli	Apress

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Subject Code CS110594	Minor Project-I	L = 0	T = 0	P =2	Credits = 1
Evaluation Scheme	ESE	CT	TA	-	ESE Duration
	25	-	25	-	3 Hours

Course Objective	Course Outcomes
The objectives of this lab are: The objective of this course is to improve student 's ability to analyze, design and solve complex engineering problems through pedagogies **(Project Based Learning)** that support them in developing these skills. The goal here is not to passively absorb and reiterate information; but rather to actively engage with the content, work through itwith others, relate to it through an analysis, use modern tools and effectively solve problems with the corresponding knowledge gained.	**On successful completion of the course, the student will be able to:** **CO1:** Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach. **CO2:** Reproduce, improve and refine technical aspects of engineering projects applying appropriate techniques, resources, and modern engineering and IT tools. **CO3:** Work as an individual and as a member or leaderin teams in development of technical projects. **CO4:** Follow management principle and value health, safety and ethical practices during project. **CO5:** Communicate and report effectively project related activities and findings.

The Process Followed to Maintain the Quality of Student Projects are: [12 Hrs.]

(a) Allotment of Projects:

(i) Students form their team (max four students) and submit their areas in which they would liketo pursue their projects.

(ii) Through meeting and deliberations students are allotted guide depending on their preferenceand maximum number of groups under a faculty is limited to three.

(b) Identification of projects:

Students are asked to formulate problem statement and state objectives of their project inconsultation

with the project guide

c) Continuous Monitoring

(i) Progress is continuously monitored by guide and instructions are given how to proceedfurther during their project periods as per time table.

(ii) Students submit weekly progress report to the project in-charge after consultation with theirproject guide.

(d) Evaluation

(i) In order to evaluate projects two project seminars (assessment) are taken in which student ‘steam present their project through presentations and demonstrate their work.

(ii) Students are assessed on the basis of their technical skill implementation, use of modern tools, communication skill, team work, health, safety and ethical practices and relevance of theproject.

(iii) At the end of the semesters a report is submitted by the students and student ‘s projects arefinally evaluated by external examiner in end semester practical examination based

Reference Books:

S. No.	Title	Authors	Publisher
1	Basics Of Project Management	IES Master Team	IES Master Publication (1 January 2021)
2	Modern Systems Analysis and Design	Jeffrey A. Hoffer, Joey F. George, Joseph S. Valakati	Pearson Education; Third Edition; 2002.

Professional Elective-I

Subject Code CS110521	Artificial Neural Network	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
Define what is Neural Network and model a Neuron and Express both Artificial Intelligence and Neural Network . Analyze ANN learning, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning.Implement Simple perception, Perception learning algorithm, Modified Perception learning algorithm, and Adaptive linear combiner, Continuous perception, learning in continuous perception. Analyze the limitation of Single layer Perceptron and Develop MLP with 2 hidden layers, Develop Delta learning rule of the output layer and Multilayer feed forward neural network with continuous perceptions.	On successful completion of the course, the student will be able to: CO1: Model Neuron and Neural Network, and to analyze ANN learning, and its applications. CO2: Perform learning and training. CO3: Know the working of various neural network model. CO4: Identify application areas of Neural Network. CO5 : Model neural network and fuzzy systems.

Unit I :Introduction to Artificial Neural Networks [CO1]

Elementary Neurophysiology, Models of a Neuron, Neural Networks viewed as directed graphs, Feedback, from neurons to ANN, Artificial Intelligence and Neural Networks; Network Architectures, Single-layered Feed forward Networks, Multi-layered Feed forward Networks, Recurrent Networks, Topologies. **[7 Hrs]**

Unit II: Learning and Training [CO2]

Activation and Synaptic Dynamics, Hebbian, Memory based, Competitive, Error-Correction Learning, Credit Assignment Problem: Supervised and Unsupervised learning, Memory models, Stability and Convergence,

Recall and Adaptation.

