A POSTGRADUATE PROGRAM IN COMPUTER SCIENCE

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ARTIFICIAL INTELLIGENCE ● DATA SCIENCE ● APP DEVELOPMENT (FULL-STACK)

16 MONTHS COURSE

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MSIT (MS in IT or Master of Science in Information Technology) is a 16-month postgraduate program in Computer Science that started in 2001. It is an innovative multi-university and interdisciplinary postgraduate program. The program is offered by the 'Consortium of Institutions of Higher Learning' (CIHL), formed by the Universities and in collaboration with Carnegie Mellon University (CMU), Pittsburgh, USA.

It is no hidden secret that true learning is seeded in tackling challenges head-on. We learn the most when we are pushed to expand our horizons. This holds true now more than ever when the world is recovering from one of the largest pandemics of modern history.

The COVID pandemic has upended industries worldwide and higher education is no exception to this rule. But the unique challenges it has left us with are only opportunities for us to demonstrate our resilience and passion to building the next generation of innovators, problem-solvers, and disruptors alike.

At the MSIT Program, we are poised to leap into the next stage of evolution of technical education, starting with deploying a completely virtual admissions process and evolving to contactless-teaching programs. But the future is not completely remote, it is centred around hybrid learning.

Hybrid learning is not just limited to our physical or virtual presence but expands to encompass how we learn. At the MSIT Program, we have embraced hybrid learning long before the advent of the 2020 pandemic with ‘Learning By Doing’ our unique teaching methodology.

Students at MSIT learn by participating in a corporate-like project-centric approach to problem-solving offering them a hands-on approach to apply classroom learning to real-world scenarios. This prepares our students to not just tackle today’s challenges but helps build the right ‘problem-solving attitude,’ which can be applied to any new challenge they come across in their careers.

So, when I’m asked how I feel about the future of education, I’m fairly confident in saying, “Those with the hunger to learn and the passion to do, will have the opportunity to succeed.”

For we are not solving today’s challenges which are well known and extensively documented, but rather venturing into the unknown of tomorrow with a prepared mind and confidence bursting in our hearts.

We are ready for new challenges. It is in our DNA. Therefore, I leave you with this thought:

‘No challenge can seem too great, when you challenge yourself to push your own limits each day.’

- Praveen Garimella
Dean, MSIT Program
The IT workshop course follows a story-centered curriculum and project-based approach. The goal of the course is to make the students proficient in the use of modern digital technologies. Students and faculty play a role as consultants and supervisors in a fictitious organization that provides digital transformation solutions to clients. As a consultant, you will be assigned a series of projects by your supervisor. Your goal is to complete all the projects at a mastery level.

Mastery level is A-grade performance in the project. Upon submission of your work, your supervisor will review the work done against a set of parameters. Your goal is to meet the expectations of all the given parameters to demonstrate mastery. Your supervisor will ask you to rework the project in case any of the parameters are incomplete. And you repeat this until mastery is achieved.

Projects have requirements or specifications of a problem to be solved. Your solutions should be submitted as a set of deliverables. The set of deliverables and their formats will be given. Your goal is to submit the deliverables within the stipulated deadline. Note that a deadline is a deadline! There is no negotiation or exceptions. So, plan ahead and make sure that you submit the set of deliverables, even if the work done is incomplete, to be in good standing.

How can you complete the projects without learning the skills? Well, that is where learning by doing philosophy comes. You are provided with a step-by-step guide to solve the problems. These steps are given in the guide along with a link to learning modules. You may also use any other learning resources that are available to you on the web.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Use modern video conference tools
- Evaluate computer and smartphone-based inputs methods
- Use the search engine to find data sources
- Organize data in spreadsheets and create datasets
- Use HTML and CSS to create websites
- Publish websites on GitHub and other social platforms
- Use the Linux shell and text editors to automate repetitive tasks
Computer Science Principles and Programming is a course in fundamental computing principles for students with little to no computing background. Programming constructs: sequencing, selection, iteration, and recursion. Data organization: arrays and lists. Use of abstraction in computing: data representation, computer organization, computer networks, functional decomposition, and application programming interfaces for graphics. Use of computational principles in problem-solving: divide and conquer, randomness, and concurrency. Classification of computational problems based on complexity, non-computable functions, and using heuristics to find reasonable solutions to complex problems. Social, ethical and legal issues associated with the development of new computational artifacts will also be discussed.

