Program Structure and Syllabus

BTech (Artificial Intelligence and Machine Learning) III Year (I & II Semesters)

R20 Regulations

Department of Artificial Intelligence

ANURAG UNIVERSITY
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BTech (AIML) III YEAR I SEMESTER [4 T + 4 P + 1 M]

S. No	Course Code	Category	Course	Hours per week			Credits
				L	T	P	
1	A55031	PCC	Essentials of Machine Learning	3	1	0	4
2	A55032	PCC	Computer Systems II	3	1	0	4
3	A55033	PCC	Web Programming with MEAN	3	0	0	3
4	A55081 A55080 A55079	OEC-I	1. Data Storytelling 2. Entrepreneurship Development 3. Intellectual Property Rights	3 3 2	0 0 1	0 0 0	3
5	A55213	PCC-Lab	Computer Systems Lab	0	0	3	1.5
6	A55214	PCC-Lab	Web Programming with MEAN Lab	0	0	3	1.5
7	A55215	PCC-Lab	Essentials of Machine Learning Lab	0	0	3	1.5
8	A55288	BSC-Lab	Quantitative Aptitude and Reasoning	0	0	3	1.5
9	A55091	MC	NSO/NSS	0	0	2	0
			TOTAL	**12**	**3**	**14**	**20**

BTech (AIML) III YEAR II SEMESTER [5 T + 2 P + 1 M]

S. No	Course Code	Category	Course	Hours per week			Credits
				L	T	P	
1	A56061	PCC	Automata Theory and Applications	3	1	0	4
2	A56069	PCC	Web Data Mining	3	0	0	3
3	A56063	PCC	Computer Vision and Image Processing	3	0	0	3
4	A56036 A56054 A56037 A56064	PEC-I	1. R Programming 2. Mobile Application Development 3. Internet of Things 4. Unified Modeling Language	2	0	0	2
5	A56065 A56066 A56067 A56068	PEC-II	1. Distributed Systems 2. Evolutionary Computing 3. Cryptography 4. Fundamentals of Image Data Mining	3	0	0	3
6	A56288	HSS&MC	Verbal Ability and Critical Reasoning	0	0	3	1.5
7	A56221	PCC Lab	Computer Vision and Web Data Mining Lab	0	0	4	2
8	A56208 A56218 A56209 A56222	PEC-I Lab	1. R Programming Lab 2. Mobile Application Development Lab 3. Internet of Things Lab 4. Unified Modeling Language Lab	0	0	3	1.5
			TOTAL	14	1	10	20

*** L – Lecture, T – Tutorial, P - Practical**

ESSENTIALS OF MACHINE LEARNING

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55031	PCC	L	T	P	C	CIE	SEE	Total
		3	1	0	4	40	60	100

Course Objectives

1. Understand the basic concepts of feature engineering and machine learning systems
2. Apply and evaluate supervised machine learning algorithms for classification and regression tasks
3. Apply and evaluate unsupervised learning algorithms for clustering tasks.
4. Understand the Bayesian and Ensemble learning, apply and evaluate different types of these algorithms for better prediction.
5. Understand and Design Artificial Neural Networks computational model

Course Outcomes

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

1. Understand the essentials of feature engineering, state-of-art tools and concepts of machine learning
2. Design and evaluate different types of supervised learning algorithms for classification and regression tasks
3. Design and evaluate different types of unsupervised learning algorithms for clustering tasks
4. Design and evaluate strong learners for better real time prediction such as Bayesian and ensemble learning algorithms
5. Design Artificial neural networks computational model

UNIT-I

Machine Learning: Introduction, Definition and Applications, Types of Machine Learning Models - Supervised, Unsupervised, Reinforcement learning, Applications, State-of-the-art Languages and Tools, Preparing to Model: Basic Types of Data, Exploring Structure, Data Quality and Remediation. Model Representation: Overfitting and Underfitting, Bias–variance trade-off

Feature Engineering: Feature Transformation, Feature Extraction and Feature Selection Process

UNIT-II

Supervised Learning: Applications. Classification and Regression Tasks, Evaluating performance of classification and regression models, Classification Algorithms: k-Nearest

Neighbor, Decision Tree. Regression Algorithms: Simple Linear Regression, Multiple Linear Regression, Logistic Regression

UNIT-III

Unsupervised Learning: Applications, Clustering task, Different types of Clustering techniques: K-Means Clustering, K-medoids, Agglomerative Hierarchical Clustering, Evaluating performance of clustering models.

UNIT-IV

Bayesian Learning: Bayes' Theorem and Concept Learning: Brute-force algorithm, Consistent Learners, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks

Ensemble Learning: Bootstrap Aggregation (Bagging) - Random Forest, Boosting - AdaBoost and Gradient Boost.

UNIT-V

Artificial Neural Networks: Understanding the Biological Neuron, Exploring the Artificial Neuron, Types of Activation Functions, Early Implementations of ANN. Architectures of Neural Network: Single-layer feed forward network, Multi-layer feed forward network, Competitive network, Recurrent Network. Learning Process in ANN. Back propagation algorithm

Text Books

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, *Machine Learning*, 2019, Pearson
2. Tom M. Mitchell, —*Machine Learning*, McGraw-Hill Education (India) Private Limited, 2013

References

1 Andreas C. Müller, Sarah Guido, *Introduction to Machine Learning with Python*, O'Reilly Media, Inc, October 2016
2 Ethem Alpaydin — *Introduction to Machine Learning (Adaptive Computation and Machine Learning)*, The MIT Press 2004
3 Aurélien Géron, *Hands on Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems*, O'Reilly Media, Inc 2019

COMPUTER SYSTEMS II

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55032	PCC	L	T	P	C	CIE	SEE	Total
		3	1	0	4	40	60	100

Course Objectives

1 Understand the structure and functions of OS.
2 Learn about Processes, Threads and Scheduling algorithms and understand the principles of concurrency and Deadlocks.
3 Learn various memory management schemes
4 To understand the protocol layering and physical level communication.
5 To analyze the performance of a network.

Course Outcomes

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

1 Analyze various scheduling algorithms.
2 Understand deadlock, prevention and avoidance algorithms.
3 Compare and contrast various memory management schemes
4 Understand the basic layers and its functions in computer networks.
5 Evaluate the performance of a network

UNIT-I

Operating System Overview: Introduction, Barebones Computer System, Operating System Concept, Services and Facilities, Organization, Types of Computer Systems, Purpose of User Interface, Types of User Interface

UNIT-II

File Management: Introduction, Logical and Physical view of files, Role of file management system, Logical file access methods, Physical File storage, Directory Structure, Network File Access, File Protection

UNIT-III

Processor and Memory Management: Introduction, OS Requirements, Bootstrap, Process and Threads, Basic loading and execution operation, CPU Scheduling and Dispatching, Memory Management, Virtual Storage, Secondary storage scheduling, Network OS services, OS issues

UNIT-IV

Networks and Data Communication: Introduction, View of Data Communication, Data Communication Concepts, Network Topology, Types of Networks, Network Interconnection, Standards

UNIT-V

Ethernet and TCP/IP Networking: Introduction, TCP/IP, OSI and other Communication Protocol models, Physical and Data Link Layer, Network Layer, Transport Layer, IP Addresses, Domain Names and DNS Services, Quality of Service, Network Security, Alternative Protocols

Text Book

1. Irv Englander, *The Architecture of Computer Hardware, Software and Networking, An Information Technology Approach* , 5th Edition, Wiley Publication

References

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, *Operating System Concepts*, 10th Edition, John Wiley and Sons Inc., 2018.
2. Behrouz A. Forouzan, *Data Communications and Networking*, Fifth Edition TMH, 2013.
3. James F. Kurose, Keith W. Ross, *Computer Networking, A Top-Down Approach Featuring the Internet*, Sixth Edition, Pearson Education, 2013.

