Mahatma Education Society's

Pillai College of Arts, Commerce & Science (Autonomous)

Affiliated to University of Mumbai

'NAAC Accredited 'A' grade (3 cycles)'
'Best College Award' by University of Mumbai
ISO 9001:2015 Certified

SYLLABUS

Program: Master of Science (M. Sc.) in Information Technology

M.Sc.- Part I Information Technology

PCACS/PMSIT/SYL/2024-25/PII

As per National Education Policy
Choice Based Credit & Grading System

Academic Year 2024-25

Board of Studies in the Department of Computer Science

Sr. No.	Name of the	Details	Sign
1	Prof. Deepika Sharma	Chairperson (Head of Department of Information Technology & Computer Science), Vice Principal	
2	Dr. Gajanan Wader	Principal	
3.	Mrs.Munawira Kotyad Pillai, Director Pillai Center for Innovation & Research	Management Representative	Absent
4	Dr. Amiya Kumar Tripathy Director Center for GeoAI & ML, Professor, Computer Engineering, Don Bosco Institute of Technology, Mumbai	Subject Expert From Outside Parent University	
5	Dr.Mrs. Anjali Kulkarni CKT College, New Panvel	Vice Chancellor Nominee, University of Mumbai	
6	Mr. Tito Idicula, Director, Programming Hub	Alumni representative	
7	Mr. Anant Baddi, Security Solution Architect, cloud Google Google	Industry Representative (Industry/Corporate/Allied Sector)	Absent
8	Mr. Bhupendra Kesariya Professor,N. M. .College, Vile Parle	Subject Expert in Mathematics From Outside Parent University	
9	Mrs. Anju Somani	Faculty Specialization	
10	Mrs. Shubhangi Pawar	Faculty Specialization	
11	Mrs. Soly Zachariah	Faculty Specialization	
12	Mrs. Ramya S. Kumar	Faculty Specialization	
13	Mrs. Sujata Shahabade	Faculty Specialization	

14	Mrs. Sreevidya T.V.	Faculty Specialization	
15	Mr. Omkar Sherkhane	Faculty Specialization	
16	Mr. Abhijeet Salvi	Faculty Specialization	

Introduction to Program

The Master of Science (M.Sc.) in Information Technology (IT) is a postgraduate degree program designed to provide students with advanced knowledge and skills in various aspects of information technology. This program is suitable for individuals who wish to enhance their expertise in IT and pursue careers in fields such as software development, cybersecurity, data management, systems analysis, and IT management.

The M.Sc. Information Technology program typically offers a comprehensive curriculum that covers both theoretical and practical aspects of IT. Students delve into topics such as computer programming, database management, network security, software engineering, data analytics, artificial intelligence, and human-computer interaction. The program aims to equip students with the necessary skills to tackle complex IT challenges and contribute to the development and implementation of innovative IT solutions.

Program Outcomes

Sr No	PO Title	POs in brief
PO1	**Advanced Knowledge and Expertise**	Ability to apply the knowledge of Information Technology with recent trends aligned with research and industry.
PO2	**Research and Innovation**	Ability to apply IT in the field of Computational Research, Soft Computing, Big Data Analytics, Data Science, Image Processing, Artificial Intelligence, Networking and Cloud Computing.
PO3	**Interdisciplinary Perspective**	Ability to provide socially acceptable technical solutions in the domains of Information Security, Machine Learning, Internet of Things and Embedded System, Infrastructure Services as specializations.
PO4	**Leadership Abilities & Entrepreneurial Mindset**	Ability to apply the knowledge of Intellectual Property Rights, Cyber Laws and Cyber Forensics and various standards in interest of National Security and Integrity along with IT Industry.
PO5	**Communication Competence**	Ability to write effective project reports, research publications and content development and to work in multidisciplinary environment in the context of changing technologies.
PO6	**Advanced Tools Usage**	The program teaches the students to apply the advances tools to solve real world problems
PO7	**Nurturing project Planning and Management Capabilities**	The program trains students for designing and conceptualizing the software architecture, planning and managing the product development process of complex and live software projects. It also makes students understand the decision making for selection of an appropriate project management capabilities
PO8	**Teamwork and Leadership Development**	Trains students to work in a team and also to take leadership of the project management team.

Program Specific Outcomes

Sr. No	PSOs in brief
PSO1	Competence in employing principles, techniques and tools of data analytics for business analytics.
PSO2	Curiosity and readiness to deal with small and big data and ability to engage in exploratory research.
PSO3	Capability to become a successful trainer in data science, data analytics, productive decision maker and therefore well-respected personality at work and in life.
PSO4	Students completing this programme will become full-stack data scientists, well-equipped for a variety of job roles depending on their choices and temperament including Data Scientists, Data Analysts as well as Industrial and Societal Entrepreneurs.

Semester III						
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures/ Week**
PMSIT301	**Major**	Applied Artificial Intelligence	Theory	100	4	4
PMSIT302	**Major**	Machine Learning	Theory	100	4	4
PMSIT303	**Major**	Robotic Process Automation	Theory	100	4	4
PMSIT304	**Major**	A. Business Analytics B. Digital Footprints: Unraveling Web Analytics C. Computational Social Networks	Theory	50	2	4
PMSIT305P	**Major Practical**	Practicals (PMSIT301 + PMSIT302)	Practical	100	2	4
PMSIT306P	**Major Practical**	Practicals (PMSIT303 + PMSIT304)	Practical	100	2	4
PMSIT307P	**RP**	Research Project		100	4	2
Total				650	22	26
All Subjects having Field Project as part of Continuous Assessment-2						

Abbreviations:

RM : Research Project

Semester IV						
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures/ Week**
PMSIT401	**Major**	Deep Learning	Theory	100	4	4
PMSIT402	**Major**	Blockchain	Theory	100	4	4
PMSIT403	**Major**	Natural Language Processing	Theory	100	2	4
PMSIT404P	**Major Practical**	Practical (PMSIT401)	Practical	50	2	2
PMSIT405P	**Major Practical**	Practical (PMSIT402)	Practical	50	2	2
PMSIT406P	**Major Practical**	Practical (PMSIT403)	Practical	50	2	2
PMSIT407P	**RP**	Project Dissertation with Implementation	-	200	6	4
Total				650	22	22
All Subjects having Field Project as part of Continuous Assessment-2						

Abbreviations:

RM : Research Project

Evaluation Pattern

Marking Code	Marking Scheme
A	60 Marks Final Exam, 20 Marks Internal Exam, 15 Marks Field Project, 5 Marks Attendance
B	50 marks distributed within report /case study/ project/ presentation etc.
C	50 Marks Practical Examination.
D	100 Marks Practical Examination. Subject 1 Practical (50 Marks) + Subject 2 Practical (50 Marks) =100
E	100 Marks distributed within report / internship period / certificate etc.
F	50 Marks Theory Exam.

