SIES COLLEGE OF COMMERCE & ECONOMICS

AUTONOMOUS

DEPARTMENT OF INFORMATION TECHNOLOGY

Date of BOS meeting: 19th April, 2024

Name of BOS Chairperson: Ms. Taranum Mohd. Salim Shaikh

Sr. No.	Heading	Particulars
1	Title of the course	M. Sc. (Information Technology)
2	Eligibility for admission	BSc IT, BSc CS, BSc DS, BE, BCA, BSc Physics, BSc Maths, BSc Statistics, BSc Electronics
3	Minimum percentage	40 %
4	Semesters	III & IV
5	Level	PG
6	Pattern	02 years & 04 semesters CBGS
7	To be implemented from	From Academic year 2024-25 in a progressive manner

SIES COLLEGE OF COMMERCE & ECONOMICS
(AUTONOMOUS)
(Affiliated to University of Mumbai)
RE-ACCREDITED GRADE "A" BY NAAC

BOARD OF STUDIES
INFORMATION TECHNOLOGY

(WITH EFFECT FROM THE ACADEMIC YEAR 2024-2025)

SEMESTER - III					
	Course Title				
Course Code	Theory	Credits	Course Code	Practical	Credits
MIT-MAJS3-501	Applied Artificial Intelligence	4	MIT-MJPS3-502	Applied Artificial Intelligence Practical	2
MIT-MAJS3-503	Machine Learning	4	MIT-MJPS3-504	Machine Learning Practical	2
Elective : Select Any one from the courses listed below along with corresponding practical course					
MIT-ELES3-505	Robotic Process Automation	4	MIT-ELPS3-506	Robotic Process Automation Practical	2
MIT-ELES3-507	Computer Vision	4	MIT-ELPS3-508	Computer Vision Practical	2
			MIT-RPS3-509	Research Project	4
	Total Theory Credits	**12**		Total Practical Credits	**10**
Total Credits for Semester III: 22					

SEMESTER III

Applied Artificial Intelligence

COURSE CODE: MIT-MAJS3-501 **COURSE CREDIT: 04**

Course Objectives:

- To explore the applied branches of artificial intelligence
- To enable the learner to understand applications of artificial intelligence
- To enable the student to solve the problem aligned with derived branches of artificial intelligence.

Sr. No	Modules/Units	No of Lectures
1.	**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	12
2.	**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	12
3.	**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	12
4.	**Evolutionary Computation:** Soft computing, genetic algorithms, genetic programming concepts, evolutionary programming, swarm intelligence, ant colony paradigm, particle swarm optimization and applications of evolutionary 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	12
5.	**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	12

REFERENCE BOOKS:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence	Saroj Kaushik	Cengage	1st	2019
2.	Artificial Intelligence: A Modern Approach	A. Russel, Peter Norvig		1st	
3.	Artificial Intelligence	Elaine Rich,Kevin Knight,Shivashankar B. Nair	Tata Mc-Grawhill	3rd	

Artificial Intelligence Practical

COURSE CODE: MIT-MJPS3-502 **COURSE CREDIT: 02**

- To understand the fundamentals concepts of expert system and its applications.
- To use probability and concept of fuzzy sets for solving AI based problems.
- To be able to understand the applications of Machine Learning and also apply fuzzy system for solving problems.
- To understand the applications of genetic algorithms in different problems related to artificial intelligence.
- To use knowledge representation techniques in natural language processing.

List of Practical:	
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.

Machine Learning

COURSE CODE: MIT-MAJS3-503 **COURSE CREDIT: 04**

Course Objectives:

- Understanding Human learning aspects.
- Understanding primitives in learning process by computer.
- Understanding nature of problems solved with Machine Learning

Sr. No	Modules/Units	No of Lectures
1.	**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.	12
2.	**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 hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.	12
3.	**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.	12
4.	**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.	12
5.	**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.	12

REFERENCE BOOKS:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press		2012
2.	Introduction to Statistical Machine Learning with Applications in R	Hastie, Tibshirani, Friedman	Springer	2nd	2012
3.	Introduction to Machine Learning	Ethem Alpaydin	PHI	2nd	2013

Machine Learning Practical

COURSE CODE: MIT-MJPS3-504 **COURSE CREDIT: 02**

Course Objectives:

- To understand the key issues in Machine Learning and its associated applications in intelligent business and scientific computing.
- To acquire the knowledge about classification and regression techniques.
- To understand and implement the techniques for extracting the knowledge using machine learning methods.
- To achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
- To understand the statistical approach related to machine learning and 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.