WEB PROGRAMMING WITH MEAN

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55033	PCC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1. To introduce Node.js for web server platform
2. To introduce Express for the framework
3. To introduce MongoDB for the Database
4. To introduce Mongoose for data modeling
5. To introduce Angular for front-end framework

Course Outcomes

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

1. Gain knowledge on client side scripting
2. understand server side scripting
3. understand MongoDB and create Database
4. understand Express frame work
5. create multi-tier architecture web application

UNIT-I

Architecture of WWW, HTTP, HTTPS, 2-Tier and multi-Tier web application architectures.

Introducing full-stack development

Introduction to the full-stack, history of web development, Introduction to MEAN stack. Node.js, Express, MongoDB and Angular, supporting cast

Designing a MEAN Stack Architecture

Common MEAN stack architecture, Beyond SPAs, Designing flexible MEAN architecture, planning a real application, breaking the development into stages, hardware architecture

UNIT-II

Building a Node Web Application

Creating and setting up a MEAN project: Creating an Express project, modifying Express for MVC, Importing Bootstrap for quick, responsive layouts, making it live on Heroku

Building a static site with Node and Express: Defining the routes in Express, building basic controllers, creating some views, adding the rest of the views, taking the data out of the views and making them smarter

UNIT-III

Building a data model with MongoDB and Mongoose: Connecting the Express application to MongoDB by using Mongoose, Benefits of modeling the data, defining simple mongoose schemas, using the MongoDB shell to create a MongoDB database and add data, getting database live

Writing a REST API: Exposing the MongoDB database to the application: The rules of a REST API, setting up the API in Express, GET methods: Reading data from MongoDB, POST methods: Adding data to MongoDB, PUT methods: Updating data in MongoDB, DELETE method: Deleting data from MongoDB

UNIT-IV

Adding Dynamic Front End with Angular

Creating an Angular application with Typescript: getting up and running with Angular, working with angular components, getting data from an API, putting and Angular application into production

Building a single-page application with Angular: Foundations: Adding navigation in an Angular SPA, building a modular app using multiple nested components, adding geo-location to find places near you, and safely binding HTML content.

UNIT-V

Managing Authentication and User Sessions

Using an authentication API in Angular applications: Creating an Angular authentication service, creating the Register and Login pages, working with authentication in the Angular app.

Text Book

1. Simon Holmes, Clive Harber, *Getting MEAN with Mongo, Express, Angular and Node*, Second Edition, Manning Publications Co., 2019

References

1. Adam Bretz & Colin J. Ihrig *Full Stack Javascript Development With Mean*
2. Amos Q. Haviv, *MEAN Web Development*, Second Edition, Packt Publishing, 2016

DATA STORYTELLING

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55081	OEC-I	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Introduction

This course will cover the fundamentals of effective data-driven storytelling. Story telling can put a human perspective on the increasingly complex and rapidly changing world of the digital era. Students will learn how to interpret and analyse the data and will learn to articulate the stories with data sets and communicate data findings in visual, oral, and written contexts.

Course Objectives

The students will be able to

1. develop the skills necessary to be effective data storytellers.
2. locate relevant datasets, extract insights from that data and present their findings in myriad formats.
3. learn how to interpret data and to present it in different formatsto different audiences.

Course Outcomes

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

1. identify the stories within datasets and extract insights from that data.
2. explain the importance of communication skills and competencies for individuals who serve as data storytellers.
3. act as a data-driven visual storyteller for optimal presentation of trends, patterns, and insights.
4. make effective client presentations of their work using infographic visualizations.
5. learn tools and concepts which can be put to immediate use to transform data into stories.

UNIT-I

Introduction: We are all storytellers- Stories Bring Data to Life- The Essence of Data Storytelling

UNIT-II

Dynamics of Data Storytelling: Getting to the Core- Planning is Everything- The Quick Fix- Application of Story elements

UNIT-III

Crafting the Data Story: The Psychology of Storytelling- The narrative Techniques - Making Good stories Great! – Writer to Storyteller

UNIT-IV

Data Visualization: Use Visuals to Advantage: Data Presentation Skills- Infographics Visualizations

UNIT-V

Anatomy of Data Story: Rudiments of Grammar - Parts of Speech - Concord Rules - Academic and Technical Vocabulary - Data Interpretation - Case Studies

Text Book

1. Vora , Sejal (2019).*The Power of Data Storytelling*, Sage Publications India pvt Ltd.

References

1. Dykes, Brent (2020). *Effective Data Storytelling*: New Jersey, Wiley.
2. Knaflic, Cole Nussbaumer (2015).*Storytelling with Data: A Data Visualization Guide for Business Professionals,*https://www.amazon.com/Storytelling-Data-Visualization-Business-Professionals/dp/1119002257/
3. Morrow, Jordon (2021), *Be Data Literate- The Data Literacy Skills Everyone Needs to Succeed*, UK: Kogan Page Ltd.
4. Taylor, Scott (2021). *Telling your Data Story: Data storytelling for Time Management*, New Jersey: Technics Publications LLC.
5. https://www.amazon.com/Tableau-Your-Data-Analysis-Software/dp/1119001196/

ENTREPRENEURSHIP DEVELOPMENT

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55080	OEC-I	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

The objective of this course is to familiarize the student with entrepreneurship, the issues involved in it, the potential of entrepreneurship and intrapreneurship, the legal environment and statutory issues and explore various funding opportunities.

Course Outcomes

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

1. Interpret the concepts of Entrepreneurship and Intrapreneurship.
2. Apply the opportunity identification techniques
3. Differentiate needs of different segments and their
4. Develop business model and MVP
5. Recognize organizational forms, IPR concerns and funding opportunities for startups.

UNIT-I

Introduction to Entrepreneurship: Entrepreneurship and Intrapreneurship, Business Incubators, Rural entrepreneurship, Social Entrepreneurship, women entrepreneurs, Role of entrepreneurs in economic development, Types of entrepreneurs. Entrepreneurial mind set and stress, Causes of failure.

UNIT-II

Opportunity identification: Myths and realities of entrepreneurship, Opportunity identification, Problem worth solving, idea generation techniques, Design thinking.

UNIT-III

Customer analysis: Market segmentation, consumer persona, Product market fit, Unique Value proposition.

UNIT-IV

Business model and MVP: Business model canvas, MVP, Risks and assumptions, Importance of financial planning.

UNIT-V

Organizational forms Funding Opportunities: Organizational forms - Partnership, Sole proprietorship, Corporation. Intellectual Property Rights- Copyrights, Trademarks, Patents. Law Vs. Ethics, Informal capital- Friends and Family, Angels, Venture Capitalists, Idea/ Patent, Growth strategies

References

1. Vasant Desai, YayatiNayak, *Entrerpreneurship*, Himalaya Publishing House,2018
2. Rajeev Roy, *Entrepreneurship*, Oxford University Press, 2/e, 2012
3. D.F.Kuratko and T.V.Rao *Entrepreneurship- Cengage Learning*,2012
4. Dhruv Nath, Sushanto Mitra, *Funding Your Startup: And Other Nightmares*, 2020
5. V Srinivasa Rao, *Lean Digital Thinking: Digitalizing Businesses in a New World Order*, Bloomsbury India, 2021
6. S.K.Mohanty, *Fundamentals of Entrepreneurship*, PHI, 1/e,2005
7. MOOCS by Wadhwani Foundation

INTELLECTUAL PROPERTY RIGHTS

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55079	OEC-I	L	T	P	C	CIE	SEE	Total
		2	1	0	3	40	60	100

Course Objectives

The course aims to help the student understand the concept of Intellectual Property Rights and helps the student to appreciate the purpose and function of a trademark and the process involved in getting copyright, patent and related issues. The student is introduced to the importance of trade Secret and Geographical Indications.