SEMESTER - III				
Course Code	**Course Type**	**Course Title**	**Evaluation Pattern**	**Marks**
PMSIT301	**Major**	Applied Artificial Intelligence	A	100
PMSIT302	**Major**	Machine Learning	A	100
PMSIT303	**Major**	Robotic Process Automation	A	100
PMSIT304	**Major**	a. Business Analytics b. Digital Footprints: Unraveling Web Analytics c. Computational Social Networks	F	50
PMSIT305P	**Major**	practicals (PMSIT301 + PMSIT302)	D	100
PMSIT306P	**Major**	Practicals (PMSIT303 + PMSIT304)	D	100
PMSIT307P	**RP**	Research Project	B	100
Total				650

SEMESTER – IV				
Course Code	Course Type	Course Title	Evaluation Pattern	Marks
PMSIT401	**Major**	Deep Learning	A	100
PMSIT402	**Major**	Blockchain	A	100
PMSIT403	**Major**	Natural Language Processing	A	100
PMSIT404P	**Major**	Practical (PMSIT401)	C	50
PMSIT405P	**Major**	Practical (PMSIT402)	C	50
PMSIT406P	**Major**	Practical (PMSIT403)	C	50
PMSIT407P	**RP**	Project Dissertation with Implementation	E	200
Total				650

SEMESTER - III

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	III
Course Name	Applied Artificial Intelligence
Course Code	PMSIT301
Type of course	Major
Level of the Subject	Advanced
Credit points	4 Theory + 1 Practical

Course Objectives:
1. To explore the applied branches of artificial intelligence Practice problem analysis and decision-making
2. To enable the learner to understand applications of artificial intelligence.

Unit No.	Name of Unit	Content	Hours
1	**Review of AI**	Review of AI: History, foundation and Applications Expert System and Applications: Phases in Building Expert System, Expert System Architecture, Expert System versus Traditional Systems, Rule based Expert Systems, Blackboard Systems, Truth Maintenance System, Application of Expert Systems, Shells and Tools	**15**
2	**Probability Theory**	**Probability Theory:** joint probability, conditional probability, Bayes's theorem, probabilities in rules and facts of rule based system, cumulative probabilities, rule based system and Bayesian method **Fuzzy Sets and Fuzzy Logic:** Fuzzy Sets, Fuzzy set operations, Types of Member ship Functions, Multivalued Logic, Fuzzy Logic, Linguistic variables and Hedges, Fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems, possibility theory and other enhancement to Logic	**15**

3	**Machine Learning Paradigms**	**Machine Learning Paradigms:** Machine Learning systems, supervised and un-supervised learning, inductive learning, deductive learning, clustering, support vector machines, cased based reasoning and learning. **Artificial Neural Networks:** Artificial Neural Networks, Single-Layer feedforward networks, multi-layer feed-forward networks, radial basis function networks, design issues of artificial neural networks and recurrent networks	**15**
4	**Evolutionary Computation**	**Evolutionary Computation:** Soft computing, genetic algorithms, genetic programming concepts, evolutionary programming, swarm intelligence, ant colony paradigm, particle swarm optimization and applications of volutionary algorithms. **Intelligent Agents:** Agents vs software programs, classification of agents, working of an agent, single agent and multiagent systems, performance evaluation, architecture, agent communication language, applications Advanced Knowledge Representation Techniques: Conceptual dependency theory, script structures, CYC theory, script structure, CYC theory, case grammars, semantic web. Natural Language Processing: Sentence Analysis phases, grammars and parsers, types of parsers, semantic analysis, universal networking language, dictionary	**15**
Total No. Of Lectures			**60**

Course Outcomes:
1. Understand the fundamentals concepts of the expert system and its applications.
2. Apply probability and the concept of fuzzy sets for solving AI based problems.
3. Understand the applications of Machine Learning. The learner can also apply fuzzy system for solving problems
4. Apply to understand the applications of genetic algorithms in different problems related to artificial intelligence.
5. Apply knowledge representation techniques in natural language processing.

References:

1. Artificial Intelligence.by Saroj Kaushik Cengage (2019), APress
2. Artificial Intelligence: A Modern Approach, A. Russel, Peter Norvig: PACKT
3. Artificial Intelligence, Elaine Rich,Kevin Knight,Shivashankar B. Nair: Tata Mc-Grawhill
4. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow by Sebastian Raschka and Vahid Mirjalili
5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Aurélien Géron

CASE STUDY	
SR. NO	
1	Imagine you are a data scientist working on a machine learning model that predicts whether an email is spam or not. You have a dataset of emails, each labeled as 'spam' or 'not spam.' To improve your model's accuracy, you decide to apply probability theory. You start by calculating the probabilities of certain words appearing in spam and non-spam emails. For instance, the word "free" appears in 80% of spam emails and 20% of non-spam emails. Similarly, the word "meeting" appears in 10% of spam emails and 60% of non-spam emails
2	In the healthcare industry, ANNs are being used to predict patient outcomes based on historical data. Consider a hospital that has implemented an ANN to predict the likelihood of patients being readmitted within 30 days after discharge. The network is trained on a dataset containing various features such as age, gender, medical history, treatment received, and length of stay. The ANN has been designed with an input layer corresponding to these features, several hidden layers to process the data, and an output layer that gives the probability of readmission. The performance of the ANN is evaluated using a separate test dataset, and the predictions are compared with the actual outcomes to calculate the model's accuracy

Practicals	
Practical No.	**Details**
1	Design an Expert system using AIML. E.g: An expert system for responding the patient query for identifying the flu.
2	Design a bot using AIML.
3	Implement Bayes Theorem using Python
4	Implement Conditional Probability and joint probability using Python
5	Write a program for to implement Rule based system.
6	Design a Fuzzy based application using Python / R.
7	Write an application to simulate supervised and un-supervised learning model
8	Write an application to implement clustering algorithm
9	Write an application to implement support vector machine algorithm
10	Simulate artificial neural network model with both feed forward and back propagation approach. [You can add some functionalities to enhance the model].
11	Simulate genetic algorithm with suitable example using Python / R or any other platform
12	Design an Artificial Intelligence application to implement intelligent agents
13	Design an application to simulate language parser
14	Design an application to simulate semantic web.

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	III
Course Name	Machine Learning
Course Code	PMSIT302
Type of course	Major
Level of the Subject	Advanced
Credit points	4 Theory + 1 Practical

Course Objectives:
1. Understanding Human learning aspects.
2. Understanding primitives in the learning process by computer.

Unit No.	Name of Unit	Content	Hours
1	**Introduction: Machine learning**	**Introduction: Machine learning**, Examples of Machine Learning Problems,Structure of Learning, learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.	**15**
2	**Classification and Regression**	**Classification and Regression: Classification:** Binary Classification-Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification. **Regression**: Assessing performance of Regression- Error measures, Overfitting-Catalysts for Overfitting, Case study of Polynomial Regression. **Theory of Generalization:** Effective number of hypotheses, Bounding the Growth function, VC Dimensions, Regularization theory.	**15**
3	**Linear Models**	**Linear Models:** Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity	**15**

4	**Logic Based and Algebraic Model**	**Logic Based and Algebraic Model: Distance Based Models:** Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, **Rule Based Models:** Rule learning for subgroup discovery, Association rule mining. **Tree Based Models:** Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees. Probabilistic Model: Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models. **Trends In Machine Learning :** Model and Symbols-Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning	15
		Total No. of Lectures	**60**

Course Outcomes:

1. Understand the key issues in Machine Learning and its associated applications in intelligent business and scientific computing.
2. Apply the knowledge about classification and regression techniques where a learner will be able to explore his skill to generate data base knowledge using the prescribed techniques.
3. Understand and implement the techniques for extracting the knowledge using machine learning methods.
4. Analyze adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc
5. Understand the statistical approach related to machine learning. He will also Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

References:

1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, by Peter Flach Cambridge University Press
2. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, Hastie, Tibshirani, Friedman, Springer (2012)
3. Introduction to Machine Learning, Ethem Alpaydin PHI (2013)
4. Pattern Recognition and Machine Learning" by Christopher M. Bishop -
5. Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy

CASE STUDY	
SR. NO	
	A real estate company is using machine learning to predict the selling prices of homes. They have collected a dataset of past home sales in the area, which includes features like the size of the house (in square feet), the number of bedrooms and bathrooms, the age of

	the home, the neighborhood, and the selling price.The company decides to use both classification and regression models. For classification, they categorize homes into three classes based on their selling price: low, medium, and high. For regression, they predict the exact selling price of the homes.
	A marketing team wants to understand the impact of their advertising spend on sales. They have collected data over the past year, which includes monthly figures for advertising spend and sales revenue. The team decides to use a linear regression model to predict sales based on advertising spend. They hypothesize that there is a linear relationship between the amount spent on advertising and the sales revenue generated.

