



Advanced Computing for Executives  
School of Computing



# Full Stack Development with AI

24 Weeks | Online with Live Sessions | Capstone Project

## Programme Summary

### Full Stack Development with AI



#### Institute Name

NUS School of Computing



#### Programme Duration

24 Weeks



#### Cost

USD 2,200 + GST



#### Learning Mode

Online with live sessions



#### Weekly Effort

6-8 hours per week



#### Faculty

NUS School of Computing



#### Programme Leader

Subject Matter Experts/ Senior Industry Practitioners



#### Certificate

Upon successful completion of the programme, participants will be awarded a verified digital certificate by NUS School of Computing

## Learning Experience

- **Pre-recorded videos with NUS Faculty -**  
Don't get worried about keeping up with the classes. Learn at your own pace.
- **World-class faculty -**  
Learn from the best faculty and industry practitioners
- **High-quality videos -**  
Great learning experience, even while on the move.
- **On-demand learning -**  
Rewatch any lesson at your leisure

## Frequently Asked Questions

### How are the classes conducted with the institute faculty in this course?

Recorded and live sessions from world-renowned faculty

### Who grades/reviews assignments and projects?

Assignments will be graded by industry practitioners who support participants in their learning journey and/or by the Emeritus grading team.

### What if I miss the assignments for a particular week? Can I attempt them later?

An assignment that is not submitted by the due date is late. Late assignments will be accepted until one week after the programme end date, which is published on the programme homepage.

### Will the Institute/Emeritus help with placement services?

This programme is designed with some of the best faculty to cover relevant topics in a manner that creates positive career outcomes. As an additional service, we provide resume writing guidance, help with looking for jobs and interview preparation, but we do not offer placement services.

### What if I don't find the programme appropriate for me after starting the sessions? Can I seek a refund?

We encourage our learners to complete the programme to fully understand the concepts and derive valuable learning outcomes. Should you still feel the need to stop your learning journey, a refund request can be initiated within 14 days from date of payment. However, after 14 days the programme fee becomes non-refundable.

### What type of certificate will I receive?

Upon successful completion of the programme, you will receive a smart digital certificate. This can be shared with friends, family, schools or potential employers. You can use it on your cover letter, resume and/or display it on your LinkedIn profile. The digital certificate will be sent approximately two weeks after the programme, once grading is complete.

### How long will I have access to the learning materials?

You will have access to the online learning platform and all the videos and programme materials for 12 months following the programme end date. Access to the learning platform is restricted to registered participants per the terms of agreement.

### Is this programme eligible for SFC (skills future credit)?

No, this programme is not eligible for SFC (skills future credit) because our programmes are curated as per global market research which caters to global participation.

# Become an AI-Powered Full Stack Developer

The field of web development is advancing at a rapid pace, with new technologies emerging continually, user expectations rising, and the demand for robust, adaptable applications becoming more crucial than ever. This evolution has led to an increased demand for full stack developers. These professionals streamline the development process by integrating front-end and back-end tasks, thus providing a single point of contact for the entire project.

While the advent of Artificial Intelligence (AI) has raised concerns about automation replacing developers, AI is more likely to act as a collaborator than a competitor. AI-powered tools can handle repetitive tasks such as code generation, testing, and debugging, allowing full-stack developers to concentrate on complex logic and creative problem-solving.

The NUS School of Computing **Full Stack Development with AI** programme is designed to equip full stack developers to leverage AI technologies to their advantage. This comprehensive programme equips participants with the skills and knowledge needed to become proficient in developing end-to-end applications. Through an immersive learning experience, participants will become proficient in both frontend and backend technologies and gain an understanding of AI fundamentals and their integration into full stack development. With **pre-recorded video lectures from top faculty, real-world case studies, and a capstone project**, gain the essential skills to navigate the ever-evolving landscape of web development. From **managing client-side and server-side programming to crafting visually-striking and robust web applications**, you will emerge as a highly proficient full stack web developer, ready to thrive in the fast-paced world of technology.