List of Practical:	
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

ELECTIVES

Robotic Process Automation

COURSE CODE: MIT-ELES3-505 **COURSE CREDIT: 04**

Course Objectives:

- To make the students aware about the automation today in the industry.
- To make the students aware about the tools used for automation.
- To help the students automate a complete process.

Sr. No	Modules/Units	No of Lectures
1.	**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.	12
2.	**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)	12
3.	**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 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	12
4.	**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	12
5.	**Managing and Maintaining the Code:** Project organization, Nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State	12

	Machines, or Sequences, Using config files and examples of a config file, Integrating a TFS server **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	

REFERENCE BOOKS:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Learning Robotic Process Automation	Alok Mani Tripathi	Packt	1st	2018
2.	Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation	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	Kelly Wibbenmeyer	iUniverse	1st	2018

Robotic Process Automation Practical

COURSE CODE: MIT-ELPS3-506 **COURSE CREDIT: 02**

Course Objectives:

- To understand the mechanism of business process and can provide the solution in an optimize way.
- To understand the features use for interacting with database plugins.
- To use the plug-ins and other controls used for process automation.
- To use and handle the different events, debugging and managing the errors.
- To test and deploy the automated process.

List of Practical:	
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.

Computer Vision

COURSE CODE: MIT-ELES3-507 **COURSE CREDIT: 04**

Course Objectives:

- To develop the student's understanding of the issues involved in trying to define and simulate perception.
- To familiarize the student with specific, well known computer vision methods, algorithms and results.
- To provide the student additional experience in the analysis and evaluation of complicated systems.
- To provide the student additional software development experience.
- To provide the student with paper and proposal writing experience.

Sr. No	Modules/Units	No of Lectures
1.	**Introduction:** What is computer vision?, A brief history, Image formation, Geometric primitives and transformations, Geometric primitives, D transformations, D transformations, D rotations, D to D projections, Lens distortions, Photometric image formation, Lighting, Reflectance and shading, Optics, The digital camera, Sampling and aliasing, Color, Compression **Feature-based alignment**: D and D feature-based alignment, D alignment using least squares , Application:Panography , Iterative algorithms , Robust least squares and RANSAC , D alignment , Pose estimation , Linear algorithms, Iterative algorithms , Application: Augmented reality , Geometric intrinsic calibration, Calibration patterns, Vanishing points , Application: Single view metrology , Rotational motion ,Radial distortion	12
2.	**Structure from motion :** Triangulation, Two-frame structure from motion , Projective (uncalibrated) reconstruction, Self-calibration , Application: View morphing , Factorization, Perspective and projective factorization , Application: Sparse D model extraction, Bundle adjustment, Exploiting sparsity , Application: Match move and augmented reality , Uncertainty and ambiguities , Application: Reconstruction from Internet photos , Constrained structure and motion , Line-based techniques , Plane-based techniques **Dense motion estimation :** Translational alignment , Hierarchical motion estimation, Fourier-based alignment, Incremental refinement , Parametric motion, Application: Video stabilization, Learned motion models, Spline-based motion, Application: Medical image registration, Optical flow, Multi-frame motion estimation, Application: Video denoising , Application: De- interlacing , Layered motion, Application: Frame interpolation, Transparent layers and reflections	12