Practicals	
Practical No.	**Details**
1	a) Design a simple machine learning model to train the training instances and test the same. b) Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file
2	a) Perform Data Loading, Feature selection (Principal Component analysis) and Feature Scoring and Ranking. b) 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.
3	a) 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. b) Write a program to implement Decision Tree and Random forest with Prediction, Test Score and Confusion Matrix.
4	a) For a given set of training data examples stored in a .CSV file implement Least Square Regression algorithm b) For a given set of training data examples stored in a .CSV file implement Logistic Regression algorithm
5	a) 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. b) Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.
6	a) Implement the different Distance methods (Euclidean) with Prediction, Test Score and Confusion Matrix b) Implement the classification model using clustering for the following techniques with K means clustering with Prediction, Test Score and Confusion Matrix
7	a) Implement the classification model using clustering for the following techniques with hierarchical clustering with Prediction, Test Score and Confusion Matrix b) Implement the Rule based method and test the same
8	a) Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart

	Disease Data Set. b) Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
9	a) Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. b) Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.
10	a) 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 b) Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
11	Perform Text pre-processing, Text clustering, classification with Prediction, Test Score and Confusion Matrix

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part – II
Semester	III
Course Name	Robotic Process Automation
Course Code	PMSIT303
Type of course	Major
Level of the Subject	Advanced
Credit points	4 Theory + 1 Practical

Course Objectives:
1. To make the students aware about the automation today in the industry
2. To make the students aware about the tools used for automation.

Unit No.	Name of Unit	Content	Hours
1	Robotic Process Automation	Robotic Process Automation: Scope and techniques of automation, About UiPath Record and Play: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio Task recorder, Step-by-step examples using the recorder.	15
2	Sequence, Flowchart	Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow Data Manipulation: Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example)	15
3	Taking Control of the Controls	Taking Control of the Controls : Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of	15

		OCR available, How to use OCR, Avoiding typical failure points	
		Tame that Application with Plugins and Extensions: Terminal plugin, SAP automation, Java plugin, Citrix automation, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management, Extensions – Java, Chrome, Firefox, and Silverlight	
4	Handling User Events and Assistant Bots	Handling User Events and Assistant Bots: What are assistant bots?, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger ,Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, License management, Publishing and managing updates	**15**
Total No. Of Lectures			60

Course Outcomes:

1. Understand the mechanism of business process and can provide the solution in an optimize way
2. Understand the features use for interacting with database plugins
3. Apply plug-ins and other controls used for process automation
4. Create and handle the different events, debugging and managing the errors
5. Evaluate deploy the automated process Effectively use existing software tools to solve real problems using a soft computing approach

References:

1. Learning Robotic Process Automation by Alok Mani Tripathi Packt publication 1st. 2018
2. Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation by Srikanth Merianda Createspace Independent Publishing 1st. 2018
3. The Simple Implementation Guide to Robotic Process Automation (Rpa): How to Best Implement Rpa in an Organization by Kelly Wibbenmeyer iUniverse (2018)
4. Practical Robotic Process Automation: Enterprise Blue Prism" by Kashyap Patel
5. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath" by Alok Mani Tripathi

CASE STUDY	
SR. NO	
6.	A financial institution is looking to streamline its customer onboarding process. The current process is manual, involving multiple departments, and is prone to errors and delays. To address this, the institution implements an RPA solution using a flowchart-based approach for visualizing the process and a sequence of automated tasks to perform the actions. The RPA system is designed to verify customer documents, perform background checks, and set up new accounts. Each step is mapped out in the flowchart, with decision nodes indicating where human intervention is required. The sequence ensures that tasks are performed in the correct order, and exceptions are handled appropriately.
7.	A logistics company implemented RPA to manage its warehouse operations more efficiently. The RPA system was designed to control the inventory levels, track shipments, and process orders automatically. However, to ensure the system operated effectively within the company's operational guidelines, a control mechanism was put in place. This mechanism included regular audits of the RPA system's decisions, real-time monitoring of its operations, and a set of rules that triggered alerts if any anomalies were detected.

Practicals	
Practical No.	**Details**
1	a. Create a simple sequence based project. b. Create a flowchart-based project. c. Create an UiPath Robot which can empty a folder in Gmail solely on basis of recording.
2	a. Automate UiPath Number Calculation (Subtraction, Multiplication, Division of numbers). b. Create an automation UiPath project using different types of variables (number, datetime, Boolean, generic, array, data table)
3	a. Create an automation UiPath Project using decision statements. b. Create an automation UiPath Project using looping statements
4	a. Automate any process using basic recording. b. Automate any process using desktop recording. c. Automate any process using web recording.
5	a. Consider an array of names. We have to find out how many of them start with the letter "a". Create an automation where the number of names starting with "a" is counted and the result is displayed.
6	a. Create an application automating the read, write and append operation on excel file. b. Automate the process to extract data from an excel file into a data table and vice versa

7	a. Implement the attach window activity.
	b. Find different controls using UiPath.
	c. Demonstrate the following activities in UiPath:
	      i. Mouse (click, double click and hover)
	      ii. Type into
	      iii. Type Secure text

8	a. Demonstrate the following events in UiPath:

	i. Element triggering event
	ii. Image triggering event
	iii. System Triggering Event
	b. Automate the following screen scraping methods using UiPath
	    i. Full Test
	    ii. Native
	    iii. OCR
	c. Install and automate any process using UiPath with the following plug-ins:
	    i. Java Plugin
	    ii. Mail Plugin
	    iii. PDF Plugin
	    iv. Web Integration
	    v. Excel Plugin
	    vi. Word Plugin
	    vii. Credential Management

9	a. Automate the process of send mail event (on any email). b. Automate the process of launching an assistant bot on a keyboard event. c. Demonstrate the Exception handing in UiPath. d. Demonstrate the use of config files in UiPath.
10	a. Automate the process of logging and taking screenshots in UiPath. b. Automate any process using State Machine in UiPath. c. Demonstrate the use of publish utility. d. Create and provision Robot using Orchestrator

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	III
Course Name	Business Analytics
Course Code	PMSIT304
Type of course	Major Elective
Level of the Subject	Advanced
Credit points	2 Theory + 1 Practical

Course Objectives:
1. The main objective of this course is making the students know about various fundamental principles of image and video analysis and have an idea of their application.
2. Understand how to apply filters in an image & transformations in images and videos.