*If you're a developer, AI will likely not take your job. But a developer who uses AI effectively likely will.*

**- Peter Guagenti, Forbes Technology Council**



# Industry Trends



The number of developers in Asia are rapidly growing. Singapore saw the most growth in developer population this year in APAC, and ranks first globally with the highest ratio of developers to overall population.

*Source: The State of Open Source and Rise of AI in 2023, Git Hub*



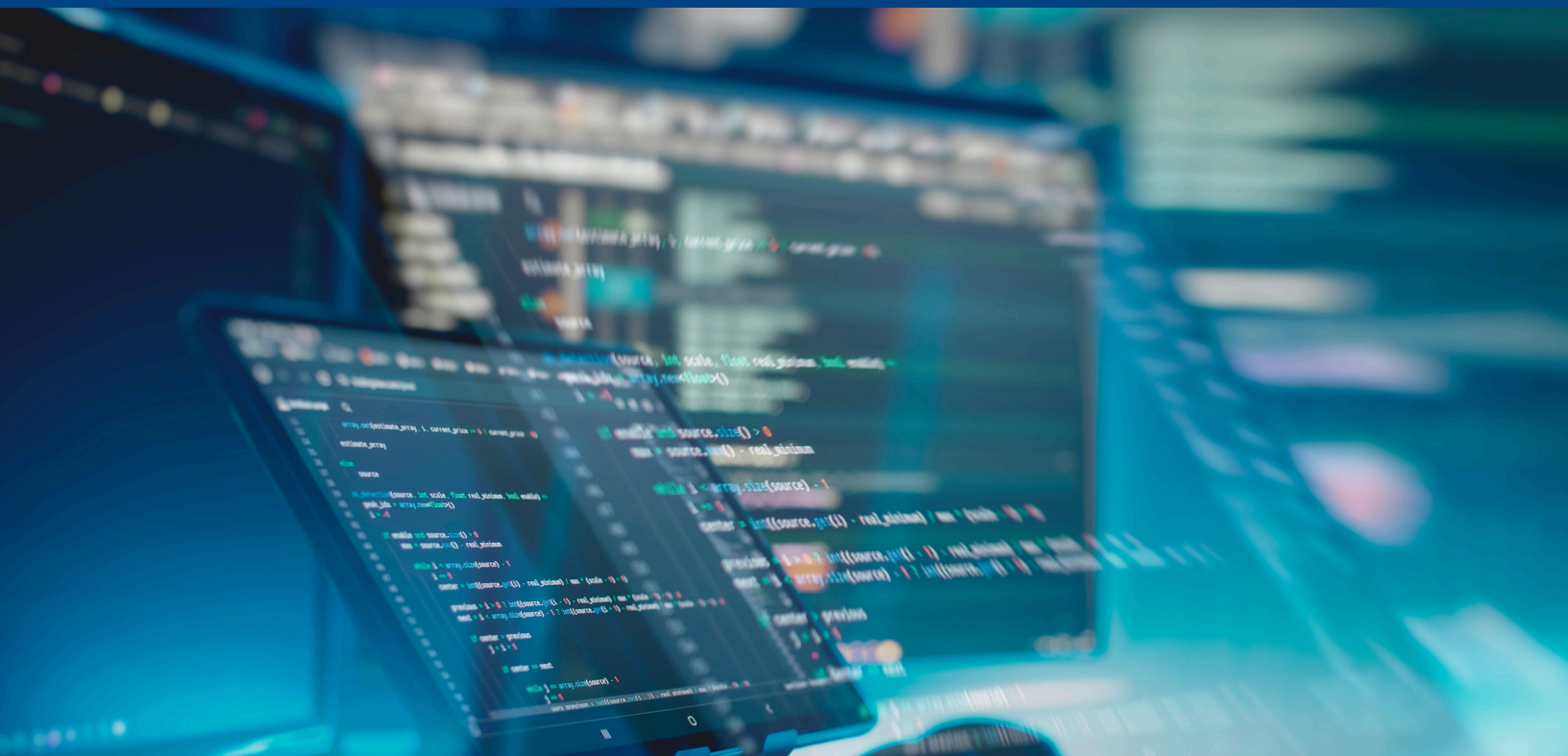
The Asia Pacific Custom Software Development Market will witness market growth of 20.9% CAGR during the forecast period (2022-2028).