3.	**Image stitching :** Motion models, Planar perspective motion, Application: Whiteboard and document scanning, Rotational panoramas , Gap closing , Application: Video summarization and compression, Cylindrical and spherical coordinates, Global alignment, Bundle adjustment, Parallax removal , Recognizing panoramas, Direct vsfeature-based alignment, Compositing , Choosing a compositing surface, Pixel selection and weighting (de-ghosting), Application:Photomontage, Blending **Computational photography :** Photometric calibration, Radiometric response function ,Noise level estimation, Vignetting ,Optical blur (spatial response) estimation, High dynamic range imaging ,Tone mapping, Application: Flash photography, Super-resolution and blur removal, Color image demosaicing, Application: Colorization, Image matting and compositing ,Blue screen matting ,Natural image matting ,Optimization- based matting ,Smoke, shadow, and flash matting ,Video matting ,Texture analysis and synthesis ,Application: Hole filling and inpainting ,Application: Non- photorealistic rendering	12
4.	**Stereo correspondence** Epipolar geometry , Rectification ,Plane sweep , Sparse correspondence , D curves and profiles , Dense correspondence, Similarity measures , Local methods , Sub-pixel estimation and uncertainty , Application: Stereo-based head tracking , Global optimization , Dynamic programming , Segmentation-based techniques, Application: Z-keying and background replacement, Multi-view stereo, Volumetric and D surface reconstruction, Shape from silhouettes **3D reconstruction :** Shape from X , Shape from shading and photometric stereo, Shape from texture, Shape from focus , Active rangefinding , Range datamerging , Application: Digital heritage , Surface representations , Surface interpolation, Surface simplification, Geometry images , Point-based representations, Volumetric representations , Implicit surfaces and level sets , Model-based reconstruction, Architecture, Heads and faces , Application: Facial animation, Whole body modeling and tracking, Recovering texture maps and albedos , Estimating BRDFs Application: D photography	12
5.	**Image-based rendering :** View interpolation, View- dependent texture maps, Application: Photo Tourism , Layered depth images, Impostors, sprites, and layers, Light fields and Lumigraphs , Unstructured Lumigraph, Surface light fields, Application: Concentric mosaics, Environment mattes, Higher-dimensional light fields , The modeling to rendering continuum, Video-based rendering , Video-based animation, Video textures , Application: Animating pictures, D Video, Application: Video-based walkthroughs **Recognition :** Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and D shape models, Application: Personal photo collections, Instance recognition, Geometric alignment, Large databases, Application: Location recognition, Category recognition, Bag of words, Part-based models, Recognition with segmentation,	12

	Application: Intelligent photo editing, Context and scene understanding , Learning and large image collections, Application: Image search, Recognition databases and test sets	

REFERENCE BOOKS:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Computer Vision: Algorithms and Applications	Richard Szeliski	Springer	1st Edition	2010

Computer Vision Practical

COURSE CODE: MIT-ELPS3-508 **COURSE CREDIT: 02**

Course Objectives:

- To understand the basics of computer vision.
- To understand and analyse various structure form motion and various estimates of Dense Motion.
- To apply various motion models to images and understand computation photography techniques.
- To apply Epipolar geometry, Rectification and various other 3D correspondence and Stereo reconstruction techniques.
- To understand image-based rendering and reconstruction.

List of Practical:

10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later.

Research Project

COURSE CODE: MIT-RPS3-509 **COURSE CREDIT: 04**

The Research Project documentation and implementation and Viva Voce details are given in **Appendix 1**.

DEPARTMENT OF INFORMATION TECHNOLOGY
PROPOSED SCHEME OF EXAMINATION

Evaluation Scheme

Internal Evaluation (40 Marks)

The internal assessment marks shall be awarded as follows:

1. **30 marks (Any one of the following):**
   - **a.** Written Test or
   - **b.** SWAYAM (Advanced Course) of minimum 20 hours and certification exam completed or
   - **c.** NPTEL (Advanced Course) of minimum 20 hours and certification exam completed or
   - **d.** Valid International Certifications (Prometric, Pearson, Certiport, Coursera, Udemy and the like)
   - **e.** One certification marks shall be awarded one course only. For four courses, the students will have to complete four certifications.
   - **f.** Research paper publication
2. **10 marks**
   - **a.** Assignments/ Group discussions/ Debates/ Quiz/ Subject specific case study/ Mini Project/ Presentation/ Field work/ Program implementation/ any other

External Examination: (60 marks)

	All questions are compulsory	
Q1	(Based on Unit 1) Attempt *any two* of the following:	12
a.		
b.		
c.		
d.		
Q2	(Based on Unit 2) Attempt *any two* of the following:	12
Q3	(Based on Unit 3) Attempt *any two* of the following:	12
Q4	(Based on Unit 4) Attempt *any two* of the following:	12
Q5	(Based on Unit 5) Attempt *any two* of the following:	12

Practical Evaluation (50 marks)

A certified copy journal is essential to appear for the practical examination.