Unit No.	Unit Name	Content	Hours
1	Concept of analytics	Concept of analytics, Types of Analytics, Application fields - Marketing Analytics, Finance Analytics, HR Analytics, Operation Analytics, Retail Analytics, Healthcare Analytics, Supply Chain Analytics - Role of Data Scientist in Business & Society	15
2	Visualization/ Data Issues	Visualization/ Data Issues Organization/sources of data - Structured Vs Semi structured Vs Unstructured data, Importance of data quality - Dealing with missing or incomplete data - Data Classification Types of Data Sources- Data Warehouse Vs Databases, Relational Database vs NonRelational Database, RDBMS Data structures, Columnar Data structures	15
3	Introduction to Data Mining	Introduction to Data Mining Introduction to Data Mining -Data Mining meaning - Data Mining Process - Data mining tool - Market Basket Analysis, Association Rules and clustering, Decision trees, Random forests	15
4	Business analytics future trends	Business analytics future trends Role of Artificial Intelligence in Business, Machine Intelligence, Competitive Intelligence, Text Mining, Web Analytics (Web content mining, Web usage mining, Web structure mining), Role of Intelligent Agents in e-business, e-commerce, m-commerce,	15

		Location Analytics, Intelligent Agent in search & retrieval, Personalization and Comparison), Social Networking Analysis, Big Data Tools & Techniques, Content Analytics (Sentimental Analysis & Opinion Analysis). Ethical and Legal considerations in Business Analytics	
	Total No. of Lectures		**60**

Course Outcomes:
1. Understand the requirements of image processing.
2. Illustrate the principles and techniques of digital image in applications related to digital imaging systems.
3. Demonstrate image recognition and motion recognition.
4. Understand color models, transformations and the fundamentals of digital video processing.
5. Illustrate the object detection, recognition and tracking of objects.
6. Analysis of the video processing in applications.

References:
1. Essentials of Business Analytics: An Introduction to the methodology and its application, Bhimasankaram Pochiraju, Sridhar Seshadri, Springer
2. Ben Fry- Visualizing Data. Released December 2007. Publisher(s): O'Reilly Media, Inc.
3. An Introduction to Business Analytics, Ger Koole, Lulu.com, 2019
4. Business Analytics: The Science of Data-Driven Decision Making" by U. Dinesh Kumar
5. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett

CASE STUDY	
SR. NO	
1.	In the small town of Greenfield, there lived an old watchmaker named Mr. Winton. He was known for his exquisite craftsmanship and the ability to repair even the most intricate timepieces. His shop was a treasure trove of clocks, watches, and all things related to timekeeping. One day, a mysterious old clock was brought to him for repair. It was an antique, with delicate hands and a face that told more than just time. As Mr. Winton worked on the clock, he discovered a hidden compartment that contained a faded letter and a map leading to an unknown destination.
2.	Amidst the dense Amazon rainforest, a group of explorers stumbled upon an ancient city. The structures were overgrown with vines and moss, but their grandeur was unmistakable. The city, believed to be the lost city of Zerzura, was filled with artifacts and hieroglyphs that hinted at a civilization that thrived on astronomy and agriculture. The explorers were amazed to find an observatory with a perfectly aligned telescope pointing to the stars, suggesting that the inhabitants had advanced knowledge of celestial events.

Practicals

Practical No	Details
1	Descriptive Analytics: ● Task: Analyze historical sales data to identify trends and patterns. ● Tools: Excel, Tableau, Power BI
2	Diagnostic Analytics: ● Task: Investigate why website traffic dropped last month. ● Tools: Google Analytics, SQL queries
3	Predictive Analytics: ● Task: Forecast next quarter's sales based on historical data. ● Tools: Python (Scikit-learn, TensorFlow),
4	4. Prescriptive Analytics: ● Task: Recommend optimal pricing strategies for products. ● Tools: Optimization software, Python libraries
5	5. Marketing Analytics: ● Task: Segment customers based on purchasing behavior. ● Tools: CRM software, Google Analytics, Python (scikit-learn)
6	6. Finance Analytics: ● Task: Detect fraudulent transactions in a financial dataset. ● Tools: Python (Pandas, Scikit-learn), R
7	7. HR Analytics: ● Task: Analyze employee turnover rates and identify contributing factors. ● Tools: HR software, Python (Pandas, Matplotlib)
8	8. Operation Analytics: ● Task: Optimize inventory levels using historical sales data. ● Tools: Excel, Python (Pandas)
9	9. Retail Analytics: ● Task: Analyze customer purchase patterns and recommend product bundles. ● Tools: Python (Pandas, Scikit-learn), Tableau
10	10. Healthcare Analytics: ● Task: Predict patient readmission rates using medical history data. ● Tools: Python (Scikit-learn, TensorFlow), R

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	III
Course Name	Digital Footprints: Unraveling Web Analytics
Course Code	PMSIT304
Type of course	Major Elective
Level of the Subject	Advanced
Credit points	2 Theory + 1 Practical

Course Objectives :
1. By the end of the course, students will be able to demonstrate a comprehensive understanding of web analytics concepts, including key metrics, terminology, and the historical evolution of web analytics tools.
2. Throughout the course, students will develop practical skills in implementing and utilizing web analytics tools such as Google Analytics and Tag Manager to collect and analyze data effectively, track user behavior, and optimize digital marketing strategies for improved conversion rates and user experiences.

Unit No.	Unit Name	Content	Hours
1	Foundation of Web Analytics	**Introduction to Web Analytics:** Understanding the significance of web analytics in the digital landscape, Key metrics and terminology (e.g., sessions, pageviews, bounce rate) , Historical context and evolution of web analytics tools **Data Collection and Tracking :** Implementing tracking codes (e.g., Google Analytics, Tag Manager) , Setting up goals, events, and e-commerce tracking , Privacy considerations and compliance (e.g., GDPR, CCPA). **User BehaviorAnalysis :** Analyzing user journeys and paths , Heatmaps, session recordings, and clickstream analysis , Identifying user segments and personas.	15
2	Advanced Analytics Techniques	**Conversion Rate Optimization (CRO) :** A/B testing and multivariate testing , Funnel analysis and conversion funnels , Landing page optimization. **Segmentation and Custom Reports :** Creating custom segments based on user attributes , Building personalized reports and dashboards , Cross-device and cross-channel analysis. **Attribution Modeling :** Understanding attribution models (first touch, last touch, linear, etc.) , Multi-channel attribution and its impact on marketing decisions	15

3	Business Insights and Decision Making	**Business KPIs and Metrics:** Aligning web analytics with organizational goals , Defining relevant KPIs (e.g., ROI, customer lifetime value) , Measuring marketing campaign effectiveness. **Data Visualization and Storytelling :** Creating compelling visualizations (charts, graphs, infographics) , Communicating insights effectively to stakeholders , Case studies and real-world examples.	15
4	Emerging Trends and Ethical Considerations	**Mobile and App Analytics :** Tracking mobile app usage and engagement , Mobile-specific metrics (e.g., app installs, retention) , Challenges and opportunities in mobile analytics. **Ethics in Web Analytics :** Balancing data collection with user privacy , Transparency and informed consent , Responsible use of analytics data.	15
	Total No. of Lectures		60

Course Outcome :-

1. Understanding the significance of Web Analytics.
2. Apply key matrices and terminology.
3. Implement effective data collection and tracking strategies.
4. Analyze user behavior and segmentation.
5. Apply convention rates and funnel analysis.
6. Create Web Analytics with business KPIs and matrices.

References :-

1. "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik
2. "Google Analytics Breakthrough: From Zero to Business Impact" by FerasAlhlou, Shiraz Asif, and Eric Fettman
3. "Web Analytics For Dummies" by Jennifer LeClaire
4. "Digital Analytics Primer" by Judah Phillips
5. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik

CASE STUDY	
1	**Background:** A leading e-commerce platform aimed to enhance its digital footprint and improve online sales through effective web analytics strategies. **The Problem:** The company faced challenges with high bounce rates, low conversion rates, and a lack of understanding of customer behavior on its website. This hindered their ability to optimize marketing efforts and maximize revenue.
2	**Background:** A hospitality management company sought to enhance its online presence and improve guest experiences through effective web analytics strategies. **The Problem:** The company faced challenges with low direct bookings through its website, limited understanding of guest behavior online, and a lack of personalization in marketing efforts.