[7 Hrs]

Unit III :A Survey of Neural Network Models **[CO3]**

Single-layered Perceptron – least mean square algorithm, Multi-layered Perceptrons – Back propagation Algorithm, XOR – Problem, The generalized Delta rule, BPN Applications, Adalines and Madalines – Algorithm and applications..
[7 Hrs]

Unit IV: Applications **[CO4]**

Talking Network and Phonetic typewriter : Speech Generation and Speech recognition, Neocognitron – Character Recognition and Handwritten Digit recognition, Pattern Recognition Applications. **[7 Hrs]**

Unit V: Neural Fuzzy Systems **[CO5]**

Perceptron algorithm – Multilayer perceptrons back propagation nonlinear regression, Multiclass discrimination, Training procedures, Deep Learning overview and importance over machine Learning **[8 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Artificial Neural Networks	B. Yagna Narayan	PHI
2	Neural Networks Fuzzy Logic & Genetic Algorithms	Rajshekaran & Pai	Prentice Hall

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Neural Networks	James A. Freeman and David M. Strapetuns,	Prentice Hall
2	Neural Network & Fuzzy System	Bart Kosko	PHI.
3	Neural Network Design	Hagan Demuth Deale	Vikas Publication House

Subject Code CS110522	Introduction to Game Theory	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
Game theory, also known as multi-person decision theory, analyzes situations in which payoffs to players depend on the behavior of other players as well as the player himself/herself. Game theory has found many applications in various fields, such as economics, biology, business, law, politics, sociology, and computer science. It focuses on fundamentals of game theory including basic concepts and techniques, various ways of describing and solving games, and various applications in economics, political sciences, and business.	On successful completion of the course, the student will be able to: **CO1**: Distinguish a game situation from a pure individual's decision problem **CO2**: Understand the concepts of players, strategies, payoffs, rationality, equilibrium. **CO3**: Describe neural network model based games. **CO4**:Understand the games and its strategic behaviour. **CO5**: Understand decision taking techniques.

Unit I :Introduction to Game Theory **[CO1]**

Elements of Game theory, examples, Strategic Games, 2 Player Strategy Games, payoffs, Minimax, Weak and Strong Domination, Saddle Points, Nash Equilibrium, Prisoner's Dilemma, Stag Hunt, Matching pennies, BOS, Multi NE, Cooperative and Competitive Games, Strict and Non Strict NE, Best response functions for NE. **[7 Hrs]**

Unit II: Type of Games **[CO2]**

Combinatorial games, Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games. **[7 Hrs]**

Unit III :A Survey of Neural Network Models **[CO3]**

Cournot's Oligopoly, Bertrand's Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory. **[7 Hrs]**

Unit IV: Games & Strategic Behaviour [CO4]

		July 2022	1.00	Applicable for AY 2022-23 Onwards
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Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg's model of Duopoly, Buying Votes. **[7 Hrs]**

Unit V: Decision Making **[CO5]**
Committee Decision making, Repeated Games, Prisoner's Dilemma, Supermodular Game and Potential Games. **[8 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Games of Strategy, 3rd edition, 2009	A. Dixit, S. Skeath and D. Reiley,	W.W. Norton & Company: New York.
2	Games of Strategy,4th edition, 2015	A. Dixit, S. Skeath and D. Reiley,	W.W. Norton & Company: New York.
3	An Introduction to Game Theory	Martin Osborne	Oxford University Press.

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Game Theory	Thomas Ferguson	World Scientific
2	Introduction to Game Theory	Stef Tijs	Hindustan Book Agency.
3	Game Theory for Wireless Engineers	Allan MacKenzie	Synthesis Lectures On Communications.

Subject Code CS110523	Management Information Systems	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.To enable students understand the various knowledge representation methods and different expert system structures as strategic weapons to counter the threats to business and make business more competitive.	On successful completion of the course, the student will be able to: CO1 : Relate the basic concepts and technologies used in the field of management information systems CO2 : Compare the processes of developing and implementing information systems. CO3 : Outline the role of the various support systems used in an organization. CO4 : Apply the understanding for designing a Management Information System. CO5 : Apply the understanding of how business uses various information systems to gain competitive advantage.

Unit I :Introduction to Information Technology **[CO1]**

Introduction to Information Technology (IT), Advantages /Disadvantages of IT, Difference from Computer science (CS), Brief introduction to Database management systems (DBMS) and various data models (Relational, Hierarchical, Network). Concept of 2-Ties and 3- Tier architecture, System analysis and design (software development life cycle) **[7 Hrs]**

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Unit II: Management Information Systems **[CO2]**

Management Information systems (MIS), classification of MIS, need of MIS, Transaction processing system (TPS), office automation system (OAS), Executive support system (ESS) **[7 Hrs]**

Unit III : Decision Support System **[CO3]**

Decision support system (DSS), Expert system (ES), Functional applications of TPS, OAS, MIS, DSS, ESS and ES in the organization. **[7 Hrs]**

Unit IV: Designing MIS **[CO4]**

		July 2022	1.00	Applicable for AY 2022-23 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Designing MIS with software solutions (Case study for a Banking enterprise), characteristics and functions of MIS and DSS, component of MIS and DSS, capability of DSS, classification of DSS; Simon's Model for decision making. **[7 Hrs]**