MODULE OVERVIEW

Upon successful completion of the course, the student should be able to:

- Demonstrate knowledge of Python syntax by reading and writing Python code
- Transform computational ideas between different levels of abstraction
- Indicate which data structures would be the best fit for specific situations
- Describe how efficiency affects the practical usage of algorithms and data structures
- Identify different algorithmic techniques for running programs at scale
- Construct programs that apply computational concepts as a tool in other domains
- Discuss how computer science interacts with and affects the world
INTRODUCTION TO
SOFT SKILLS

MODULE OVERVIEW

In the preparatory course, students will be introduced to a host of various professional skills. This course would also have a continuous credit component, wherein the students would apply effective verbal, non-verbal & visual communication skills with confidence through repeated practice of public speaking activities.

LEARNING OBJECTIVES

Upon successful completion of the course, the student should be able to:

- Adapt the techniques and best practices of Learning How To Learn
- Apply Listening, Speaking, Reading and Writing skills required for effective communication
- Integrate various parts of communication for effective spoken and written professional communication
- Establish a personal brand via a repository of skills & endorsements
Data science is the study and practice of how we can extract insight and knowledge from large amounts of data. It is a developing field, currently attracting substantial demand from both academia and industry.

This course provides a practical introduction to a data science analysis, including data collection and processing, data visualization and presentation, statistical model building using machine learning for scaling these methods.

**Topics covered include:** Collecting and processing data, free text analysis; Analyzing the data using a variety of statistical and machine learning methods.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Use modern video conference tools
- Evaluate computer and smartphone-based inputs methods
- Use the search engine to find data sources
- Organize data in spreadsheets and create datasets
- Use HTML and CSS to create websites
- Publish websites on GitHub and other social platforms
- Use the Linux shell and text editors to automate repetitive tasks
The study of algorithms and data structures is fundamental to any computer-science curriculum, but it is not just for programmers and computer-science students. Everyone who uses a computer wants it to run faster or to solve larger problems. They have become essential tools in engineering; and from database systems to internet search engines, they have become essential parts of modern software systems. And these are but a few examples as the scope of computer applications continues to grow. This course covers the essential information that every serious programmer needs to know about algorithms and data structures, with emphasis on applications and scientific performance analysis of Java implementations which covers elementary data structures, sorting, and searching, and graph algorithms.

MODULE OVERVIEW

Upon successful completion of the course, the student should be able to:

- Describe Big O notation
- Describe, Implement and Analyze Stacks and Queues
- Implement and Analyze selection, insertion, merge, quick sorts
- Describe and Implement Priority Queues, Symbol Tables, Binary Search Trees, Hashtables
- Describe and Implement Undirected, Directed Graphs with traversing algorithms

LEARNING OBJECTIVES
Students implement a concurrent caching Web proxy that sits between their browser and the rest of the World Wide Web. This lab exposes students to the interesting world of network programming, and ties together many of the concepts from the course, such as byte ordering, caching, process control, signals, signal handling, file I/O, concurrency, and synchronization.

In this course, students build a simple concurrent caching Web proxy that accepts HTTP 1.0 requests from clients, forwards them to end servers, and then sends the replies back to the clients. The proxy caches objects returned by the end servers, and attempts to satisfy requests from clients from the cache before forwarding the requests to the end servers.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Understand the client server architecture
- Able to learn the concepts of web server and its request, responses
- Understand the concepts of concurrency
- Understand and Learn the concepts of Cache
- Learn the importance of proxy and its uses
This course is designed to develop Listening, Speaking, Reading and Writing skills required for effective communication.