Course Outcomes

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

1. Explain the concepts of intellectual property rights and related agencies.
2. Describe the purpose and functions of a trademark in a competitive environment.
3. Analyze the process of copyright and procedure.
4. Understand the process of patent and patent issues.
5. Explore the trade secret and geographical indications of its protection from unfair practices.

UNIT-I

Introduction to IPR: Concept of intellectual property rights, importance of intellectual property rights. Types of intellectual property, international agencies, and treaties.

UNIT-II

Trademarks: Concept of trademarks, purpose, and function of trademarks. Acquisition of trademark rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

UNIT-III

Law of copyrights: Concept of copyright right, fundamentals of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration.

UNIT-IV

Law of patents: Introduction to patent, foundation of patent law, patent searching process, ownership rights and transfer.

UNIT-V

Trade Secrets & Geographical Indication: Law pertaining to trade secrets, determination of trade secrets. Trade secret litigation. Unfair competitions. Geographical Indication, concept of geographical indication, importance of geographical indication, new development of intellectual property rights.

Text Book

1. Deborah. E. Bouchoux, *Intellectual property right,* 5/e, 2018, cengage learning.
2. Neeraj Pandey, *Intellectual property right*, PHI, 2019.

References

1. Ramakrishna Chintakunta and M. Geethavani, Kindle e 2021
2. Prabuddha Ganguli, *Intellectual Property Right: Unleashing the Knowledge Economy*, 2/e, 2017 Tata Mc Graw Hill Publishing company Ltd.

COMPUTER SYSTEMS LAB

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55213	PCC-Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

List of Programs

1. Program for
   a. Simulating CPU scheduling algorithms (Round Robin, Priority, FCFS, SJF)
   b. using system calls: fork, exit
2. Program for implementing the following problem using shared memory and semaphores
   a. Producer-Consumer problem
   b. Readers-writers problem
   c. Dining philosopher problem
3. Program using multithreading (pthreads)
4. Create a client-server application using any programming language
5. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool
6. Configuring network chord, switch and router
7. Usage of packet tracer software

WEB PROGRAMMING WITH MEAN LAB

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55214	PCC-Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

The following tasks have to be performed week wise

Week 1:
Identification of the problem

Week 2:
a. Requirement specification
b. Architecture design

Week 3, 4 & 5:
Development of the front end.

Week 6, 7 & 8:
Development of backend

Week 9, 10 & 11:
Creation of Database

Week 12:
Integration and Testing

Week 13:
Presentation

Week 14:
Documentation and Submission

ESSENTIALS OF MACHINE LEARNING LAB

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55215	PCC-Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Course Objectives

1. Installation of Python and libraries, and implement feature engineering
2. Apply and evaluate supervised machine learning algorithms for classification and regression tasks
3. Apply and evaluate unsupervised learning algorithms for clustering tasks.
4. Understand the Bayesian and Ensemble learning, apply and evaluate different type of these algorithms for better prediction.
5. Understand and Design Artificial Neural Networks computational model

Course Outcomes

1. Knowledge of Installation of Python libraries, and implement feature engineering
2. Design and evaluate different types of supervised learning algorithms for classification and regression tasks
3. Design and evaluate different types of unsupervised learning algorithms for clustering tasks
4. Design and evaluate strong learners for better real time prediction such as Bayesian and ensemble learning algorithms
5. Design Artificial neural networks computational model

Week 1

Get familiar with Python, NumPy and Pandas

Week 2

Perform Feature Engineering for a given dataset

Week 3

Implement linear and multiple regression algorithms on a given dataset

Week 4

Implement Binary Classification using ID3 Decision Tree Algorithm- Medical Application Domain - Diabetes Dataset or any standard dataset

Week 5

Implement logistic regression algorithm for stock prices prediction

Week 6

Write a program to implement k-Nearest Neighbor algorithm to classify the iris dataset. Print both correct and wrong predictions

Week 7
Implementation of decision tree based ID3 algorithm and use an appropriate dataset
Week 8
Implement K- means clustering algorithm for identifying cancerous data
Week 9
Implementation of Agglomerative Clustering algorithm to cluster a set of data stored in a CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering
Week 10
Implementation of 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
Week 11
Implementation of Boosting-Ada Boost and Gradient Boost to convert weak learner to strong learners
Week 12
Develop a predictive model for predicting house prices using random forest Artificial Neural Network (ANN) for Diabetes Classification
Week 13
Perform Data Analysis - Data Cleaning, Feature Engineering, Data Visualization and Binary Classification for Census Income Dataset
Week 14
Project: Employ all the classification algorithms for Diabetes dataset, IRIS dataset and any dataset of your choice report the best result for each dataset.
Week 15
Project: Employ all the regression algorithms for house sales prediction dataset, of any dataset of your choice. Report the best result.
Week 16
Project: Employ all the clustering algorithms for an appropriate dataset of your choice. Report the best result.

NOTE: Datasets for the above exercises available in Kaggle and UCI repository mentioned below
1. https://www.kaggle.com
2. http://archive.ics.uci.edu/ml/datasets.html

QUANTITATIVE APTITUDE AND REASONING

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55288	BSC-Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

UNIT-I

Number System: Speed Math's, Numbers, Factors, Prime and co-primes, LCM & HCF, Divisibility rules, Finding the unit digit and applications, remainder theory.

Ratio and Proportion with Ages: Definition of ratio and Proportion, Finding the resultant ratio. Problems based on Ratios and ages.

Percentages: Introduction to percentages, Percentage Increase /Decrease, Results on Population, Results on Depreciation, Variations, Applications of Percentage

Profit and Loss: Classification of Profit and Loss, Profit/ Loss Percentages, Successive Discount.

UNIT-II

Time and Distance: Difference between the average, Relative and Effective speed, reaching the destination late and early, stoppage time per hour, problems based on Trains and problems based on Boats.

Time and Work: Calculating Efficiency, alternate days concept, work and wages, Chain rule, problems based on Pipes and cisterns.

Simple and Compound Interest: Simple interest, Principle, Rate, Amount, Applications of Simple interest, Compound interest, Compounded annually, Compounded Half yearly, Compounded Quarterly, Difference between simple and compound interest

UNIT-III

Permutations and Combinations: Fundamental rules, Problems on Permutations and Combinations

Probability: Definition, Notations and Problems based on Probability.

Mean, Median and Mode: Introduction and problems on mean, median and mode

Partnership: Relation between Partners, Period of Investments and Shares

Averages: Average of different groups, change in average by adding, deleting and replacement of objects

Flow Chart: Introduction of symbols and problems on flow charts.

UNIT-IV

Seating Arrangement: Circular, Row, Column, Square and Double row arrangement

Puzzles: Paragraph, incomplete puzzles and problems on them.

Number Series: Number, Alphabet and Letter Series.

Analogy: Simple, Double, Word and Number Analogy
Coding and Decoding: Classifications and Problems on Coding and Decoding.

UNIT-V

Clocks: Relation between minute and hour hand, angle between hands of a clock, exceptional cases in clocks. Gaining and loosing of time.
Calendars: Classification of years, finding the day of any random calendar date, repetition of calendar years.
Direction Sense Test: Sort of directions in puzzle distance between two points, Problems on shadows.
Blood Relations: Defining the various relations among the members of a family, Solving blood relation puzzles by using symbols and notations. Problems on coded relations.

Text Book

1. R.S Agarwal, *Verbal and Non Verbal Reasoning* –New Edition -2020, S. Chand.
2. R.S Agarwal, *Quantitative Aptitude* –New Edition- 2020, S. Chand.