1.	Practical Question 1	20
2.	Practical Question 2	20
3.	Journal	5
4.	Viva Voce	5

OR

1.	Practical Question	40
2.	Journal	5
3.	Viva Voce	5

Research Project Implementation and Viva Voce Evaluation (100 marks)

The documentation should be checked for plagiarism and as per UGC guidelines,should be less than 10%.

1.	Documentation Report (Chapter 1 to last)	40
2.	Implementation	20
3.	Relevance of the topic	10
4.	Innovation in the topic	10
5.	Documentation/Topic presentation	10
4.	Viva Voce	10

Appendix – 1

Research Project Documentation and Implementation Viva-voce (Semester III)

Goals of the course Project Documentation and Viva-Voce

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 analyse 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 student´s final oral presentations.
- Look at the finished reports.
- Talk to senior master students.
- Attend possible information events (workshops / seminars / conferences etc.) about therelated topics.

Application and approval:

- Read all the detailed information about project.
- Finalise finding a place and supervisor.
- Check with the coordinator about 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.

SIES COLLEGE OF COMMERCE & ECONOMICS

AUTONOMOUS

DEPARTMENT OF INFORMATION TECHNOLOGY

Date of BOS meeting: 26th October, 2024

Name of BOS Chairperson: Ms. Taranum Mohd. Salim Shaikh

Sr. No.	Heading	Particulars
1	Title of the course	M. Sc. (Information Technology)
2	Eligibility for admission	BSc IT, BSc CS, BE, BCA, BSc Physics, BSc Maths, BSc Statistics, BSc Electronics
3	Minimum percentage	40 %
4	Semesters	III & IV
5	Level	PG
6	Pattern	02 years & 04 semesters CBGS
7	To be implemented from	From Academic year 2024-25 in a progressive manner

SIES COLLEGE OF COMMERCE & ECONOMICS
(AUTONOMOUS)
(Affiliated to University of Mumbai)
RE-ACCREDITED GRADE "A" BY NAAC

BOARD OF STUDIES
INFORMATION TECHNOLOGY

(WITH EFFECT FROM THE ACADEMIC YEAR 2024-2025)

SEMESTER - IV					
	Course Title				
Course Code	Theory	Credits	Course Code	Practical	Credits
MIT-MAJS4-501	Blockchain Technology	4	MIT-MJPS4-502	Blockchain Technology Practical	2
MIT-MAJS4-503	Deep Learning	4	MIT-MJPS4-504	Deep Learning Practical	2
Elective : Select Any one from the courses listed below along with corresponding practical course					
MIT-ELES4-505	Natural Language Processing	3	MIT-ELPS4-506	Natural Language Processing Practical	1
MIT-ELES4-507	Digital Image Forensics	3	MIT-ELPS4-508	Digital Image Forensics Practical	1
			MIT-RPS4-509	Research Project	6
	Total Theory Credits	**11**		Total Practical Credits	**11**
Total Credits for Semester IV: 22					

SEMESTER IV

Blockchain
COURSE CODE: MIT-MAJS4-501 **COURSE CREDIT: 04**

Course Objectives:

- 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.
- To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.
- To provide a critical evaluation of existing smart contract capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Sr. No	Modules/Units	No of Lectures
1.	**Blockchain:** Introduction, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases. **Working of Blockchain:** Blockchain foundation, Cryptography, Game Theory, Computer Science 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 Nodesand SVPs, Bitcoin wallets.	12
2.	**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, 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,	12

	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	12
4.	**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.	12
5.	**Blockchain Application Development:** Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum—Sending Transactions, Creating a Smart Contract, Executing Smart Contract Functions, Public vs. Private Blockchains, Decentralized Application Architecture, **Building an Ethereum DApp:** The DApp, Setting Up a Private Ethereum Network, Creating the Smart Contract, Deploying the Smart Contract, Client Application, **DApp deployment:** Seven Ways to Think About Smart Contracts, Dapp Contract Data Models, EVM back-end and front-end communication, JSONRPC, Web 3, JavaScript API, Using Meteor with the EVM, Executing Contracts in the Console,Recommendations for Prototyping, Third-Party Deployment Libraries, **Creating Private Chains.**	12