Practicals

Practical No	Details
1	**A/B Testing and Multivariate Testing:** - Design and conduct an A/B test on two different versions of a landing page to determine which one leads to higher conversion rates. - Perform a multivariate test on multiple elements of a webpage (e.g., headline, call-to-action button) to identify the combination that maximizes conversion rates.
2	**Funnel Analysis and Conversion Funnels:** - Use web analytics tools to analyze the conversion funnel of an e-commerce website and identify stages with high drop-off rates. - Implement changes to key steps in the conversion funnel and track the impact on overall conversion rates over time.
3	**Landing Page Optimization:** - Evaluate the performance of landing pages using web analytics data and identify opportunities for optimization. - Implement changes to landing page elements (e.g., layout, content) based on insights from A/B testing and monitor the effects on conversion rates.
4	**Segmentation and Custom Reports:** - Create custom segments based on user attributes (e.g., age, location, device type) using web analytics tools. - Build personalized reports and dashboards tailored to specific stakeholder needs, incorporating custom segments for deeper insights into user behavior.
5	**Attribution Modeling:** - Compare different attribution models (e.g., first touch, last touch, linear) to understand their impact on marketing decisions and budget allocation. - Implement a multi-channel attribution model to attribute conversions accurately across various marketing channels and assess the effectiveness of each channel.
6	**Business KPIs and Metrics:** - Define relevant KPIs aligned with organizational goals (e.g., ROI, customer acquisition cost) and track them using web analytics platforms. - Analyze the performance of marketing campaigns by measuring KPIs and assessing their contribution to overall business objectives.
7	**Data Visualization and Storytelling:** - Create compelling visualizations (e.g., charts, graphs, infographics) to represent web analytics data and communicate key insights effectively to stakeholders. - Develop a storytelling narrative around the data, highlighting trends, patterns, and actionable recommendations for business decision-makers.
8	**Mobile and App Analytics:** - Track mobile app usage and engagement metrics (e.g., app installs, session duration, retention rate) using app analytics tools. - Identify challenges and opportunities in mobile analytics, such as cross-device tracking and optimizing user experiences across different platforms.
9	**Ethics in Web Analytics:** - Evaluate the ethical considerations of data collection practices in web analytics, including user privacy concerns and data transparency. - Develop guidelines for responsible data collection and use, ensuring compliance with regulations (e.g., GDPR) and maintaining user trust.

10	**Real-World Case Studies:**
	     - Analyze real-world examples and case studies of successful conversion rate optimization strategies, attribution modeling approaches, and ethical considerations in web analytics.
	     - Apply learnings from case studies to develop actionable recommendations for optimizing web analytics practices in various business contexts.

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	III
Course Name	Computational Social Networks
Course Code	PMSIT304
Type of course	Major Elective
Level of the Subject	Advanced
Credit points	2 Theory + 1 Practical

Course Objectives :
1. Understand the fundamental concepts of social network analysis & Apply computational techniques to analyze and model social networks.
2. Evaluate the impact of network structures on information diffusion, influence, and behavior & Critically assess ethical considerations related to computational social science.

Unit No.	Unit Name	Content	Hours
1	Introduction to Computational Social Scienc	**Overview of Computational Social Science (CSS) :** Definition of CSS , scope , historical development . **Data Collection and Preprocessing :** sources of social data , data cleaning , preprocessing techniques. **Network Representation :** Basics of network theory , visualization tools and techniques **Social Influence and Contagion Models :** Diffusion models , contagion process in social networks	15
2	Social Network Analysis	**Centrality measures :** degree centrality, closeness centrality , betweenness centrality. **Community Detection Algorithm :** Modularity – based methods , hierarchical clustering **Structural Balance Theory :** Triadic closure , Balance and imbalance in social relationships. **Homophily and Assortativity :** Similarity based network formation , Assortative mixing patterns . **Temporal Network Analysis :** Dynamic network metrics , Temporal motifs and patterns	15
3	Text Analysis in Social networks	**Natural Language Processing (NLP) for Social Media data :** Text preprocessing , feature extraction . **Sentiment Analysis :** Sentiment Lexicons , classifiers ,application in social media analysis **Topic Modeling :** Latent Dirichlet Allocation (LDA), Dynamic Topic Modelling	15

		Influence of Textual Content on network dynamics :Information diffusion in text-based networks , opinion dynamics models	
4	Agent based modeling and simulation	**Introduction to Agent-based-modeling (ABM):** What is ABM ,Basic concepts of ABM, principles of ABM , application in social science **ABM for Social Networks :**Modeling individual behavior and interactions , network formation and evolution . **Emergent behavior and collective phenomena :** Self – organization in complex systems , emergence of macroscopic patterns form local interactions **Calibration and Validation of ABMs :** Parameter estimation techniques , validation strategies for ABM. **Case study using NetLogo or Other ABM platforms**	15
Total No. of Lectures			60

Course Outcome :-
1. Understand the foundation and evolution of computational social science.
2. Create Master data collection, preprocessing, and network representation techniques.
3. Analyze social influence and contagion process.
4. Evaluate network structures using centrality measures and community detection algorithms.
5. Understand structural balance homophily and assortativity in social relationships.
6. Analyze Utilize text analysis techniques for social media data.

References :-
1. Easley, D., & Kleinberg, J. (2010). *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*. Cambridge University Press.
2. Barabási, A.-L. (2016). *Network Science*. Cambridge University Press.
3. Social Network Analysis by Stanley Wasserman and Katherine Faust
4. Agent Based and Individual Based Modelling : A practical Introduction by Steven F. Railsback and Volker Grimm.
5. Computational Social Network Analysis: Trends, Tools, and Research Advances" edited by Ajith Abraham and Aboul-Ella Hassanien

CASE STUDY	
SR. NO	
1	**Background:** A research team aimed to simulate the spread of a contagious disease within a social network to understand the impact of different intervention strategies on disease transmission dynamics. **The Problem:**

	The research team faced challenges in modeling the complex interactions between individuals within the network and assessing the effectiveness of various intervention measures, such as va
2	**Background:** A social media platform aimed to enhance user engagement and content dissemination through effective network analysis and modeling. **The Problem:** The platform experienced challenges in understanding the dynamics of information diffusion and identifying influential users within its network. This hindered their ability to optimize algorithms for content recommendation and improve overall user experience.