References

3. Abhijeet Guha, *Quantitative Aptitude*: New Edition-2020, Mc Graw Hill.

NATIONAL SPORTS ORGANIZATION (NSO) / NATIONAL SERVICE SCHEME (NSS)

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A55091	MC	L	T	P	C	CIE	SEE	Total
		0	0	2	0	0	100	100

UNIT-I

Health and Wellness

Dimensions of Health: Physical, Mental and Social. Objectives of Health Education. Definition and Dimensions of Wellness – Physical, Emotional, Social, Spiritual, Intellectual and Environmental Wellness. Achieving Wellness.

Practical: Basketball, Cricket, Kho-Kho (Any Two) & Badminton (Mandatory)
Layout of Courts / Fields, Skills, Rules & Lead-up Games.

UNIT-II

Fitness and Body Composition

Physical Fitness Components: Body Composition, Muscular Endurance, Strength, Cardiovascular Fitness and Flexibility, Importance of Cardio-Respiratory Endurance. Obesity and Health Risk Factors. Body Composition Indicators and Measurements.

Practical: Football, Kabaddi, Volleyball (Any Two) & Table Tennis (Mandatory)
Layout of Courts / Fields, Skills, Rules & Lead-up Games.

UNIT-III

Introduction and Basic Concepts of NSS: History, Philosophy, Aims & Objectives of NSS. Emblem, Flag, Motto, Song, Badge, Organizational Structure, Roles and Responsibilities of Various NSS functionaries. NSS Programmes and Activities, Volunteerism and Shramdan.

UNIT-IV

Personality Development Through Community Service: Importance and Role of Youth Leadership, Life Competencies, Social Harmony and National Integration, Youth Development Programmes in India, Citizenship, Health, Hygiene and Sanitation, Environment Issues, Disaster Management, Life Skills.

UNIT-V

Vocational And Entrepreneurship Skills Development: Definition and meaning of Entrepreneurship, Qualities of good entrepreneur, Steps /ways in operating an Enterprise and role of financial and support service Institutions. Project Cycle Management, Resource Mobilisation and Documentation and Reporting.

Project work/ Practical: Conducting Surveys on Special Theme, Involving in Shramadan, Swachh Bharat, Blood Donation, Tree Plantation, Awareness Programmes, Identify the Community Problems and List out the all Possible Solutions, Educate the Villagers on Health, Hygiene, Sanitation and Environment Protection. Self-Review of the Students on their Improvements by Participating in the Community Service Programmes.

References

1. Rajiv Parti, *The Soul of Wellness: 12 holistic principles for achieving a healthy body, mind, heart and spirit*, Select book incorporation, New York.
2. H. & Walter, H., (1976). *Turners School Health Education*. Saint Louis: The C.Y. Mosby Company.
3. Nemir, A. (n.d.). *The School Health Education*. New York: Harber and Brothers.
4. Edward T Howley, *Health Fitness Instructors Handbook*, Human Kinetics, USA.
5. **About NSS:** National Service Scheme Manual by Government of India Ministry of Youth Affairs & Sports, New Delhi.
6. Robert N Lussier, *Management Fundamentals - Concepts, Applications, Skill Development*, Cengage Leaning, First Edition, 2012.
7. Mroczex & Little, *Handbook of Personality Development* –(eds).2006.
8. Richard Blundel, *Exploring Entrepreneurship Practices and Perspectives*, Oxford, 2011.

AUTOMATA THEORY AND APPLICATIONS

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56061	PCC	L	T	P	C	CIE	SEE	Total
		3	1	0	4	40	60	100

Course Objectives

1. Introduce concepts in automata theory
2. Identify different formal language classes and their relationships
3. Design grammars and recognizers for different formal languages
4. Identify undecidable problems
5. Introduce various applications of Automata Theory

Course Outcomes

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

1. Understand the core concepts in automata theory and formal languages
2. Design of NFA and DFA for a given Regular Language
3. Design of PDA for the given CFG
4. Design Turing Machine to solve computing Problems
5. Understand the role of Automata theory in different Applications like Compiler, Natural Language Processing and Artificial Intelligence

UNIT-I

Language Fundamental: Strings, Languages, Language Recognition, A machine based hierarchy of language classes, A Tractability hierarchy of language classes.

Finite State Machine: Deterministic Finite State Machine, the Regular Languages, Designing Deterministic and Nondeterministic Finite State Machine, Simulators for FSMs, Minimizing FSMs.

UNIT-II

Regular Expressions and Regular Grammars: Regular Expression, Kleene Theorem, Applications of Regular Expressions, Regular Grammar, Regular Grammar and Regular Languages.

Regular and Non-regular Languages: Classifications of Regular Languages, Showing that Languages is Regular, Closure Properties of Regular Languages, Showing that Languages is not Regular.

UNIT-III

Context Free Grammars: Rewrite systems and Grammar, Context Free Grammars and Languages, Designing and Simplifying Context Free Grammar, Derivations and Parse Trees, Ambiguity.

Normal Forms: Normal Forms for Grammar, Converting to a Normal Form, Converting to Chomsky Normal Form and Greibach Normal Forms

UNIT-IV

Pushdown Automata: Definition of (Nondeterministic) PDA, Deterministic and Nondeterministic PDAs, Equivalence of CFGs and PDAs, Nondeterminism and Halting.

Turing Machines: Definition, Notation, computing with Turing Machine, Adding Multiple Tapes and Nondeterministic, Simulating a "Real" Computer

UNIT-V

Unrestricted Grammars: Definition, Equivalence of Unrestricted Grammars and Turing Machines, Grammars Compute Functions, Undecidable Problems about Unrestricted Grammars.

Compilers: Defining Syntax of Programming Languages, Context Free Grammar and Programming Languages, Designing Programming Languages and Their Grammar, Compilers for Programming Languages

Text Book

1. Elaine A. Rich, *Automata, Computability and Complexity: Theory and Applications*, Pearson Education, Inc.

References

1. John E.Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, *Introduction to Automata Theory, Languages and Computation*, Third Edition, Pearson, 2013.
2. Daniel I.A.Cohen, *Introduction to Computer Theory*, Second Edition, John Wiley.
3. Vivek Kulakarni, *Theory of Computation*, Oxford University press 2013, Second Edition, 2014

WEB DATA MINING

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56069	PCC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1. To have an idea of data mining and web mining, concepts of association rules in Mining
2. To understand supervised classification algorithms based on associations, Bayesian learning and SVM
3. To understand unsupervised hierarchical clustering, distance functions, handling standardized data
4. To expose the students to basic concepts of information retrieval and web page preprocessing
5. To understand web page ranking algorithms and social network analysis

Course Outcomes

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

1. Understand the concept of Data Mining and Web Mining and Association rules
2. Learn to apply Naïve Bayes and SVM algorithms for classification task
3. Learn to apply data standardization methods and handle mixed attribute data types, and also perform hierarchical clustering
4. Understand basic concepts of information retrieval methods and web page preprocessing steps
5. Learn the web page ranking algorithms in web mining

UNIT-I

The World Wide Web, History of the Web and the Internet, Data Mining, Web Mining Basic Concepts of Association Rules, Apriori Algorithm – Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with Multiple Minimum Supports – Extended Model, Mining Algorithm, Rule Generation

UNIT-II

Classification based on Associations, Naïve Bayesian Text Classification, Support Vector Machines – Linear SVM Separable and Non Separable cases, Non Linear SVM Kernel functions

UNIT-III

Representation of Clusters, Hierarchical Clustering – Single Link, Complete Link and Average Link Method, Strength and Weaknesses, Distance Functions – Numeric, Binary

and Nominal Attributes and Text Documents, Data Standardization, Handling of Mixed Attributes

UNIT-IV

Basic Concepts of Information Retrieval, IR Methods – Boolean Model, Vector Space Model, Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing- Stopword Removal, Stemming, Web page preprocessing, Duplicate Detection

UNIT-V

Web Search, Meta-Search: Combining Multiple Rankings – Similarity Score and Rank Positions, Web Spamming – Content and Link Spamming, Hiding Techniques, Combatting Spam

Link Analysis - Social Network Analysis, PageRank Algorithm, HITS Algorithm

Text Book

1. Bing Liu , *Web Data Mining*, Springer India, 2010

References

1. Soumen Chakrabarti, *Mining the Web*, Morgan-Kaufmann Publishers, Elseiver, 2002
2. Manu Konchady, *Text Mining Application Programming*, Cengage Learning, 2006

COMPUTER VISION AND IMAGE PROCESSING

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56069	PCC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1. Analyze general terminology of digital image processing.
2. Understand the image noise models and enhancement methods.
3. Evaluate the image segmentation methodologies.
4. Understand the image compression and color image processing techniques.
5. Apply image processing algorithms in practical applications.