*Source: Research & Markets*



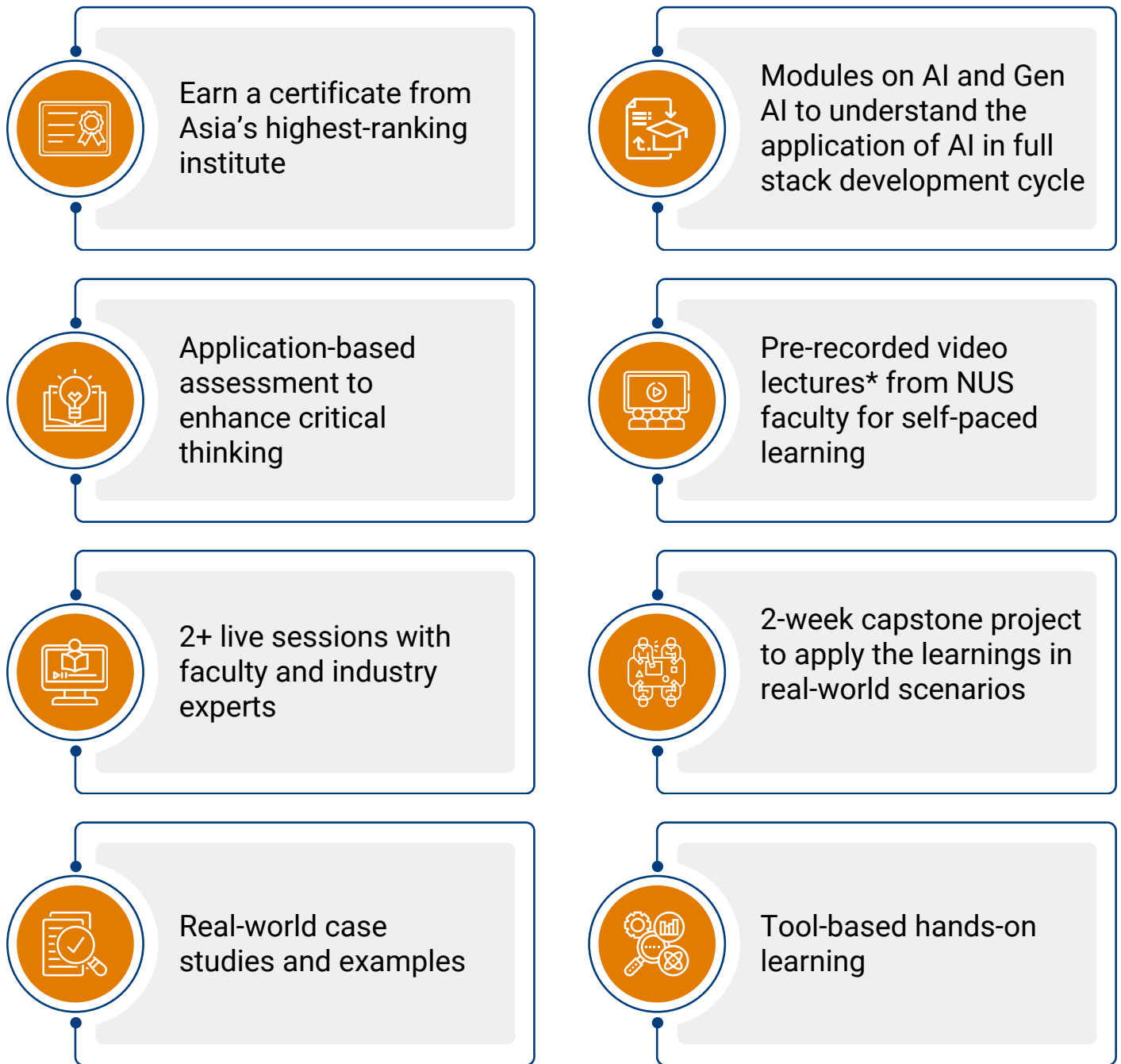
The role of a web developer is expected to grow 13% from 2018 to 2028, much faster than the average occupation.

