

Skilling / Reskilling Program to build Human Resource Capacity in Technology Entrepreneurship

The Information Technology / Business Process Management (IT / BPM) industry is poised to become the largest contributor to the national economy of Sri Lanka by 2025. Targets are fixed around US\$ 5 billion income which requires around 200,000 qualified human resources. As stated in the NATIONAL IT - BPM WORKFORCE SURVEY 2019 commissioned by the Information Communication Technology Agency of Sri Lanka (ICTA) one of the main factors affecting the industry from reaching these targets is the lack of Manpower. As per the latest Workforce Survey, there is a gap of 12,140 graduates between the need of the industry and the supply by universities (see box).

Demand for graduates has increased from 6,246 in 2014 to 21,216 in 2019. The survey also reported an increase in supply of the total number of graduates produced by training organizations from 6,611 in 2014 to 9,076 in 2019. The quality of the training staff in ICT training organizations has improved significantly in terms of academic qualifications and experience. Despite the growth in numbers of graduate output, however, the projections indicate a situation of a widening gap between demand and supply of ICT workforce in the country. This implies that the training system of ICT in the country is not geared to cater for the market demand by producing sufficient numbers of graduates; a key challenge that calls for urgent attention of policy makers, ICT industry stakeholders as well as educationists in the Country. [Source: National IT - BPM Workforce Survey 2019, ICTA]

In addition, successive governments have set targets in converting Sri Lankan Economy into a “Knowledge Economy”. This would require a large workforce that is equipped with the knowledge and skills in IT. The Fourth Industrial Revolution (4IR) which has disrupted the labour market has brought in large scale job displacement and talent shortages, mainly on technical areas. It is observed that “technological integration will change the business models of all industries, giving rise to a number of emerging jobs. A proactive and strategic effort is needed on the part of all relevant stakeholders to manage reskilling and upskilling to mitigate against both job losses and talent shortages.” [Towards a Reskilling Revolution, http://www3.weforum.org/docs/WEF_Towards_a_Reskilling_Revolution.pdf]

The shortage of skilled personnel cannot be addressed in short-term through conventional methods, i.e. by increasing intake to national universities. This is because increasing the intake requires a considerable amount of resources. physical, financial and human, that need to be channeled to the universities almost immediately. On the other hand, around 50,000 graduates, mainly from non IT fields, are unemployed or underemployed. Even some IT graduates are found to be underemployed making their contribution to the national economy non-optimal. A large number of students also follow Diploma and Higher Diplomas in many areas of study. Some of these students could be trained to occupy jobs in the IT field through a short term training program. Through such a program, they will be given the basic knowledge and skills with industry exposure. Companies absorbing these trainees can provide the required specialised training in-house.

Thus, Sri Lanka Association for Software Service Companies (SLASSCOM) has embarked on a program to train and/or retrain students in collaboration with Sri Lanka Technology Campus (SLTC) in basic skills in IT to find a stop-gap measure to increase the human resource base required by the IT / BPM industry.

SLASSCOM is interested in expanding the program to other state and non-state sector universities. As a first step it has requested the Open University to join the program. The Industry Liaison Center (ILC) has developed a Conversion Program in Technology Entrepreneurship to train and/or retrain post A/L students. These students may be following degree programs, following or completed a diploma or a higher diploma from a recognised institute, graduates from other disciplines and IT graduates who are not contributing to the development of IT/BPM industry due to many reasons. The curriculum was based on the program designed jointly by the SLASSCOM and the Sri Lanka Technology Campus (SLTC).

The program has the following objectives:

1. Create a pool of personnel with basic IT knowledge and skills required to be employed at entry level positions in It/BPM companies in Sri Lanka and abroad.
2. Provide an opportunity for students and graduates of the Open University of Sri Lanka to obtain more lucrative employment opportunities in the IT / BPM industry
3. Contribute to the national economy by supporting the growth of the IT industry
4. Facilitate job creation opportunities by providing training in Entrepreneurship
5. Improve the communication and other 21st Century Skills to make the participants competitive in the global market

Program Duration

The program will be offered over a period of 24 weeks with two intermediate evaluation points happening after 6 weeks and 12 weeks respectively. The evaluations will be done by a panel consisting of industry representatives and academics.

Entry Criteria

Any student who has 3 passes at GCE (A/L) or an equivalent qualification

Certification

Those who successfully complete the program will be issued a “Certificate of Proficiency” as specified in the CERC by-laws. All modules will be evaluated on the basis of industry oriented Projects, Mini-projects and Marked Assignments. Interim evaluations will be carried out at 8 weeks and at 16 weeks. Those who are not successful in completing the modules delivered during the period will be required to redo the projects.

Successful completion of the program is defined as passing all the modules. A student who is not successful in one or more modules will be given 2 more opportunities to obtain a pass mark.

Delivery of the Program

The program will be delivered as a short course under CERC by-laws, rules and regulations.

Approval is sought to conduct the Program under CERC guidelines.