Course Outcomes

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

1. Understand the fundamental concepts of digital image processing systems.
2. Understand the image noise models and enhancement techniques
3. Comprehension of different image segmentation and restoration methodologies
4. Analyze the concepts of image compression and color image processing.
5. Acquire the knowledge of morphological operations and image processing related areas.

UNIT-I

Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts.

Fundamental Concepts of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models. Fundamental steps in image processing, image processing applications

UNIT-II

Digital Image Processing Operations: Basic relationships and distance metrics, Classification of image processing operations- Arithmetic operations, Logical operations.

Image Enhancement: Image quality and need for image enhancement, image enhancement point operations-piecewise linear functions, Histogram based techniques, Spatial filtering concepts.

UNIT-III

Image Restoration: Categories of image degradations- noise modeling, image restoration in the presence of noise only- Mean filters, order statistics filters.

Image Segmentation: Detection of discontinuities, types of edge detectors, First-order edge detection operators, and second-order derivatives filters.

UNIT-IV

Image Compression: Compression model, Lossless and Lossy Compression and Coding techniques for image compression.

Color Image Processing: Introduction, color monitors, color image storage -and processing, color models-RGB Colour Model, HSI Colour Models, HSV Colour Model, HLS Colour Models, TV Color Models.

UNIT-V

Image Morphology: Need for morphological processing, morphological operators, Hit-or-Miss transform, Basic morphological algorithms, and Gray-scale morphology.

Image Descriptors and Features: Texture Descriptors, Colour Features, Object Boundary and Shape Representations

Text Books

1. S. Sridhar, *Digital Image Processing*, Oxford University Press
2. D. and J. Ponce, *Computer Vision: A Modern Approach,* Prentice Hall, 2nd ed., 2015

References

1. Gonzalez R.C., Woods R.E, *Digital Image Processing,* 3rd Edition, Pearson, Prentice-Hall of India Pvt. Ltd. New Delhi.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing, Analysis and Machine Vision*
3. Anil K. Jain, *Fundamentals of Digital Image Processing,* Prentice- Hall of India Pvt. Ltd, New Delhi.

R PROGRAMMING

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56036	PEC-I	L	T	P	C	CIE	SEE	Total
		2	0	0	2	40	60	100

Course Objectives

1. To make students exercise the fundamentals of statistical analysis in R environment.
2. To analyze data for the purpose of exploration using Descriptive and Inferential Statistics.

Course Outcomes

1. Demonstrate vector and matrix operations using R.
2. Apply various operators on data frames and list.
3. Write functions using iterative programming
4. Analyze the data using R
5. Describe linear and multiple regression models for time series data & web data

UNIT-I

Basics of R: Introduction, R-Environment Setup, Programming with R, Basic Data Types.
Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector Subsetting.
Matrices: Creating and Naming Matrices, Matrix Subsetting.
Arrays, Class.

UNIT-II

Factors and Data Frames: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, Subsetting of Data Frames, Extending Data Frames, Sorting Data Frames.
Lists: Introduction, Creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors.
Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.

UNIT-III

Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.
Functions in R: Introduction, Writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R, Cumulative Sums and Products, Calculus in R, Input and Output Operations.

UNIT-IV

Apply Family in R: Introduction, Using Apply in R, Using Lapply in R, Using Sapply, Using Tapply in R: Split Function, Using Mapply in R.
Charts and Graphs: Introduction, Pie Chart: Chart Legend, 3D Pie Chart, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

UNIT-V

Data Interfaces: Introduction, CSV Files: Syntax, Importing a CSV File, Excel Files: Syntax, Importing an Excel file, Binary Files: Syntax, XML Files, Web Data, Databases.
Statistical Applications: Introduction, Basic Statistical Operations, Linear Regression Analysis, Chi-Squared Goodness of Fit Test, Chi-Squared Test of Independence, Multiple Regression, Time Series Analysis.

Text Book

1. K G Srinivas, G M Siddesh, *Statistical programming in R*, Oxford Publications.

References

1. Mark Gardener, *Beginning R: The Statistical Programming Language,* Wrox.
2. Y. Anchang Zhao, *R and Data Mining: Examples and Case Studies* Elsevier in December 2012.
3. Avril Coghlan, *A Little Book of R For Time Series*, Release 0.2.

MOBILE APPLICATION DEVELOPMENT

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56054	PEC-I	L	T	P	C	CIE	SEE	Total
		2	0	0	2	40	60	100

Course Objectives

1. Outline the usage of Android development framework.
2. Understand the main components of an Android application and its entire life Cycle.
3. Develop database programming using SQLite.
4. Identify the use of location-based service in android applications.
5. Build SMS and MMS applications using Intents

Course Outcomes

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

1. Analyze the architecture of android and current trends in mobile operating systems.
2. Apply suitable software tools and APIs for the design of User Interfaces to a particular mobile application
3. Design applications for mobile devices using SQLite Database
4. Apply the location-based services in android applications.
5. Summarize the Monitoring changes to the phone, network, data connectivity and SIM states.

UNIT-I

Introduction to Android: Features of Android, The development framework: Understanding the Android Software Stack, Android Application Architecture; the Dalvik Virtual Machine, Creating First Android Application, Types of Android Applications, Android Development Tools: The Android Virtual Device Manager, Android Emulator, The Dalvik Debug Monitor Service.[TB1-chapter 1,2]

UNIT-II

Creating applications and Activities: Introduction to the application Manifest File, Using the Manifest Editor, Externalizing Resources: Creating Resources - Simple Values, Drawable, Layouts, Menus, Animations. The Android Activity Life cycle. **Building User Interfaces:** Fundamental Android UI design, Introducing Layouts: Defining Layouts, Using Layouts to Create Device Independent User Interfaces, Optimizing Layouts.[TB1-Chapter 3,4]

UNIT-III

Databases and Content Providers: Introduction to Android Databases, Introducing SQLite, Content Values and Cursors, working with SQLite Databases - Introducing the

SQLiteOpenHelper, querying a Database, Extracting Values from a Cursor, Adding, Updating, and Removing Rows, Creating Content Providers, Using Content Providers - Introducing the Content Resolver, Querying Content Providers, Adding, Deleting, and Updating Content.[TB1-chapter 8]

UNIT-IV

Maps and Location based services: Using the location-based services, selecting a Location Provider, selecting a Location provider, and finding current location;

Creating Map-Based Activities: Introducing Map View and Map Activity, Creating a Map-Based Activity, Maps and Fragments.[TB1-chapter 13]

UNIT-V

Telephony and SMS: Using telephony - Initiating Phone Calls, Accessing Telephony Properties and Phone State, Monitoring Changes in Phone State Using the Phone State Listener.