*Source: US Bureau of Labour Statistics*





# Programme Highlights

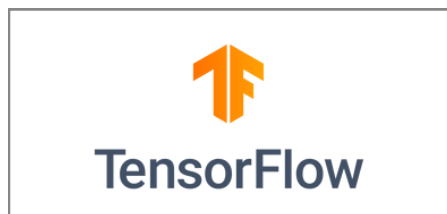
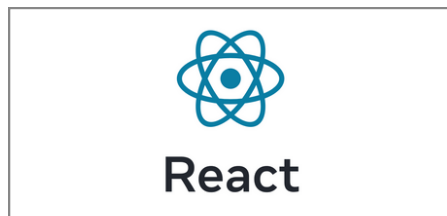


## Note:-

- *This is a self-paced asynchronous programme. Post-session video recordings will be available for up to 12 months after programme completion.*
- *Assignments are graded by industry practitioners who are available to support participants in their learning journey and/or by the Emeritus grading team.*
- *The final number of quizzes, assignments and discussions will be confirmed closer to the programme's start date.*

# Explore Cutting-Edge Tools

Gain hands-on experience by exploring industry-relevant tools



## Note:

- All product and company names mentioned in this material are trademarks or registered trademarks of their respective holders. Their use does not imply any affiliation with or endorsement by them.
- The tools will be taught by teaching faculty, industry practitioners, or linked to relevant knowledge bases for your reference and self-guided learning.
- Apart from the tools mentioned above, learners will get to experience other industry related tools.

# Ranking

# #1

in Asia for Data  
Science and Artificial  
Intelligence

# #6

in the world for Data  
Science and Artificial  
Intelligence

# #6

in the world for  
Computer Science and  
Information Systems

*(QS World University Rankings by Subject 2024)*

## High-Level Programme Outcomes



Gain skills and knowledge for proficient development of end-to-end applications.



Master both frontend and backend technologies through an immersive learning experience.



Gain an understanding of AI fundamentals and their integration into full stack development.



Identify areas where AI can create value, improve efficiency, optimise processes, and enhance decision-making within organisations.



# Phase 1

## Introduction

### Module 1: Fundamentals for Beginners

- Introduction to Programming
- Working with Variables and Operators
- Working with Control Flows
- Working with Functions
- Overview of Web Development Technologies
- Introduction to Full Stack Development

# Phase 2

## Web Development

### Module 2: Introduction to Git

- Introduction to Git and GitHub
- Tracking Changes to a Git Repository
- Working with a Remote Repository in GitHub
- Basic Branching and Merging Operations
- Merge Conflict Resolution

### Module 3: HTML and CSS Fundamentals

- Structure and Syntax of HTML Pages
- Common HTML Tags
- Working with URLs
- Working with Form-Related Tags
- Introduction to CSS
- Introduction to Document Object Model (DOM)
- Basic CSS Selectors
- Common CSS Properties

### Module 4: Intermediate HTML and CSS

- Semantic HTML5 Elements
- Advanced CSS Selectors
- Generating Basic Layout using CSS
- CSS Flexbox
- CSS Grid
- Introduction to Responsive Design
- Introduction to Frontend Design Frameworks
- Generate Responsive Layout using CSS Frameworks
- Working with Templates