Practicals

Computational Social Networks (PMSIT304C)	
Practical No	Details
1	Data Collection and Preprocessing: - Question: How does data cleaning affect the accuracy and reliability of social data analysis? Analyze a dataset collected from social media platforms and perform data cleaning techniques to prepare it for analysis.
2	Network Representation: - Question: Visualize a social network dataset using network theory principles. Compare and contrast different visualization tools and techniques for representing social networks.
3	Social Influence and Contagion Models: - Question: Implement a diffusion model to simulate the spread of information or behavior in a social network. Analyze the impact of different parameters on the contagion process.
4	Centrality Measures: - Question: Calculate degree, closeness, and betweenness centrality measures for nodes in a given social network dataset. Identify key influencers or central nodes and analyze their impact on network dynamics.
5	Community Detection Algorithm: - Question: Apply modularity-based methods or hierarchical clustering algorithms to identify communities within a social network dataset. Evaluate the effectiveness of different algorithms in detecting communities.
6	Structural Balance Theory: - Question:Analyze triadic closure and balance theory in a social network dataset. Identify balanced and imbalanced triads and explore their implications on social relationships.
7	Homophily and Assortativity: - Question: Investigate assortative mixing patterns in a social network dataset based on homophily principles. Analyze the degree of similarity-based network formation and its impact on network structure.
8	Temporal Network Analysis: - Question: Explore dynamic network metrics and temporal motifs/patterns in a

	time-varying social network dataset. Identify temporal dynamics and patterns of interaction over time.
9	Natural Language Processing (NLP) for Social Media Data: - Question: Perform text preprocessing and feature extraction on social media data using NLP techniques. Analyze sentiment trends and topics discussed in the dataset.
10	Agent-based Modeling (ABM) for Social Networks: - Question: Develop an ABM to simulate individual behavior and interactions in a social network context. Explore how network formation and evolution emerge from local interactions.

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	III
Course Name	Research Project
Course Code	PMSIT307
Type of course	Research Project
Level of the Subject	Advanced
Credit points	4

Students have to build a software regarding web application / analysis by using various technologies with documentation as per given following direction.

1. **Project Proposal**:

   ○ Start with a **project proposal** that outlines the purpose, objectives, and scope of your research. Include the following sections:

      i. **Introduction**: Briefly describe the problem or topic you're addressing.

      ii. **Objectives**: Clearly state what you aim to achieve.

      iii. **Methodology**: Explain the research methods you plan to use.

      iv. **Expected Outcomes**: Mention the expected results or contributions.

      v. **Timeline**: Provide a project schedule.

2. **Literature Review**:

   a. Conduct a thorough **literature review** to understand existing work related to your topic.

   b. Summarize relevant research papers, articles, and studies.

   c. Highlight gaps in the existing literature that your project aims to address.

3. **Methodology Section**:

   a. Describe the **data collection process**:

      i. Specify data sources (datasets, APIs, surveys, etc.).

      ii. Explain how you'll preprocess and clean the data.

   b. Detail the **machine learning algorithms** or statistical techniques you plan to use.

   c. Include any **assumptions** made during the analysis.

4. **Results and Analysis**:

   a. Present your findings in a clear and concise manner.

   b. Use tables, charts, and visualizations to illustrate results.

   c. Discuss any patterns, trends, or insights you've discovered.

5. **Discussion and Conclusion**:

   a. Interpret the results and relate them to your research objectives.

   b. Discuss limitations and potential areas for improvement.

   c. Conclude by summarizing the project's impact and future directions.

6. **References**:

   a. List all the sources you've referenced throughout your document.

   b. Follow a consistent citation style (e.g., APA, MLA).

7. **Formatting and Style**:

   a. Use a consistent font (e.g., Times New Roman, Arial) and font size (usually 12pt).

   b. Set appropriate margins (usually 1 inch on all sides).

   c. Organize content into sections with clear headings, Proofread carefully for grammar and spelling errors.

Semester – IV

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	IV
Course Name	Deep Learning
Course Code	PMSIT401+PMSIT404P
Type of course	Major
Level of the Subject	Advanced
Credit points	4 Theory + 2 Practical

Course Objectives:
1. Gain a thorough understanding of the philosophy and architecture of Web applications using To present the mathematical, statistical and computational challenges of building neural networks
2. To study the concepts of deep learning

Unit No.	Name of Unit	Content	Hours
1	Applied Math and Machine Learning Basics	Applied Math and Machine Learning Basics: Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors identity and Inverse Matrices, Linear Dependence and Span , norms, special matrices and vectors, eigen decompositions Numerical Computation: Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization	15
2	Deep Networks	Deep Networks: Deep feedforward network regularization for deep learning , Optimization for Training deep models	15
3	Convolutional Networks	Convolutional Networks, Sequence Modelling, Applications	15
4	Deep Learning Research	Deep Learning Research: Linear Factor Models, Autoencoders, representation learning Approximate Inference, Deep Generative Models	
Total No. of Lectures			**60**

Course Outcomes:
1. Describes basics of mathematical foundation that will help the learner to understand the concepts of Deep Learning.

2. Understand and describe model of deep learning.
3. Design and implement various deep supervised learning architectures for text & image data.
4. Design and implement various deep learning models and architectures
5. Apply various deep learning techniques to design efficient algorithms for real-world applications.

References:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio,Aaron Courvile An MIT Press book 2016
2. Fundamentals of Deep Learning by Nikhil Buduma O'Reilly 2017
3. Deep Learning: Methods and Applications by Deng & Yu Now Publishers 2013.
4. Deep Learning CookBook by Douwe Osinga O'Reilly publisher 2017
5. Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani

CASE STUDY	
SR. NO	
1	A tech company is developing a deep learning model to enhance its facial recognition software. The model uses a Convolutional Neural Network (CNN) to analyze and identify facial features from images. The dataset includes thousands of labeled images, each tagged with the identity of the person. The CNN has been trained to recognize patterns in facial structures and can distinguish between different individuals with high accuracy.
2	A team of researchers is working on a deep learning project to improve the accuracy of automated medical diagnoses. They are using Deep Networks, specifically Deep Convolutional Neural Networks (DCNNs), to analyze medical images such as X-rays and MRIs. The DCNNs are trained using a large dataset of annotated images where each image is labeled with the correct diagnosis. The goal is to enable the DCNN to identify patterns and features in the images that are indicative of specific medical conditions.

Practicals	
Practical No.	**Details**
1	Performing matrix multiplication and finding eigen vectors and eigen values using TensorFlow
2	Solving XOR problem using deep feed forward network.
3	Implementing deep neural network for performing binary classification task.
4	a) Using deep feed forward network with two hidden layers for performing multiclass classification and predicting the class. b) Using a deep feed forward network with two hidden layers for performing classification and predicting the probability of class. Using a deep feed forward network with two hidden layers for performing linear regression and predicting values
5	Evaluating feed forward deep network for regression using KFold cross validation. Evaluating feed forward deep network for multiclass Classification using KFold cross-validation.
6	Implementing regularization to avoid overfitting in binary classification.

7	Demonstrate recurrent neural network that learns to perform sequence analysis for stock price.
8	Performing encoding and decoding of images using deep autoencoder
9	Implementation of convolutional neural network to predict numbers from number images
10	Denoising of images using autoencoder.