Introducing SMS and MMS: Using SMS and MMS in Your Application, Sending SMS and MMS from Your Application Using Intents, Sending SMS Messages Using the SMS Manager. [TB1-chapter 17]

Text Book

1. Reto Meier, *Professional Android 4 Application Development*, First Edition, Wrox Press, Wiley Publishing, 2014

References

1. Pradeep Kothari, *Android Application Development (with Kitkat Support), Black Book*, 2014, Dreamtech Press publisher, Kogent Learning Inc., 2014
2. Erik Hellman, *Android Programming: Pushing the Limits*, First Edition, Wiley Publications, 2014
3. Mike Wolfson, *Android Developer Tools Essentials,* O'Reilly Edition, First Edition, 2013

INTERNET OF THINGS

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56037	PEC-I	L	T	P	C	CIE	SEE	Total
		2	0	0	2	40	60	100

Course Objectives

1. Differentiate Physical and Logical Design of IoT
2. Categorize pin configuration of Arduino Uno Board
3. Demonstrate Code in Node-RED
4. Identify communication between M2M
5. Develop an IoT Applications using Raspberry Pi board

Course Outcomes

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

1. Identify physical and logical design of IoT
2. Understand Arduino Uno Board
3. Implement code in Node-RED
4. Develop an IoT Application using Arduino Uno board
5. Develop an IoT Applications using Raspberry Pi board

UNIT-I

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.

Domain specific applications of IoT: Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and lifestyle.

UNIT-II

Arduino Basics: Hardware Requirements, Software Requirements, Arduino Programming Language References

Internet Connectivity: Arduino Uno Wired Connectivity (Ethernet), Arduino Uno Wireless Connectivity (Wifi)

UNIT-III

Communication Protocols: HTTP, MQTT (3 hours)(T2, Chapter3)

Complex Flows: Node-RED: Hardware and Software Required, Circuit, Node-RED Flow, code (Arduino)

UNIT-IV

Prototypes

IoT Patterns: Real-time Clients, Remote Control, On-Demand Clients, Web Apps, Location Aware, Machine to Human, Machine to Machine.

UNIT-V

Using IOT for RFID and MQTT and the Raspberry Pi: Introduction to Raspberry Pi, RFID Technology, IoTRFID Hardware and Software, Building an MQTT Server on a Raspberry Pi, the Software on the Raspberry Pi, Building the IOTRFID Project

Text Books

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things - A Hands-on Approach*, Universities Press, 2015
2. Adeel Javed, *Building Arduino Projects for the Internet of Things Experiments with Real-World Applications*, Apress, 2016
3. John C. Shovic , *Raspberry Pi IoT Projects, Prototyping Experiments for Makers*, Apress, 2016

References

1. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, (CRC Press)
2. Matt Richardson & Shawn Wallace, *Getting Started with Raspberry Pi*, O'Reilly (SPD), 2014
3. R.K.Mittal and I J Nagrath, *Robotics and Control*, TMH, 2003

UNIFIED MODELING LANGUAGE

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56064	PEC-I	L	T	P	C	CIE	SEE	Total
		2	0	0	2	40	60	100

Course Objectives

1. The importance of modeling in the software development life cycle
2. The UML notation and symbols
3. The object-oriented approach to analyzing and designing systems and software solutions
4. How to Employ the UML notation to create effective and efficient system designs

Course Outcomes

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

1. Ability to abstract object-based views for generic software systems.
2. Ability to analyze and model software specifications.
3. Ability to abstract behavioral model software specifications.
4. Ability to deliver robust software components.
5. Ability to inculcate necessary skills to handle complexity in software design.

UNIT-I

Introduction to UML: Importance of modeling, Principles of modeling, Object oriented modeling, Conceptual model of the UML.

UNIT-II

Use cases, Use case diagrams

Basic Structural Modeling: Classes, Relationships, Modeling Techniques for Class diagrams.

Object Diagrams: Concepts, Modeling Techniques for Object diagrams.

UNIT-III

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Packages.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT-IV

Basic Behavioral Modeling: Activity diagrams, Interaction diagrams, Sequence diagrams

UNIT-V

Advanced Behavioral Modeling: Collaboration diagrams, State chart diagrams

Case Study: The unified Chatbot Application

Text Books

1. Grady Booch, James Rumbaugh, Ivar Jacobson: *The Unified Modeling Language User Guide,* Pearson Education 2nd Edition.
2. Terry Quatrani, *Modeling with Rational Rose 2000 and UML /.Rose* 2000 ed.

References

1. Meilir Page-Jones, *Fundamentals of Object Oriented Design in UML*, Pearson Education.
2. Martina Seidl,Marion Scholz, Christian Huemer, Gerti Kappel, *UML @ Classroom: An Introduction to Object-Oriented Modeling*, Springer International Publishing
3. Atul Kahate, *Object Oriented Analysis & Design*, The McGraw-Hill Companies.
4. Mark Priestley, *Practical Object-Oriented Design with UML*, TMH.
5. Craig Larman, *Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process*, Pearson Education.

DISTRIBUTED SYSTEMS

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56065	PEC-II	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1. To acquire an understanding of the issues in distributed systems
2. To study architectures and working of distributed file systems
3. To expose the students to distributed transaction management, security issues and replication

Course Outcomes

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

1. Students would be able to describe the problems and challenges associated with principles of distributed systems.
2. Students will be able to evaluate the effectiveness and shortcomings of different solutions.
3. Students can implement small scale distributed systems and can actually learn the solutions by doing.

UNIT-I

Introduction: Goals and Types of Distributed Systems

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware, and Self-Management in Distributed Systems.

Processes: Threads, Virtualization, Clients, Servers, and Code Migration.

Communication: Fundamentals, Remote Procedure Call, Message-Oriented Communication, Stream-Oriented Communication, and Multicast Communication.

UNIT-II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and Attribute-Based Naming.

Synchronization: Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, and Election Algorithms.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

UNIT-III

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

Distributed Object-Based Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-IV

Distributed File Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Distributed Web-Based Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-V

Distributed Coordination-Based Systems: Introduction to Coordination Models, Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Map-Reduce: Example, Scaling, programming model, Apache Hadoop, Amazon Elastic Map Reduce, Mapreduce.net, Pig and Hive.

Text Book

1. Andrew S. Tanenbaum and Maarten Van Steen, *Distributed Systems*, PHI 2nd Edition, 2009.

References

1. R.Hill, L.Hirsch, P.Lake, S.Moshiri, *Guide to Cloud Computing, Principles and Practice*, Springer, 2013.
2. R.Buyya, J.Borberg, A.Goscinski, *Cloud Computing-Principles and Paradigms*, Wiley 2013.

EVOLUTIONARY COMPUTING

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56066	PEC-II	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1. About the basic concepts of evolution and the manner of operation of an evolutionary algorithm
2. About evolutionary strategies
3. About parameter control evolutionary algorithms and multi modal problems and spatial distribution
4. Optimize different types of functions. Will also be able to describe about schema theorem, statistical mechanics.
5. About constraint handling. Including interactive and non-stationary aspects.

Course Outcomes

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

1. Formulate solutions for problems involving evolutionary aspects
2. Perform fitness, mutation and recombination operations on chromosomes using a wide range of methods.
3. Perform classification with a wide range of data using genetic programming
4. Solve problems using Memetic algorithms and also decide on the appropriateness of Lamarckian and Baldwinian methods.
5. Solve Problems involving multiple objectives and constraints and demonstrate the special forms of evolution and working with evolutionary algorithms with examples

UNIT-I

Evolutionary Algorithms: Need for Evolutionary Computing, Basic Definition, Components of Evolutionary algorithms, Evolutionary Cycle, The Operation of an Evolutionary Algorithm, Natural Versus Artificial Evolution, Evolutionary Computing, Global Optimization and Other Search Algorithms

UNIT-II

Representation, Mutation, Recombination, Fitness and Selection: Binary Representation, Integer Representation, Real valued representation, Population Management Models, Parent Selection, Survivor selection, Selection Pressure

UNIT-III

Evolutionary Algorithm Variants: Genetic Algorithms, Evolution Strategies, Evolutionary Programming, Genetic Programming, Learning Classifier Systems, Differential Evolution, Particle Swarm Optimization

Parameter Control: Introduction, Examples of changing parameters, Classification of control techniques, Examples of varying EA parameters

UNIT-IV

Hybridization: Lamarckianism and the Baldwin Effect, Structure of a Memetic Algorithm, Adaptive Memetic Algorithms, Design Issues for Memetic Algorithms

Multiobjective Evolutionary Algorithms: Multiobjective Optimization, Dominance and Pareto Optimality, EA Approaches to Multiobjective Optimization Schema Theorem, Dynamical systems, Markov Chains, Penalty methods, Repair methods, Analysis, Some examples,, algorithms.