### **Module 5: Introduction to JavaScript**

- Introduction to JavaScript
- Variables, Data Types, and Operators in JavaScript
- Conditional Control Flow with JavaScript
- Iterative Control Flow with JavaScript
- JavaScript Functions
- Arrays and Objects in JavaScript
- DOM Programming Interface for HTML
- Basic DOM Manipulation with JavaScript

### **Module 6: Introduction to Python**

- Variables, Data Types, and Operators in Python
- Basic Input and Output with Python
- Conditional Control Flow with Python
- Iterative Control Flow with Python
- Python Functions
- Basic Data Structures in Python
- Limitations of Python Basic Data Structures
- Overview of Python Libraries for Data Science and AI
- Data Processing with NumPy ndarray
- Introduction to Pandas Series
- Introduction to Pandas DataFrame
- Data Preparation with Pandas DataFrame
- Data Visualisation with Matplotlib

## **Phase 3**

### **Frontend Development**

### **Module 7: Frontend Frameworks**

- Introduction to Frontend Frameworks
- Traditional Approach to Frontend Development
- Modern Approach to Frontend Development
- Declarative Approach to Development
- Component-Based Design
- Single Page Applications
- Getting Started with Frontend Development Frameworks

## **Module 8:** **Working with React**

- Introduction to React
- Setting Up a React Webpage
- JSX and Transpiling
- Working with Props in React
- JavaScript Expressions in React
- ES6 Constructs in React Applications
- ES6 Module System and Organising React Applications
- Creating React Applications without Setup
- Handling HTML and React Events
- Difference Between Props and States
- React Hooks and State Variables
- Controlled vs Uncontrolled React Components
- AJAX and the fetch() API
- Working with the useEffect Hook
- Working with the useRef Hook and React Hooks Rules
- Using React Router for Multiple Pages
- Creating and Organising React Applications with Create React App

# Phase 4

## **Backend Development and Databases**

## **Module 9:** **Relational Databases and SQL**

- Introduction to Database Systems
- Database Modeling and Data Models
- The Relational Database Model
- Create an Entity Relationship (ER) Diagram
- Basics of Structured Query Language (SQL)
- Write SQL Data Manipulation Language (DML)
- Write Advanced SELECT Queries
- Write SQL Joins to Combine Data from Multiple Tables



### **Module 10: Introduction to Backend Development**

- Overview of Backend Software Engineering with JavaScript and Python
- Introduction to Node.js and Express.js
- Server-side Web Application Development with Express.js
- Using the Pug Template Engine with Express.js
- Creating Database-driven Web Application with Express.js
- Introduction to Flask
- Server-side Web Application Development with Flask
- Using the Jinja2 Template Engine with Flask
- Creating Database-driven Web Application with Flask

### **Module 11: Non-Relational Databases and MongoDB**

- Introduction to NoSQL Databases
- Basics of Document-based Databases
- Set up MongoDB Environment for NoSQL Database
- Insert and Find Documents
- Query Documents and Query Operators
- Query Arrays and Nested Documents
- Update and Delete Documents
- Connecting to MongoDB Driver for Applications

### **Module 12: RESTful API Development**

- Overview of Service-Oriented Architecture (SOA) and Microservices Architecture
- Introduction to RESTful Web Services
- Introduction to JSON
- Best Practices in RESTful API Design
- Creating RESTful API Endpoints with Express.js
- Testing RESTful API Endpoints with Postman
- Creating RESTful API Endpoints with Flask and Connexion

# Phase 5

## AI Fundamentals

### Module 13: Introduction to Artificial Intelligence and Machine Learning

- Overview of AI and its Subfields
- Supervised, Unsupervised, and Reinforcement Learning Revisited
- Overview of Python Libraries: Sklearn, Tensorflow, PyTorch, and Keras.
- Real-world Applications of AI and Machine Learning

### Module 14: Neural Networks and Deep Learning

- Basics of Artificial Neuron and Activation Functions
- Perceptron
- Multi-layer Neural Networks
- Basics on Training Neural Networks with Gradient Descent