REFERENCE BOOKS:

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda	Apress		2020
2.	Introducing Ethereum and Solidity	Chris Dannen	Apress		2017
3.	The Blockchain Developer	Elad Elrom	Apress		2021
4.	Mastering Ethereum	Andreas M. Antonopoulos Dr. Gavin Wood	O'Reilly	First	2018
5.	Blockchain Enabled Applications	Vikram Dhillon David Metcalf Max Hooper	Apress		2017

Blockchain Practical

COURSE CODE: MIT-MJPS4-502 **COURSE CREDIT: 02**

List of Practical:

10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop

Deep Learning

COURSE CODE: MIT-MAJS4-503 **COURSE CREDIT: 04**

Course Objectives:

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To enable the students to know deep learning techniques to support real-time applications.

Sr. No	Modules/Units	No of Lectures
1.	**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.	12
2.	**Deep Networks:** Deep feedforward network, regularization for deep learning, Optimization for Training deep models	12
3.	Convolutional Networks, Sequence Modelling, Applications	12
4.	**Deep Learning Research**: Linear Factor Models, Autoencoders, representation learning	12
5.	Approximate Inference, Deep Generative Models	12

REFERENCE BOOKS:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courvile	An MIT Press book	4th	2022
2.	Fundamentals of Deep Learning	Nikhil Buduma	O'Reilly	3rd	2020
3.	Deep Learning: Methods and Applications	Deng & Yu	Now Publishers	1st	2013
4.	Deep Learning CookBook	Douwe Osinga	O'Reilly	4th	2021

Deep Learning Practical

COURSE CODE: MIT-MJPS4-504 **COURSE CREDIT: 02**

List of Practical:

10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop.

Electives

Natural Language Processing
COURSE CODE: MIT-ELES4-505 **COURSE CREDIT: 03**

Course Objectives:

- 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.
- To provide understanding of various NLP tasks and NLP abstractions such as Morphological analysis, POS tagging, concept of syntactic parsing, semantic analysis etc.
- To provide knowledge of different approaches/algorithms for carrying out NLP tasks.
- To highlight the concepts of Language grammar and grammar representation in Computational Linguistics.

Sr. No	Modules/Units	No of Lectures
1.	Introduction to NLP, Brief history, Working of NLP NLP applications: Speech to Text(STT), Text to Speech(TTS), Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Sentiment Analysis, Text Entailment, Cross Lingual Information Retrieval (CLIR)	12
2.	Text Processing Challenges, 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	12
3.	Word Classes ad Part-of-Speech tagging(POS), survey of POS tagsets, Rule based approaches (ENGTOWL), Stochastic approaches(Probabilistic, N-gram and HMM), Evaluation metrics: Precision/Recall/F-measure, error analysis.	12
4.	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, Probabilistic parsing, Dependency	12

	Parsing: Covington algorithm, MALT parser, MST parser.	
5.	Concepts and issues in NL, Theories and approaches 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	12

REFERENCE BOOKS:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Handbook of Natural Language Processing	Indurkhya, N., & Damerau, F. J.	CRC Press Taylor and Francis Group	2nd	2010
2.	Speech and Language Processing	Martin, J. H., & Jurafsky, D.	Pearson Education India	2nd	2013
3.	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	MIT Press	1st	1997
4.	Natural Language Processing With Python	Steven Bird, Edward Loper	O'Reilly Media	2nd	2016
5.	Video Links				

Natural Language Processing Practical

COURSE CODE: MIT-ELPS4-506 **COURSE CREDIT: 01**

List of Practical:

10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop.

Digital Image Forensics
COURSE CODE: MIT-ELES4-507 **COURSE CREDIT: 03**

Course Objectives:

- To understand describe the origin of computer forensics and the relationship between law enforcement and industry.
- Describe electronic evidence and the computing investigation process.
- Extracting Digital Evidence from Images and establishing them in court of Law.
- Enhancing images for investigation and various techniques to enhance images.
- Interpret and present Evidences in Court of Law.