UNIT-V

Constraint Handling: Types, Approaches to Handling Constraints

Co-evolutionary Systems: Cooperative and Competitive Coevolution, Schema Theorem, Dynamical Systems, Markov Chain Analysis

Working with Evolutionary Algorithms: Performance measures, Test problems, Examples

Text Book

1. A.E. Eiben, J.E. Smith, *Introduction to Evolutionary Computing*, Natural Computing Series, Springer-Verilag, ISBN : 978, 3- 662-44873-1, 2nd Edition, 2015

References

1. Thomas Back, David B Fogel and Zbigniew Michalewicz, *Evolutionary Computation Basic Algorithms and Operators*, IOP Publishing Ltd, 2000
2. Goldberg and David E, *Genetic Algorithms in Search. Optimization and Machine Learning*, Pearson Education, New Delhi, 2006
3. Dan Simon, *Evolutionary Optimization Algorithms*, Wiley, 2013
4. Kalyamoy Deb, *Multiobjective Optimization using Evolutionary Algorithms*, John Wiley & Sons, First Edition, USA, 2003.
5. Koza, John, Wolfgang Banzhaf, Kumar Chellapilla, Kalyanmoy Deb, Marco Dorigo, David Fogel, Max Garzon, David Goldberg, Hitoshi Iba, and Rick Riolo(Eds.), *Genetic Programming*, Academic Press. Morgan Kaufmann, USA, 1998.

CRYPTOGRAPHY

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56067	PEC-II	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1 Summarize the concepts of cryptography and its applications.
2 Compare and analyze encryption Algorithms
3 Differentiate Authentication Functionalities of MAC and Hash
4 Analyze security aspects of various web Applications
5 Analyze different network protocols

References

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

1. Outline fundamentals of cryptography and its applications.
2. Differentiate Symmetric and Asymmetric Algorithms
3. Compare MAC and Hash Authentication Algorithms
4. Classify different network protocols.
5. Analyze security aspects of various web Applications

UNIT-I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security

Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks. [TB1-chapter 1,2]

UNIT-II

Symmetric key Ciphers: Block Cipher principles, AES, Blowfish, Block cipher operation, Stream ciphers, RC4. [TB1-chapter 3,5,7]

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.[TB1-Chapter 9,10]

UNIT-III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Digital Signature Scheme. [TB1-Chapter 11, 13]

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure, protocol building blocks [TB1-Chapter 14, 15]

UNIT-IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer, Security, HTTPS, Secure Shell (SSH)-[TB1-Chapter 17]

Wireless Network Security: Wireless Security, Mobile Device Security, Wireless LAN, Wireless LAN Security [TB1-Chapter 18]

UNIT-V

E-Mail Security: Pretty Good Privacy, IP Security: IP Security overview, IP Security Architecture, Authentication Header, encapsulating security payload, combining security associations, Internet Key Exchange [TB1-Chapter 19]

Text Books

1. William Stallings, *Cryptography and Network Security - Principles and Practice,* Pearson Education, 6th Edition
2. Bruce schneier, *Applied Cryptography: Protocols, Algorithms, and Source Code in C*, Wiley, 2nd Edition

References

1. Forouzan Mukhopadhyay, *Cryptography and Network Security*, McGraw Hill, 3rd Edition
2. WM. Arthur Conklin, Greg White, *Principles of Computer Security,* TMH
3. Bernard Menezes, *Network Security and Cryptography*, Cengage Learning
4. C K Shyamala, N Harini, Dr T R Padmanabhan, *Cryptography and Network Security,* Wiley India, 1st Edition.

FUNDAMENTALS OF IMAGE DATA MINING

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56068	PEC-II	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Course Objectives

1. Describe the essential tools for image mining, such as Fourier transforms, Gabor filters, and contemporary wavelet transforms.
2. Review a varied range of state-of-the-art models, algorithms, and procedures for image mining.
3. Emphasize on real image data for practical image mining.
4. Extraction of features like color, texture, and shape from images for image representation.
5. Presents powerful approaches for classifying image data.

Course Outcomes

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

1. Understand the essential tools for image mining, such as Fourier transforms, Gabor filters, and contemporary wavelet transforms.
2. Understand the varied range of state-of-the-art models, algorithms, and procedures for image mining.
3. Highlight the real image data for practical image mining
4. Analyze the features like color, texture, and shape from images for image representation
5. Implementation of powerful approaches for classifying image data

UNIT-I

Fourier Transform: Introduction, Fourier series, Discrete Fourier Transform, 2D Fourier Transform and its Properties.

Windowed Fourier Transform: Introduction, Short term Fourier Transform and Gabor Filters.

Wavelet Transform: Discrete wavelet Transform, Multiresolution Analysis and Fast Wavelet Transform.

UNIT-II

Color Feature Extraction: Color Histogram, Color Structure Descriptor, Dominant Color Descriptor, Color Coherence Vector and Color Layout Descriptor.

Texture Feature Extraction: Spatial Texture Feature Extraction Methods, Spectral Texture Feature Methods Using Gabor Filters and Wavelet Transform.

UNIT-III

Contour Based Shape Methods: Shape Signatures, Shape Context, Boundary Moments and Fourier Descriptor.

Region Based Shape Feature Extraction: Geometric Moments, Generic Fourier Descriptor, Shape Matrix and Shape Profiles.

UNIT-IV

Image Classification: Introduction, Image Classification using Bayesian Classifier, Support Vector Machine, Decision Tree and Artificial Neural Network.

Image Annotation: Introduction, Image annotation with decision tree-Splitting criterion.

UNIT-V

Image Indexing and Ranking: Numerical Indexing, Inverted File Indexing, Similarity Measures and Performance Measures.

Image Presentation: Caption Browsing, Category Browsing and Context Browsing.

Text Book

1 Dengsheng Zhang, *Fundamentals Of Image Data Mining, Analysis, Features, Classification And Retrieval* Springer International Publishing, 2019

References

1. Gonzalez R.C., Woods R.E, *Digital Image Processing*, 3rd Edition, Pearson, Prentice-Hall of India Pvt.Ltd. New Delhi.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing, Analysis and Machine Vision*

VERBAL ABILITY AND CRITICAL REASONING

BTech (AIML) III Year I Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56288	HSS&MC	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

UNIT-I

Data Interpretation: Tabular, Pie-charts, Bar and line graphs and Problems on all models.

Data Sufficiency: Introduction and Problems based on all Quant and logical topics.

Allegations and Mixtures: Allegation rule, mean value of the mixture, Replacement of equal quantity of mixtures.

UNIT-II

Geometry: Line, line segment, angle, Triangles and Polygons with their Properties.

Mensuration: Area and perimeter of Triangle, Rectangle, Square, Parallelogram, Trapezium, Surface area & Volume of 3D figures.

Logarithms: Formulas and Problems based on Logarithms.

Progressions and Quadratic Equations: Arithmetic, Geometric and Harmonic Progressions and their relations. General forms of Quadratic equations and finding the roots and their nature.