**MODULE OVERVIEW**

Upon successful completion of the course, the student should be able to:

**READING**
- Comprehend and synthesize information in passages that contain complex language and are conceptually dense
- Identify connections among pieces of information and make appropriate inferences
- Recognize the expository organization of a passage and the purpose that specific information serves within the larger context

**LISTENING**
- Comprehend central ideas and explicitly stated important details
- Keep track of conceptually complex, sometimes conflicting information over extended portions of a lecture
- Identify how information or examples are being used and how they are connected

**WRITING**
- Produce clear, well-developed, well-organized text
- Select important information from multiple sources, integrate it, and present it coherently and clearly in writing

**SPEAKING**
- Speak clearly and use intonation to support meaning so that speech is easy to understand and follow
- Speak with relative ease on a range of general and academic topics
- Convey well supported summaries, explanations, and opinions, including both concrete and abstract information, with well-controlled organization and cohesion.
Continuing with LSRW, LSRW (2) is the second course in the main program.

In order to achieve personal and professional goals, it is essential for the individuals to bring about improvements in LSRW skills. These are referred to as listening, speaking, reading and writing.

The 8 week module would be learning around a theme, as a weekly structure for integrating content areas. Thematic learning helps learners to make connections, transfer knowledge and apply it. It fosters comparison, categorizing and pattern finding - all of which are building blocks of effective communication.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Acquire necessary listening skills in order to follow and comprehend discourse such as lectures, conversations, interviews and discussions.
- Develop adequate speaking skills to communicate effectively.
- Draw inferences relying on the context through their reading skills and should be able to analyze and synthesize information presented in different sources.
- Use mechanics of writing appropriately and will write a coherent, logical and organized essay replete with an introduction, body paragraphs and conclusion.
Professional Development is one of the most critical skills that the students must develop to drive their career forward. It includes spoken, written, digital and visual communication. Communication can be in the form of presentations, emails, video calls, in-person conferences or minutes of a meeting.

Effective professional communication is important to convey ideas as clearly as possible. It helps the learners to stand out among their co-workers, leverage their skills to make progress in their career and deal effectively with external stakeholders—clients, customers, etc.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Email etiquette
- How to create concise sentences
- Time management
- Presentation strategies
- Data visualization
- Design PowerPoint
- Address team communication and visual hierarchy.
TECHNICAL WRITING

MODULE OVERVIEW

Technical writing is a writing discipline that is defined as simplifying the complex. It results in relevant, useful and accurate information geared to specifically targeted audiences in order to enable a set of actions on the part of the audience in pursuit of a defined goal.

LEARNING OBJECTIVES

Upon successful completion of the course, the student should be able to:

- Understand and implement the full data science pipeline
- Automatically scrape, clean, and process data
- Use data management techniques to store data
- Use statistical methods and visualization to analyze and gain insights into data
This course focuses on how to make a good first impression during an interview and revolves around the skills required to plan and prepare for an interview.

**MODULE OVERVIEW**

Upon successful completion of the course, the student should be able to:

- To create a robust resume
- To design an outstanding LinkedIn profile
- Focus on experiences that demonstrate flexibility, adaptability, responsibility, progress, achievement, creativity, initiative, and leadership.
- Pay close attention to tone and body language
The specialization covers theory as well as practical algorithms for machine learning from a variety of perspectives. It has been designed to give students a thorough grounding in the methodologies, technologies, mathematics and algorithms required to work in the field of machine learning.

MODULE OVERVIEW

Upon successful completion of the course, the student should be able to:

- Implement and analyze existing ML algorithms, including well studied ones for classification, regression, structured prediction, clustering, representation learning, deep learning and reinforcement learning.
- Integrate multiple facets of practical machine learning into a single pipeline: data preprocessing, learning, regularization and model selection.
- Describe the formal properties of models and algorithms for ML and explain the practical implications of those results.
- Compare and contrast different paradigms for ML (supervised, unsupervised).
- Design experiments to evaluate and compare different ML techniques on real world problems.