# Phase 6

## Integrating AI into Full Stack Applications

### Module 15: AI Libraries and Frameworks

- Introduction to Deep Learning
- Convolutional Neural Networks (CNNs) for Image Data with Keras Example
- Recurrent Neural Networks (RNNs) for Text Data with Keras Example

### Module 16: Integrating AI Models into Full Stack Applications

- Overview of Model Persistence and Serving
- Saving and Loading scikit-learn Models
- Saving and Loading Keras Models
- Serving Models via RESTful API Endpoints Using Python with Flask and Connexion
- Consuming RESTful API Endpoints from a React Web Application Using axios
- Consuming RESTful API Endpoints from an Express.js Backend Using axios
- Consuming RESTful API Endpoints from a Flask Backend Using Requests
- Serving a Model using MLflow

**Module 17:**  
**Introduction to  
AI-Driven Features**

- Introduction to Recommendation Systems
- Preliminary Mathematical Considerations of Recommendation Systems
- Content-Based Recommender System
- Building Content-Based Recommender System
- Collaborative Filtering Recommender System
- Introduction to Model-based Collaborative Filtering Recommender System
- Model-based Collaborative Filtering Recommender System
- Recommendation using Softmax Model

**Module 18:**  
**Performance  
Optimisation and  
Scalability**

- Introduction to Performance Optimisation and Scalability
- Optimising AI Model Performance
- Scaling Strategies and Database Optimisation
- Caching and Load Balancing
- Asynchronous Processing and Message Queues
- Monitoring and Performance Analysis
- Load Testing Fundamentals and Analysis
- Best Practices and Future Trends

**Module 19:**  
**Generative AI  
Application**

- Introduction to Generative AI in Full Stack Development
- Benefits and Use Cases of Generative AI in Full Stack Applications
- Advanced Generative AI Applications
- Generative AI in Software Development
- Evolution of Language Models: From Traditional to Transformers
- Milestones in Large Language Models
- Optimising LLM Outputs: Prompts and Parameters
- Fine-tuning LLMs
- Introduction to LLM Selection and AI Agents
- LLM Performance and Benchmarks
- Evaluating LLM Requirements for Specific Use Cases
- LLM Deployment Considerations
- Combining Multiple LLMs for Complex Applications
- Introduction to AI-Powered Software Development
- Features of Autonomous AI Software Engineers
- Pros and Cons of Autonomous AI Agents in Software Development



# Who is This Programme For?



Entry level tech professionals looking to start a career or switch to a high-growth field and gain exposure to the full development lifecycle.



Early and mid-level tech professionals looking for new trends and technologies to bring innovation and automation in their organisations.

This programme transcends industry boundaries, attracting IT, tech, software, and engineering research enthusiasts. Whether you are a programming novice or an experienced hand, our comprehensive curriculum ensures a holistic learning experience of both frontend and backend tasks.



# Faculty



**Prof Tan Wee Kek**

Associate Professor  
(Department of Information  
Systems & Analytics)



**Dr Lek Hsiang Hui**

Senior Lecturer  
(Department of Information  
Systems & Analytics)



**Dr Prabhu Natarajan**

Senior Lecturer  
(Department of Computer  
Science)



**Ms Samantha Sow**

Senior Lecturer  
(Department of Information  
Systems & Analytics)



**Mr Uli Hitzel**

Industry Expert  
(Dyson)/Executive  
Education Fellow (Data  
Engineering & Automation)

# Learning Journey



## Orientation Week

The first week is orientation week. During this week you will be introduced to the other participants in the class from across the world, and you will learn how to use the learning management system, discussion boards and other learning tools provided.



## Weekly Goals

As you begin the programme, meet your learning goals set for the week. The goals would include completing the assignments, which have weekly deadlines.



## Support and Guidance from Industry Expert

The Industry Expert is a subject matter expert who guides learners through their learning journey. The Industry Expert conducts Office Hours to clarify learner queries related to the learning content and grades a few designated assignments.