Sr. No	Modules/Units	No of Lectures
1.	History of Forensic Digital Enhancement, Establishing Integrity of Digital Images for Court	12
2.	Digital Still and Video Cameras, Color Modes and Channel Blending to Extract Detail	12
3.	Multiple Image Techniques, Fast Fourier Transform (FFT) – Background Pattern Removal	12
4.	Contrast Adjustment Techniques, Advanced Processing Techniques, Comparison and Measurement	12
5.	The Approach – Developing Enhancement Strategies for Images Intended for Analysis, Digital Imaging in the Courts, Interpreting and Presenting Evidence.	12

REFERENCE BOOKS:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Forensic Digital Image Processing: Optimization of Impression Evidence	Brian Dalrymple, Jill Smith	CRC Press	3rd	2018
2.	Forensic Uses of Digital Imaging	John C. Russ, Jens Rindel, P. Lord	Taylor & Francis Group	4th	2020

Digital Image Forensics Practical

COURSE CODE: MIT-ELPS4-508 **COURSE CREDIT: 01**

List of Practical:

10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop.

Project Implementation and Viva

COURSE CODE: MIT-RPS4-509 **COURSE CREDIT: 06**

The project dissertation and Viva Voce details are given in **Appendix 1**.

DEPARTMENT OF INFORMATION TECHNOLOGY
PROPOSED SCHEME OF EXAMINATION

Evaluation Scheme

Internal Evaluation (40 Marks)

The internal assessment marks shall be awarded as follows:

1. **30 marks (Any one of the following):**
   - **a.** Written Test or
   - **b.** SWAYAM (Advanced Course) of minimum 20 hours and certification exam completed or
   - **c.** NPTEL (Advanced Course) of minimum 20 hours and certification exam completed or
   - **d.** Valid International Certifications (Prometric, Pearson, Certiport, Coursera, Udemy and the like)
   - **e.** One certification marks shall be awarded one course only. For four courses, the students will have to complete four certifications.
   - **f.** Research paper publication
2. **10 marks**
   - **a.** Assignments/ Group discussions/ Debates/ Quiz/ Subject specific case study/ Mini Project/ Presentation/ Field work/ Program implementation/ any other

External Examination: (60 marks)

	All questions are compulsory	
Q1	(Based on Unit 1) Attempt *any two* of the following:	12
a.		
b.		
c.		
d.		
Q2	(Based on Unit 2) Attempt *any two* of the following:	12
Q3	(Based on Unit 3) Attempt *any two* of the following:	12
Q4	(Based on Unit 4) Attempt *any two* of the following:	12
Q5	(Based on Unit 5) Attempt *any two* of the following:	12

Practical Evaluation (50 marks)

A certified copy journal is essential to appear for the practical examination.

1.	Practical Question 1	20
2.	Practical Question 2	20
3.	Journal	5
4.	Viva Voce	5

OR

1.	Practical Question	40
2.	Journal	5
3.	Viva Voce	5

Project Documentation and Viva Voce Evaluation (50 marks)

The documentation should be checked for plagiarism and as per UGC guidelines, should be less than 10%.

1.	Documentation Report (Chapter 1 to 4)	20
2.	Innovation in the topic	10
3.	Documentation/Topic presentation and viva voce	20

Project Implementation and Viva Voce Evaluation (50 marks)

1.	Documentation Report (Chapter 5 to last)	20
2.	Implementation	10
3.	Relevance of the topic	10
4.	Viva Voce	10

Appendix – 1

Project Documentation and Viva-voce (Semester III) and Project Implementation and Viva-Voce (Semester IV)

Goals of the course Project Documentation and Viva-Voce

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 analyse 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 student´s final oral presentations.
- Look at the finished reports.
- Talk to senior master students.
- Attend possible information events (workshops / seminars / conferences etc.) about therelated topics.

Application and approval:

- Read all the detailed information about project.
- Finalise finding a place and supervisor.
- Check with the coordinator about 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 III Project Documentation and Viva Voce must contain at least 4 chapters (Introduction, Review of Literature, Methodology / Approach, Proposed Design / UI design, etc. depending on the type of project.) The Semester III report should be spiral bound.

In Semester IV, the remaining Chapters should be included (which should include Experiments performed, Results and discussion, Conclusions and proposals for future work, Appendices) and Bibliography - references and links. Semester IV report should include all the chapters and should be hardbound.