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part – II
Semester	IV
Course Name	Blockchain
Course Code	PMSIT402+PMSIT405P
Type of course	Major
Level of the Subject	Advanced
Credit points	4 Theory + 2 Practical

Course Objectives:

1. To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.,
2. To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.

Unit No.	Name of Unit	Content	Hours
1	**Introduction**	Blockchain: Introduction, History, Centralized versus Decentralized systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases. Working of Blockchain: Blockchain foundation, Cryptography, Game Theory, INFORMATION TECHNOLOGY Engineering, Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain Working of Bitcoin: Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes and SVPs, Bitcoin wallets.	15
2	**Ethereum**	**Ethereum** : three parts of blockchain, Ether as currency and commodity, Building trustless systems, Smart contracts, Ethereum Virtual Machine, The Mist browser , Wallets as a Computing Metaphor , The Bank Teller Metaphor , Breaking with Banking History, How Encryption Leads to Trust, System Requirements, Using Parity with Geth, Anonymity in Cryptocurrency, Central Bank Network, Virtual Machines, EVM Applications, State Machines, Guts of the EVM, Blocks, Mining' s Place in the State Transition Function, Renting Time on the EVM,	15

		Gas, Working with Gas, Accounts, Transactions, and Messages, Transactions and Messages, Estimating Gas Fees for Operations, Opcodes in the EVM. **Solidity Programming:** Introduction, Global Banking Made Real, Complementary Currency, Programming the EVM, Design Rationale, Importance of Formal Proofs, Automated Proofs, Testing, Formatting Solidity Files, Reading Code, Statements and Expressions in Solidity, Value Types, Global Special Variables, Units, and Functions,	
3	**Hyperledger**	Overview , Fabric, composer , installing hyperledger fabric and composer , deploying, running the network, error troubleshooting. **Smart Contracts and Tokens:** EVM as Back End, Assets Backed by Anything, Cryptocurrency Is a Measure of Time, Function of Collectibles in Human Systems **Platforms for High-**Value Digital Collectibles, Tokens as Category of Smart Contract, Creating a Token, Deploying the Contract, Playing with Contracts.	**15**
4	**Mining Ether**	**Mining Ether:** Why? Ether ' s Source, Defining Mining, Difficulty, Self-Regulation, and the Race for Profit, How Proof of Work Helps Regulate Block Time, DAG and Nonce, Faster Blocks, Stale Blocks, Difficulties, Ancestry of Blocks and Transactions, Ethereum and Bitcoin, Forking, Mining, Geth on Windows, Executing Commands in the EVM via the Geth Console, Launching Geth with Flags, Mining on the Testnet, GPU Mining Rigs, Mining on a Pool with Multiple GPUs. **Cryptoecnomics**: Introduction, Usefulness of cryptoeconomics, Speed of blocks, Ether Issuance scheme, Common Attack Scenarios. DApp deployment: Seven Ways to Think About Smart Contracts, Dapp Contract Data Models, EVM back-end and front-end communication, JSON-RPC, Web 3, JavaScript API, Using Meteor with the EVM, Executing Contracts in the Console, Recommendations for Prototyping, Third-Party Deployment Libraries	**15**
	Total No. of Lectures		**60**

Course Outcomes:

1. The students would understand the structure of a blockchain and why/when it is better than a simple distributed database.
2. Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities

3. Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations
4. Understand what constitutes a "smart" contract, what are its legal implications and what it can and cannot do, now and in the near future
5. Develop blockchain DApps.
6. Analyze Either Tools

References:

1. Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions by Bikramadity a Singhal,Gautam Dhameja,Priyansu Sekhar Panda , Apress Publisher 2018
2. Introducing Ethereum and Solidity by Chris Dannen Apress Publisher 2018
3. The Blockchain Developer by Elad Elrom , Apress Publisher 2019
4. Mastering Ethereum by Andreas M. Antonopoulos Dr. Gavin W , O'Reilly 2018
5. Blockchain Enabled Applications by Vikram Dhillon David Metcalf Max Hoope , Apress Publisher 2017

CASE STUDY	
SR. NO	
1	Ethereum's blockchain technology has been leveraged by a startup to create a decentralized marketplace for digital art. The platform allows artists to tokenize their artwork as non-fungible tokens (NFTs), ensuring authenticity and ownership. Buyers can purchase these NFTs, which are recorded on the Ethereum blockchain, providing a transparent and immutable proof of ownership. The startup uses smart contracts to automate the buying and selling process, reducing the need for intermediaries and enhancing security.
2	A multinational corporation is looking to enhance the traceability and security of its supply chain using blockchain technology. They decide to implement Hyperledger Fabric, an open-source blockchain framework, to create a permissioned network among their suppliers. The network records every transaction and exchange of goods, ensuring that all parties have access to a single source of truth. This transparency helps in reducing fraud, errors, and inefficiencies.

Practicals	
Practical No.	**Details**
1	Write the following programs for Blockchain in Python: a. A simple client class that generates the private and public keys by using the builtin Python RSA algorithm and test it. b. A transaction class to send and receive money and test it. c. Create multiple transactions and display them. d. Create a blockchain, a genesis block and execute it. e. Create a mining function and test it. f. Add blocks to the miner and dump the blockchain
2	Install and configure Go Ethereum and the Mist browser. Develop and test a sample application.
3	Implement and demonstrate the use of the following in Solidity:

	a. Variable, Operators, Loops, Decision Making, Strings, Arrays, Enums, Structs, Mappings, Conversions, Ether Units, Special Variables. b. Functions, Function Modifiers, View functions, Pure Functions, Fallback Function, Function Overloading, Mathematical functions, Cryptographic functions.
4	Implement and demonstrate the use of the following in Solidity: a. Withdrawal Pattern, Restricted Access. b. Contracts, Inheritance, Constructors, Abstract Contracts, Interfaces. c. Libraries, Assembly, Events, Error handling.
5	Install hyperledger fabric and composer. Deploy and execute the application.
6	Write a program to demonstrate mining of Ether.
7	Demonstrate the running of the blockchain node.
8	Demonstrate the use of Bitcoin Core API.
9	Create your own blockchain and demonstrate its use.
10	Build Dapps with angular.

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part – II
Semester	IV
Course Name	Natural Language Processing
Course Code	PMSIT403+PMSIT406P
Type of course	Major
Level of the Subject	Advanced
Credit points	2 Theory + 2 Practical

Course Objectives:
1. The prime objective of this course is to introduce the students to the field of Language Computing and its applications ranging from classical era to modern context.
2. To provide understanding of various NLP tasks and NLP abstractions such as Morphological analysis, POS tagging, concept of syntactic parsing, semantic analysis etc.

Unit No.	Name of Unit	Content	Hours
1	**Introduction to NLP**	Introduction to NLP, brief history, NLP applications: Speech to Text(STT), Text to Speech(TTS), Story Understanding, NL Generation, QA system, Machine Translation, Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers etc., challenges/Open Problems, NLP abstraction levels, Natural Language (NL) Characteristics and NL computing approaches/techniques and steps, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Web 2.0 Applications : Sentiment Analysis; Text Entailment; Cross Lingual Information Retrieval (CLIR).	15
2	**Text Processing**	Text Processing Challenges, Overview of Language Scripts and their representation on Machines using Character Sets, Language, Corpus and Application Dependence issues, Segmentation: word level(Tokenization), Sentence level. Regular Expression and Automata Morphology, Types Survey of English and Indian Languages Morphology, Morphological parsing FSA and FST, Porter stemmer, Rule based and Paradigm based Morphology, Human Morphological Processing, Machine Learning approaches.	15

3	NL parsing basics, approaches	Word Classes ad Part-of-Speech tagging(POS), survey of POS tagsets, Rule based approaches (ENGTOWL), Stochastic approaches(Probabilistic, N-gram and HMM), TBL morphology, unknown word handling,evaluation metrics: Precision/Recall/F-measure, error analysis. NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar Formalisms: constituency and dependency school, Grammar notations CFG, LFG, PCFG, LTAG, Feature- Unification, overview of English CFG, Indian Language Parsing in Paninian Karaka Theory, CFG parsing using Earley's and CYK algorithms, Probabilistic parsing, Dependency Parsing: Covington algorithm, MALT parser, MST parser.	15
4	Concepts and issues in NL	Concepts and issues in NL, Theories andapproaches for Semantic Analysis, Meaning Representation, word similarity Lexical Semantics, word senses and relationships, WordNet (English and IndoWordnet), Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, Coreferences Resolution:Anaphora, Cataphora.	15
Total No. of Lectures			60