Unit V: Business using Information Systems **[CO5]**

How Business use Information Systems; Strategic Information Systems for Competitive Advantage; Achieving Operational Excellence and Customer Intimacy; Contemporary Issues in Information Systems. **[8 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Information Technology for Management, Transforming Organizations in the Digital Economy	Turban, Mclean, Wetherbe	Wiley
2	Management Information Systems: Conceptual Foundations, Structure and Development	Gordon, B.Davis and Margrethe H.Olson	Tata McGraw-Hill
3	Cases in Management Information Systems	Mohapatra	PHI

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Management information Systems,	Laudon & Laudon	Pearson Education
2	Management Information Systems: Managing Information Technology in the Internet worked Enterprise	O' Brien, James	Tata McGraw Hill

Subject Code CS110524	Introduction to Statistical Learning	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
To develop the students ability to deal with numerical and quantitative issues in business. To enable the use of statistical, graphical and algebraic techniques wherever relevant. To have a proper understanding of Statistical applications in various applicable areas.	On successful completion of the course, the student will be able to: **CO1**: Describe and discuss the key terminology, concepts tools and techniques used in statistical analysis **CO2**: Critically evaluate the underlying assumptions of analysis tools **CO3**: Understand and critically discuss the issues surrounding sampling and significance **CO4**: Solve a range of problems using the Data Analysis techniques. **CO5**: Discuss critically the uses and limitations of statistical analysis.

Unit I :Data Definitions and Analysis Techniques **[CO1]**

Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming **[7 Hrs]**

Unit II: Descriptive Statistics **[CO2]**

Measures of central tendency, Measures of location of dispersions, Practice and analysis with R. **[7 Hrs]**

Unit III : Basic Analysis Techniques **[CO3]**

Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test,t-Test,Analysis of variance, Correlation analysis, Maximum likelihood test, Practice and analysis with R. **[7 Hrs]**

Unit IV: Data Analyssis Ttechniques **[CO4]**

Regression analysis, Classification techniques, Clustering, Association rules analysis, Practice and analysis with R. **[7 Hrs]**

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Unit V: Case studies and projects **[CO5]**

Understanding business scenarios,Feature engineering and visualization, Scalable and parallel computing with Hadoop and Map-Reduce, Sensitivity Analysis **[8 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Business Statistics	Ken Black	Tata Macgraw Hill
2	Business Statistics	V. K. Kapoor	S. Chand
3	Business Statistics	R. S. Bharadwaj	Excel Book

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Introduction to Statistics	C.B. Gupta	Ram Prasad and Sons
2	Business Statistics	S. P. Gupta & M. P. Gupta	Sultan Chand And Sons

Subject Code CS110525	E-Commerce	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
This course provides an introduction to information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of network, the technical foundation for understanding information systems.	On successful completion of the course, the student will be able to: CO1: Understand the Concept of E-Commerce in current scenario. CO2: Understand the concept of network infra. CO3: Understand the various types of payment systems. CO4 : Understand the information distribution. CO5 : Understand the mobile wireless computing basics.

Unit I :Introduction **[CO1]**

What is E-Commerce, Forces behind E-Commerce, E-Commerce Industry Framework, and Brief History of E-Commerce. Inter Organizational E-Commerce, Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework **[7 Hrs]**

Unit II: Network Infrastructure **[CO2]**

LAN, Ethernet(IEEE standard 802.3) LAN , WAN , Internet, TCP/IP Reference Model, Domain Name Server , Internet Industry Structure, **[7 Hrs]**

Unit III : Payment Systems **[CO3]**

Electronic payment systems, types of electronic payment systems, digital token-based electronic payment systems, smart cards & electronic payment systems, credit card based electronic payment systems, risk and electronic payment systems, designing electronic payment systems. **[7 Hrs]**

Unit IV: Information Distribution and Messaging **[CO4]**

FTP,E-Mail,WWW server,HTTP, Web service implementation, Information publishing , Web Browsers, HTML, Common Gateway Interface **[7 Hrs]**

Unit V: Mobile & wireless computing **[CO5]**

Mobile & wireless computing fundamentals, mobile computing framework, wireless delivery technology and switching methods, mobile information access devices, mobile data internet working standards, cellular data communication protocols, mobile computing applications, personal communication service. Systems. **[8 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Frontiers of E-commerce	Dr. Ravi Kalakota & Marcia Robinson	Addision wesicy
2	Electronic Commerce	Bharat Bhasker	TMH

Reference Books:

S. No.	Title	Author(s)	Publisher
1	E-Commerce	K.K. Bajaj	TMH

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