LEARNING OBJECTIVES
This course teaches the end-to-end process of investigating data with a machine learning lens. It will teach how to extract and identify useful features that best represent the data, a few of the most important machine learning algorithms, and how to evaluate the performance of the same.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Implement and run a Naive Bayes classifier
- Understand the intuition behind support vector machines (SVM), and implement them
- Explain how decision tree classifiers work, including the concepts of entropy and information gain, and implement them
- Model continuous data using linear regression
- Analyze a dataset to detect outliers and remove them
- Use text data in any machine learning algorithm
- Understand the difference between supervised learning and unsupervised learning
- Explain k-means clustering and implement it
- Understand which algorithms require feature rescaling before use
- Implement feature selection
- Explain dimensionality reduction using principal component analysis (PCA) and implement it
- Use different evaluation metrics to evaluate the performance of ML algorithms
This course teaches the basics of deep learning and building deep neural networks using PyTorch. Students would get practical experience with PyTorch through coding exercises and projects implementing state of the art AI applications such as style transfer and text generation.

**MODULE OVERVIEW**

Upon successful completion of the course, the student should be able to:

- Explain how neural networks work and how to train them using data
- Use PyTorch to build and train deep neural networks.
- Use deep neural networks to build a classifier that can classify images of dogs and cats with state of the art performance
- Use convolutional neural networks to build state of the art computer vision models
- Use a deep neural network to transfer the artistic style of one image onto another image
- Use recurrent neural networks to learn from sequential data such as text or audio.
- Train a network that can generate text one letter at a time
- Build a recurrent neural network to accurately predict the sentiment of movie reviews
- Deploy PyTorch models
This course teaches students the fundamentals of reinforcement learning and its elements. As part of the course, students would be introduced to OpenAI gym - which is a programming environment used for implementing RL agents. The key objective being to familiarize students with basic RL algorithms and applications. The emphasis would thus be on algorithms and applications, with some broad explanation of the underlying principles.

**Learning Objectives**

Upon successful completion of the course, the student should be able to:

- Explain the following concepts:
  - Episodic and continuing tasks
  - Reward hypothesis, goals and rewards, cumulative rewards and discounted returns
  - Markov decision processes (MDP)
  - Policy and value functions (state value function, action value function)
- Implement and train a Deep Q network
- Implement and train a policy gradient network
This course provides a practical introduction to the “full-stack” of data science analysis, including data collection and processing, data visualization, and presentation, statistical model building using machine learning, and big data techniques for scaling these methods.

Topics covered include: collecting and processing data using relational methods, time series approaches, graph and network models, free text analysis, and spatial geographic methods; analyzing the data using a variety of statistical and machine learning methods include linear and non-linear regression and classification, unsupervised learning, and anomaly detection, plus advanced machine learning methods like kernel approaches, boosting, or deep learning; visualizing and presenting data, particularly focusing the case of high-dimensional data; and applying these methods to big data settings, where multiple machines and distributed computation are needed to fully leverage the data.

As the course name suggests, this course will highlight the practical aspects of data science, focusing on implementing and making use of the above techniques. Students will complete programming homework that emphasizes a practical understanding of the methods described in the course.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Implement and analyze the complete Data Science pipelines end to end.
- Integrate multiple facets of practical Data Science into a pipeline: data preprocessing, data cleaning, data analyzing, data modeling, and data visualization.
- Visualize the insights of the data set and try to forecast, and analyze them.
- Compare and contrast different ML modeling algorithms to get the insights.
- Design experiments to evaluate and present the real-time/dashboard updates of the Data Science Techniques.
Ingest data from unstructured and structured sources, and use relational models, time-series algorithms, graph and network processing, natural language processing, geographic information system processes to store and manage the data.

**MODULE OVERVIEW**

Upon successful completion of the course, the student should be able to:

- Learn and implement scraping techniques to download data, process data for analysis, analyze data, and visualize data.
- Explore and visualize the data in different formats to present the insights.
- Learn the techniques of Graphs and Natural Language Processing to understand the different text inputs.

**LEARNING OBJECTIVES**
STATISTICAL MODELING

MODULE OVERVIEW

Apply basic statistical techniques and analyses to understand properties of the data and design experimental setups for testing hypotheses or collecting new data.