## Follow-Up

The Emeritus Programme Support Team follows up over emails and phone calls with learners who are unable to submit their assignments.



# About the NUS School of Computing

The NUS School of Computing traces its roots back to the Nanyang University Department of Computer Science that was established in 1975 - the first of its kind in Singapore. Since then, we have developed into one of the top 10 computing schools in the world, with faculty members who are both internationally-recognised researchers and inspiring teachers.

We offer outstanding undergraduate and graduate degree programmes across the full spectrum of the field of computing, including Computer Science, Information Systems, Computer Engineering, Business Analytics and Information Security, as well as specialisations in emerging areas of importance such as Artificial Intelligence, Fintech, Blockchain, Financial Analytics and Cybersecurity. Correspondingly, we attract excellent students and produce talented graduates who are making their mark in the world.

The exceptional education that students experience here, coupled with the demand for computing talent in all fields and industries, make NUS Computing graduates highly sought-after. We instil our students with leadership qualities and a spirit of entrepreneurship through mentorship, community service initiatives and special programmes, including The Furnace, a start-up incubator which offers funding, infrastructure and management support to bring original ideas to commercial fruition.

The NUS School of Computing Advanced Computing for Executives (ACE) centre was established to help business leaders and computing professionals learn about emerging technology and leverage it for digital transformation and business competitiveness. Our three-pronged *raison d'être* is to (1) partner with industry and government to upskill and re-skill the workforce in information communication technology (ICT), (2) collaborate closely with NUS School of Computing faculty members in launching continuing education and training (CET) programmes for adult learners and (3) support and empower organisations to embark on digital transformation projects.

We are pleased to have been educating and training Singapore's and the world's business leaders and computing professionals for the past four decades and are proud to count many locally and internationally prominent leaders in the field among our large and accomplished family of alumni.



# Certificate

Upon successful completion of the programme, participants will be awarded a verified digital certificate by the NUS School of Computing.



*Note: - All certificate images are for illustrative purposes only and may be subject to change at the discretion of NUS School of Computing.*

# Programme Details



## Programme Fee

**US\$2,200 + GST**

\*Singapore residents who wish to enrol for this programme will be charged GST.



## Programme Duration

**24 Weeks, Online**

**6-8 Hours/Week**



## Programme Start

**31 March 2025**



# Emeritus Career Preparation Services

Stepping into a business leadership career requires a variety of job-ready skills. Below given services are provided by Emeritus, the learning collaborator for this program. The primary goal is to give you the skills needed to succeed in your career; however, job placement is not guaranteed.

## Emeritus provides the following career preparation services:



**Resume building videos**



**Interview preparation videos**



**LinkedIn profile building videos**



**Glossary of resume templates**

Note: NUS or Emeritus do not promise or guarantee a job or progression in your current job. Career Services is only offered as a service that empowers you to manage your career proactively. The Career Services mentioned here are offered by Emeritus. NUS is not involved in any way and make no commitments regarding the Career Services mentioned here.

# About Emeritus

NUS School of Computing is collaborating with online education provider Emeritus to offer a portfolio of high-impact online programmes. Working with Emeritus gives NUS School of Computing the advantage of broadening its access beyond their on-campus offerings in a collaborative and engaging format that stays true to the quality of NUS School of Computing.

Emeritus' approach to learning is built on a cohort-based design to maximise peer-to-peer sharing and includes video lectures with world-class faculty and hands-on project-based learning.

More than 300,000 students from over 200 countries have benefitted professionally from Emeritus' programmes.







[www.emeritus.org](https://www.emeritus.org)

Apply for the programme here

[APPLY NOW](#)

Schedule a call with a programme advisor to learn how this programme can help you

[SCHEDULE A CALL](#)

E-mail: [info@emeritus.org](mailto:info@emeritus.org)

Call: +6531296111 (11:30 AM - 6:30 PM SGT)

We hope to respond to your enquiry in less than 24 hours.

Our responses may take up to 72 hours during weekends and holidays.

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