UNIT-III

Syllogisms: Statements and Conclusions by using vein diagrams.

Odd One Out: Classification and problems based of Odd one out.

Cubes and Dice: Types of cubes and dice with Examples.

Statement and Conclusions: Introduction, Types of conclusions and different cases.

UNIT-IV

Tenses: Types, usage, question solving.

Vocabulary: Types, usage and error spotting.

Inference: conclusion reached on the basis of evidence and reasoning, question solving.

Para Jumbles: Arranging the jumbled sentence by using the strategies.

Sentence Completion: Completing a sentence by filling the gaps by understanding & analyzing the meaning of the sentence along with the approaches.

UNIT-V

Subject Verb Agreement: Rules and examples for finding the right subject and verb.

Sentence Correction: Error spotting and correcting the sentence.

Reading Comprehension: Understanding Meaning, Understanding the meaning of a text means figuring out what the passage is trying to tell you. Drawing Connections. Summarizing and Synthesizing.

Direct & Indirect Speeches: What is Direct & Indirect Speech? , reporting the message of the speaker in the exact words as spoken by the speaker and examples.

Active Voice & Passive Voice: Types of active and passive voice, rules and examples

Text Books

1. R.S Agarwal, *Verbal and Non Verbal Reasoning*, New Edition -2020, S. Chand.
2. R.S Agarwal, *Quantitative Aptitude*, New Edition- 2020, S. Chand.

References

1. Abhijeet Guha, *Quantitative Aptitude*, New Edition-2020, Mc Graw Hill

COMPUTER VISION AND WEB DATA MINING LAB

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56221	PCC Lab	L	T	P	C	CIE	SEE	Total
		0	0	4	2	50	50	100

PART-A

1. Installation of SCI lab and basic commands
2. Write the programs for vector and matrix operations
3. a. Write a program for displaying an image, printing of its properties and manipulations, arithmetic operation on images?
   b. Write a program for displaying histogram and histogram equalization?
4. a. Write a program for adding different types of noises with different percentages?
   b. Write a program for application of following mask
   i. Sobel ii. Prewitt iii. Robert iv. Canny v. Laplacian vi. LOG
5. Write a program for color image conversion models?
6. a. Write a program for reading RGB image and segmentation using threshold method?
   b. Write a program for color image histogram manipulations?
7. a. Write a Program for following morphology operations
   i. Dilation ii. Erosion iii. Open iv. Close v. Hit-or-Miss transform
   b. Write a program for rotating the image into different angles?

PART-B

1. Apply Naive Bayes Classification algorithm for a given textual dataset (1 week)
2. Apply SVM algorithm for a given dataset (2 weeks)
3. Apply Hierarchical Clustering for a given textual dataset. Experiment with different distance metrics (2 weeks)
4. Implement the distance functions for assessing similarity between documents while taking care of standardizing the attributes (1 week)
5. Apply text preprocessing methods to extract relevant text: Stop Word Removal, Stemming, Frequency Analysis for unigrams, bigrams and trigrams (2 weeks)

Note: Lucene/Weka/ MeTA/Python can be used for conducting the lab

R PROGRAMMING LAB

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56208	PEC-I Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Course Outcomes

1. Explore R environment
2. Visualize data insights using charts and graphs
3. Analysis data with linear regression model

Week 1
Installation and Environment set up R and Rstudio
Week 2
Experiments on Vector Arithmetic operations
Week 3
Experiments on Matrices operations
Week 4
Experiments on Arrays functions
Week 5
Experiments on Factors
Week 6
Experiments on Data Frames
Week 7
Experiments on List operations
Week 8
Write R scripts which demonstrate logical operations and Conditional Statements
Week 9
Write R scripts which demonstrate Looping over List
Week 10
Write R scripts which demonstrate Nested Functions and Function Scoping
Week 11
Experiments on Mathematical Functions in R
Week 12
Experiments on Calculus in R
Week 13
Experiments on Lapply, Sapply and Apply functions

Week 14
Generate different Charts and Graphs using R
Week 15
Experiments on data interfaces
Week 16
Analysis of data with linear regression model

MOBILE APPLICATION DEVELOPMENT LAB

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56218	PEC-I Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Course Outcomes

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

1. Develop user interfaces for the Android platform
2. Implement various mobile applications using Emulators
3. Create a database for mobile applications using SQLite Database
4. Perform location-based services in android applications
5. Create telephony and SMS for android applications

List of Experiments

1. Develop an application that Uses GUI Components, Font and Colors.
3. Develop an application that Uses Layout Managers and Event Listeners.
4. Develop a Native Calculator Application.
5. Write an application that Draws Basic Graphical Primitives on The Screen.
6. Develop an application that Makes Use of databases.
7. Develop a Native application that Uses GPS Location Information.
8. Implement an application that Writes Data to The SD Card.
9. Implement an application that Creates an Alert Upon Receiving A Message.
10. Write a Mobile application that Creates Alarm Clock.

INTERNET OF THINGS LAB

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56209	PEC-I Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Week 1:

1. Study and Install IDE of Arduino and different types of Arduinos.
2. Write program using Arduino IDE for Blink LED.
3. Write Program for RGB LED using Arduino.

Week 2:

4. Write program for buzzer using Arduino.
5. Write program for LDR using Arduino.
6. Write program for IR Sensor using Arduino.

Week 3:

7. Study the Temperature sensor and Write Program for monitor temperature using Arduino.

Week 4:

8. Study and Implement RFID, NFC using Arduino.

Week 5:

9. Study and implement MQTT protocol using Arduino.

Week 6:

10. Study and Implement Arduino Uno with Ethernet Connection to Send data to a Cloud

Week 7:

11. Study and Implement Arduino Uno with ESP 32 Connection to Send data to a Cloud

Week 8:

12. Study and Configure Raspberry Pi.
13. Write program for LED blink using Raspberry Pi
14. Write program for RGB LED using Raspberry Pi

Week 9:

15. Implement Raspberry Pi based Automated Street Lighting System.
16. Write an Arduino program for Distance Measurement Using Ultrasonic Sensor and displaying on LCD.

Week 10:

17. Write program for Buzzer using Raspberry Pi
18. Write program for LDR using Raspberry Pi
19. Write program for IR Sensor using Raspberry Pi

Week 11:

20. Implement IoT based weather monitoring system using Raspberry Pi.

Week 12:

21. Study and Implement RFID, NFC using Raspberry Pi.

Week 13:

22. Study and Implement Raspberry Pi with Ethernet Connection to Send data to a Cloud

Week 14:

23. Study and Implement Raspberry Pi with Wifi Connection to Send data to a Cloud

Week 15:

24. Study and Implement Zigbee Protocol using Arduino.

Week 16:

25. Study and Implement Zigbee Protocol using Raspberry Pi.

UNIFIED MODELING LANGUAGE LAB

BTech (AIML) III Year II Semester					Dept. of Artificial Intelligence			
Code	Category	Hours / Week			Credits	Marks		
A56222	PEC-I Lab	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

List of tasks to be performed week wise

1. Creation and implement of Class diagrams in UML for any application.
2. Creation and implement of Component diagrams in UML for any application.
3. Creation and implement of Deployment diagrams in UML for any application.
4. Creation and implement of Object diagrams in UML for any application.
5. Creation and implement of Package diagrams in UML for any application.
6. Create and implement of Use Case diagrams in UML for any application.
7. Creation and implement of Activity diagrams in UML for any application.
8. Creation and implement of State Chart diagrams in UML for any application.
9. Creation and implement of Sequence diagrams in UML for any application.
10. Creation and implement of Collaboration diagrams in UML for any application.
11. Creation and implement of Interaction diagrams in UML for any application.
12. Case Study on UML diagrams for Google Apps.