LEARNING OBJECTIVES

Upon successful completion of the course, the student should be able to:

- Applying the machine learning algorithms from different python libraries.
- Implementing the Statistical modeling techniques on the data to present insights
- Understanding of machine learning algorithms for testing and implementing them.

ADVANCED ML TECHNIQUES

MODULE OVERVIEW

Apply advanced machine learning algorithms such as kernel methods, boosting, deep learning, anomaly detection, factorization models, and probabilistic modeling to analyze and extract insights from data.

LEARNING OBJECTIVES

Upon successful completion of the course, the student should be able to:

- Learn how to preprocess data for data mining, explore the data before applying data mining techniques and discover association patterns in a dataset
- Use advanced predictive modeling techniques to solve problems in the real world.
- Use different advanced ML techniques to summarize data.
- Analyze the complexity of these algorithms and use them appropriately to solve problems in the real world within available resources working on advanced modeling techniques like unsupervised learning, hypothesis testing, and experimental design
- Usage of the Recommender systems, decision trees, and interpretable models on the data
DATA VISUALIZATION

MODULE OVERVIEW
Visualize the data and results from the analysis, mainly focusing on visualizing and understanding high-dimensional structured data and the results of statistical and machine learning analysis.

LEARNING OBJECTIVES
Upon successful completion of the course, the student should be able to:

- Explore the different ways of visualizing the various dimensions of data.
- Deploying the visualizations and making them publicly visible.

BIG DATA

MODULE OVERVIEW
Scale the methods to big data regimes, where distributed storage and computation are needed to realize the capabilities of data analysis techniques.

LEARNING OBJECTIVES
Upon successful completion of the course, the student should be able to:

- Understanding the term Big Data and uses of the Big Data
- Implementing the MapReduce methods and applying them to the Big Data
DATA SCIENCE DEBUGGING

MODULE OVERVIEW

Learn to diagnose problems with data science pipelines, finding problems in data collection, problem setup, machine learning models, and conclusions.

LEARNING OBJECTIVES

Upon successful completion of the course, the student should be able to:

- Understand the Data Science debugging methods
- Learn the future of Data Science
This specialization is designed to provide the learners an essence of front-end, middleware, and back-end web development technologies.

Students will learn to build an end-to-end application, test and deploy code in a Continuous Integration and Continuous Delivery (CICD) environment.

Students will learn to build the mobile interface parallel for a web application.

**LEARNING OBJECTIVES**

Upon successful completion of the course, the student should be able to:

- Apply advanced web development practices
- Architect solutions to programming problems by combining visual concepts and classes
  - Develop a fully functioning website, test, and deploy it on a server
- Develop JavaScript applications that transition between states
- Develop fully working applications that work on cross platforms
- Make use of the existing databases in a web development environment
This course presents an overview of the following topics:

- Web server Programs
- Flask Framework
- Client session Tracking
  - Cookies
  - JSON Web Tokens
- Authentication
  - OAuth
- File Upload
- Microservices/Web APIs
- Data Security
- Knowledge of Web Frameworks
  - Django
  - Spring
  - Rails
  - Node.js
  - Serverless (AWS/Google)

Upon successful completion of the course, the student should be able to:

- Build APIs/Microservices in any given framework
- Build client session tracing for any web application
- Make use of given frameworks to build the web application
- Design the backend architecture of any web application
- Build authentication and implement data security for the web application
This course presents an overview of the following topics:

- Relational Database (MySQL/Postgres)
- Object Relational Mapping (Hibernate)
- Document Oriented Database (Mongo)
- In memory database (Redis)
- Elastic Search/Algolia

Upon successful completion of the course, the student should be able to:

- Make use of different databases according to the requirement
- Apply object relational mapping to the relational databases
- Integrate the database in the existing web applications
- Conduct read, write, delete, etc. operations on any given database
MODULE OVERVIEW

This course presents an overview of the following topics:

- HTML, CSS, Bootstrap
- JavaScript/Typescript
- React Framework
- Progressive web apps

LEARNING OBJECTIVES

Upon successful completion of the course, the student should be able to:

- Apply basic principles of user interface design and user experience
- Constructing websites with valid HTML, CSS, Bootstrap, and JavaScript
- Create responsive designs that work on phones, tablets, or traditional laptops and wide-screen monitors
- Program simple JavaScript/TypeScript routines
MOBILE APPS

MODULE OVERVIEW
In this course students will be introduced to mobile apps. We use Kotlin/Java to develop the apps. Students also preview some of the tools and technologies they will use to build and run their apps.