Course Outcomes:

1. Idea about know-hows, issues and challenge in Natural Language Processing and NLP applications and their relevance in the classical and modern context.
2. Understanding of Computational techniques and approaches for solving NLP problems and develop modules for NLP tasks and tools such as Morph Analyzer, POS tagger, Chunker, Parser, WSD tool etc.
3. Analyze various grammar formalisms, which they can apply in different fields of study.
4. Create project work or work in R&D firms working in NLP and its allied areas.
5. Understand applications in different sectors
6. Evaluating various algorithms and approaches for NLP tasks based on the given dataset and stage of the NLP product

References:

1. Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions by Bikramadity a Singhal,Gautam Dhameja,Priyansu Sekhar Panda , Apress Publisher 2018
2. Introducing Ethereum and Solidity by Chris Dannen Apress Publisher 2018
3. The Blockchain Developer by Elad Elrom , Apress Publisher 2019
4. Mastering Ethereum by Andreas M. Antonopoulos Dr. Gavin W , O'Reilly 2018
5. Blockchain Enabled Applications by Vikram Dhillon David Metcalf Max Hoope , Apress Publisher 2017

CASE STUDY	
SR. NO	
1	A healthcare provider is using NLP to improve patient care by analyzing clinical notes. The NLP system processes vast amounts of unstructured text data from patient records to extract relevant medical information, such as symptoms, diagnoses, and treatment outcomes. This enables healthcare professionals to quickly identify trends and patterns, leading to more informed decision-making and personalized patient care.
2	A retail company is using NLP to enhance customer experience by analyzing product reviews. The NLP system processes the text of customer reviews to identify sentiment and extract key phrases that indicate what customers appreciate or dislike about their products. This information helps the company to improve product quality and customer service.

Practicals	
Practical No	**Details**
1.	a. Install NLTK b. Convert the given text to speech c. Convert audio file Speech to Text
2.	a. Study of various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fields, raw, words, sents, categories, b. Create and use your own corpora(plaintext, categorical) c. Study Conditional frequency distributions Study of tagged corpora with methods like tagged_sents, tagged_words. d. Write a program to find the most frequent noun tags. e. Map Words to Properties Using Python Dictionaries f. Study DefaultTagger, Regular expression tagger, UnigramTagger g. Find different words from a given plain text without any space by comparing this text with a given corpus of words. Also find the score of words
3.	a. Study of Wordnet Dictionary with methods as synsets, definitions, examples, antonyms. b. Study lemmas, hyponyms, hypernyms, entailments, c. Write a program using python to find synonym and antonym of word "active" using Wordnet d. Compare two nouns e. Handling stopword. Using nltk Adding or Removing Stop Words in NLTK's Default Stop Word List Using Gensim Adding and Removing Stop Words in Default Gensim Stop Words List Using Spacy Adding and Removing Stop Words in Default Spacy Stop Words List

4.	Text Tokenization
	    a. Tokenization using Python's split() function
	    b. Tokenization using Regular Expressions (RegEx)
	    c. Tokenization using NLTK
	    d. Tokenization using the spaCy library
	    e. Tokenization using Keras

	f. Tokenization using Gensim

5.	Important NLP Libraries for Indian Languages and perform:
	    a. word tokenization in Hindi
	    b. Generate similar sentences from a given Hindi text input
	    c. Identify the Indian language of a text

6.	Illustrate part of speech tagging.
	    a. Part of speech Tagging and chunking of user defined text.
	    b. Named Entity recognition of user defined text.
	    c. Named Entity recognition with diagram using NLTK corpus – treebank

7.	a. Define grammer using nltk. Analyze a sentence using the same.
	    b. Accept the input string with Regular expression of FA: 101+
	    c. Accept the input string with Regular expression of FA: (a+b)*bba
	    Implementation of Deductive Chart Parsing using context free grammar and a given sentence.

8.	Study PorterStemmer, LancasterStemmer, RegexpStemmer, SnowballStemmer Study WordNetLemmatizer
9.	Implement Naive Bayes classifier

BOS	INFORMATION TECHNOLOGY
Class	M.Sc. I.T. Part - II
Semester	IV
Course Name	Project Dissertation with Implementation
Course Code	PMSIT407
Type of course	Research Project
Level of the Subject	Advanced
Credit points	6

Goals of the course Project Dissertation with Implementation.

The student should:
be able to apply relevant knowledge and abilities, within the main field of study, to a given problem within given constraints, even with limited information, independently analyze and discuss complex inquiries/problems and handle larger problems on the advanced level within the main field of study reflect on, evaluate and critically review one's own and others' scientific results be able to document and present one's own work with strict requirements on structure, format, and language usage be able to identify one's need for further knowledge and continuously develop one's own knowledge

To start the project:
Start thinking early in the programme about suitable projects.
Read the instructions for the project.
Attend and listen to other students' final oral presentations.
Look at the finished reports.
Talk to senior master students.
Attend possible information events (workshops / seminars / conferences etc.) about the related topics.

Application and approval:
Read all the detailed information about the project.
Finalize finding a place and supervisor.
Check with the coordinator about the subject/project, place and supervisor.
Write the project proposal and plan along with the supervisor.
Fill out the application together with the supervisor.
Hand over the complete application, proposal and plan to the coordinator.
Get an acknowledgement and approval from the coordinator to start the project.

During the project:
Search, gather and read information and literature about the theory.
Document well the practical work and your results.
Take part in seminars and the running follow-ups/supervision.
Think early on about disposition and writing of the final report.
Discuss your thoughts with the supervisor and others.
Read the SOP and the rest you need again.

Plan for and do the mid-term reporting to the coordinator/examiner.

Do a mid-term report also at the work-place (can be a requirement in some work-places).

Write the first draft of the final report and rewrite it based on feedback from the supervisor and possibly others.

Plan for the final presentation of the report.

Finishing the project:

Finish the report and obtain an OK from the supervisor.

Ask the supervisor to send the certificate and feedback form to the coordinator.

Attend the pre-final oral presentation arranged by the Coordinator.

Rewrite the final report again based on feedback from the opponents and possibly others.

Prepare a title page and a popular science summary for your report.

Send the completed final report to the coordinator (via plagiarism software)

Rewrite the report based on possible feedback from the coordinator.

Appear for the final exam.

Project Proposal/research plan

The student should spend the first 1-2 weeks writing a 1-2 pages project plan containing:

Short background of the project

Aims of the project

Short description of methods that will be used

Estimated time schedule for the project

The research plan should be handed in to the supervisor and the coordinator.

Writing the project plan will help you plan your project work and get you started in finding information and understanding of methods needed to perform the project.

Project Documentation

The documentation should contain:

Introduction - that should contain a technical and social (when possible) motivation of the project topic.

Description of the problems/topics.

Status of the research/knowledge in the field and literature review.

Description of the methodology/approach. (The actual structure of the chapters here depends on the topic of the documentation.)

Results - must always contain analyses of results and associated uncertainties.

Conclusions and proposals for the future work.

Appendices (when needed).

Bibliography - references and links.

For the master's documentation, the chapters cannot be dictated, they may vary according to the type of project. However, in Semester IV Project Documentation & Implementation must contain at least 7 chapters (Introduction, Review of Literature, Methodology / Approach, Proposed Design / UI design, Experiments performed, Results and discussion, Conclusions and proposals for future work, Appendices and Bibliography - references and links) depending on the type of project. Semester IV report should include all the chapters and should be hardbound.