LEARNING OBJECTIVES
Upon successful completion of the course, the student should be able to:

- Build mobile interfaces with Kotlin/Java
- Demonstrate how to manage control structures in Kotlin/Java
- Make use of the advanced mobile techniques in Kotlin/Java

CONTINUOUS INTEGRATION AND CONTINUOUS DELIVERY

MODULE OVERVIEW
This course presents an overview of the following topics:

- Containerization/Clusters with Docker/Kubernetes
- Setting up GIT Actions
- Testing Frameworks
  - JEST/Enzyme
  - Selenium
- Monitoring Apps

LEARNING OBJECTIVES
Upon successful completion of the course, the student should be able to:

- Deploy a containerized application on a cluster
- Scale the deployment
- Debug the containerized application
- Test the application with frameworks
- Setup GIT in the CICD environment
Take charge of your career

Looking to advance your career in computer sciences? Then look no further! MSIT program offers cutting-edge courses with a unique Learning-by-Doing approach that ensures you are industry-ready when you graduate.

IIIT Hyderabad

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OUR NOTABLE RECRUITERS
STUDENTS SPEAK

SALTEJA

I am a CS graduate. I joined MSIT to improve my coding skills and learn new technologies with learning by doing approach. MSIT offers Soft skills courses along with IT courses which helped me to become industry ready. Mentors provide immense support throughout the course. MSIT offers a co-op program which helps you to gain practical work experience and I am fortunate to be a part of it. MSIT helped me in transforming my career and I am looking forward to joining American Express.

MANASWINI CHINTHALAPUDI

I chose to pursue MSIT because I wanted to work on my tech skills with hands-on experience. The program paves a path to learn about a variety of technologies. The faculty and management are of great support. I have been privileged to work in a co-op program, Telugu Wikipedia, offered by MSIT. Practicing what you’re learning about is amazing and it really makes me feel ready to hit the workforce when I graduate. I would recommend this program to anyone who is interested.

PREM KUMAR

Basically, I had a plan to pursue my master’s in a deemed university. Then I came across this course called MSIT which has been offered for the last 20 years. The main thing I liked about this course is ‘Learning by doing’.

This is the mantra that MSIT follows. This had changed my life a lot. Though I am from an ECE background it took just three months of time for me to get habituated to coding. The course structure here helped me a lot to enhance my programming skills as well as my soft skills.

The most important thing in this program is, we will be dealing with the corporate directly. So, as part of this project, I had worked with a company called Mobvoi (is a tech company headquartered in Beijing, China that sells and develops consumer electronics and Chinese voice recognition, natural language processing, and vertical search technology in-house). Which is a great learning for me during my master’s before I enter into the corporate world.

LAKSHMI PRASANNA

Having done my bachelor’s in ECE, MSIT has acted as a beacon for my transition into the IT domain. Different from the conventional mode of teaching, the learning by doing methodology has helped me gain expertise in technologies, programming languages, that would make one industry-ready irrespective of their undergraduate stream. The guidance provided by the mentors and the Co-op experience is so valuable. Ultimately, I am happy with the choice I made. I got placed in American Express and will cherish the beautiful friendships, experiences I gained here.
Consortium of Institutions of Higher Learning (CIHL) is a non-profit educational society formed by national-level universities of repute in Hyderabad, Telangana. The consortium’s esteemed members comprise IIIT Hyderabad, SVU Tirupati, JNTU Hyderabad, JNTU Kakinada and JNTU Anantapur. With a legacy steeped in pushing the boundaries of technical education, CIHL is the formative body behind the MSIT Program, with a vision to make cutting-edge technical education accessible to all and create industry-ready professionals for tomorrow’s workforce needs.