References:

- Towards a Reskilling Revolution,
http://www3.weforum.org/docs/WEF_Towards_a_Reskilling_Revolution.pdf
- Preparing for the Future of Work,
http://www3.weforum.org/docs/WEF_System_Initiative_Future_Education_Gender_Work_Preparing_Future_Work_2-P....pdf, National IT - BPM Workforce Survey 2019, Information and Communication Technology Agency of Sri Lanka
- NAITA Entrepreneurship Training Division,
<http://www.naita.gov.lk/index.php/en/other-services/entrepreneurship-development.html>

Summary of modules and its content

Module Code	Module	Topics	Time Allocation			MA	MP	
			Total Weeks	L	T			A
ILX0201	Life Skills for 21st Century	<ul style="list-style-type: none"> Communication, Leadership, Analytical Thinking, Learning to learn, basic literacies: financial, social and ethical, management, cultural 	3	45	45	10	6	-
ILX0302	Computational Thinking for Problem Solving	<ul style="list-style-type: none"> Flowcharts & Pseudocode, Programming, Data Structures, Algorithms, OOP, OOD 	4	50	70	30	3	1
ILX0303	Working with Data	<ul style="list-style-type: none"> RDBMS, Document Data bases, Write / Consume API, API Security 	4	50	70	30	3	1
ILX0104	Web Application Development	<ul style="list-style-type: none"> Web Application Development with HTML, CSS, React, JQuery, AJAX 	2	20	20	20	-	1
ILX0205	Mobile Application Development	<ul style="list-style-type: none"> Mobile App Development with React, AppStore Submission, Rules, Guidelines, Payments 	3	40	50	10	3	1
ILX0206	Industry Knowledge	<ul style="list-style-type: none"> Version Control (GIT), CI/CD (VSTS), Software Lifecycle, Agile / SCRUM, Cloud Computing 	4	30	50	20	2	1
ILX0207	Entrepreneurship	<ul style="list-style-type: none"> Ideation, developing a business model, preparing a business plan, marketing, Financial management, Legal issues, funding the enterprise 		50	20	30	2	1

L : Lectures / Seminars

T: Tutorial or Lab Sessions

I : Independent work including Assignments

MA: Marked Assessments and Interim Progress Reviews

MP: Mini Project

Detailed Syllabus

Module Code/Title: ILI0201 Life Skills for 21st Century

Aim: The aim of this course is to ensure that the graduates are equipped with 21st Century skills such as communication skills, leadership skills, problem solving and critical thinking skills

Learning Outcomes:

- Explain the fundamentals of communication skills and analytical thinking
- Apply previously learnt information to solve dynamic problems in a professional environment while demonstrating the principle of reinforcement
- Use and apply recognized problem-solving tools and techniques
- Evaluate theoretical and technical (methodological) foundations of research materials
- Generate confidence in communicating in English while building team spirit and leadership qualities

Outline Syllabus

- **Introduction to professional communication:**
Different modes of communication, Importance of proper communication in professional career, Importance of verbal language and body language in professional communication, Appropriate language usage in formal scenarios, Communication and Leadership in workplace
- **Interpersonal effectiveness in Communication**
Self-evaluation (SWOT analysis) Motivation, Team building, Listening Skills, Conflict management through proper communication, Barriers in communication in professional environments Physical barriers, Psychological barriers
- **Analytical thinking:**
Overall process: Defining the problem, Formulating the hypothesis, Collecting the facts, Conducting the analysis, Developing the solution; Tools and techniques for defining the problem: Problem identification, Getting to the root of the problem, Root cause analysis technique; Tools and techniques for formulating the hypothesis: Issue diagram, Brainstorming; Tools and techniques for collecting the facts: Data collection techniques, Tools and techniques for conducting the analysis: Analytical techniques, Benchmarking, SWOT, Impact analysis, Pareto analysis; Tools and techniques for developing the solution, Tools and techniques for presenting data and solution
- **Presentation skills**
Structuring a presentation, Appropriate tone, body movements, Gesticulations, Facial expressions, Recommended attire, Dos and Don'ts, The appropriate use of PowerPoint/white board/ sound systems/posters in presentations
- **Written Communication for Professional purposes**
Proper usage of Active and Passive voices, E-mail Writing, Formal letter writing, Report writing, Memo Writing, Summary writing
- **Communication Skills for employment**
CV/resume preparation, Cover letter writing, Mock Interviews
- **Learning to learn**
Learning motivation, learning strategies and orientation towards change, Academic self-concept and self-esteem, Learning environment

Evaluation Criteria

Minimum of four evaluated presentations covering analytical thinking, presentation skills, leadership skills, CV preparation, professional writing, data presentation (MA)

Overall Assessment Mark, X :100%

$X = \text{AVG}(3B \text{ MA})$

Condition for Pass: $X \geq 40$

Module Code/Title: ILX0302 Computational Thinking for Problem Solving

Aim: Introduce Computational thinking process for Problem Solving

Learning Outcomes:

- Use number system representation to perform arithmetic operations.
- Apply knowledge of data structures and algorithms to implement a solution for a given problem.
- Apply Object Oriented Design principles to analyze real life problems and to design solutions
- Develop computer programs using the Object-Oriented Programming (OOP) paradigm.
- Demonstrate the ability to use best coding practices.

Outline Syllabus

- Computer Number Formats and Computer Arithmetic: Numerical representation of data, number systems & conversions, addition, subtraction, complements, floating point notation, multiplying, division
- Designing solutions with PseudoCode and Flowcharts
- Fundamental structures of Computer Programming
- Data Structures: lists, arrays, records, stacks, queues, linked lists, hash tables and operations on them
- Algorithms: sorting, searching and recursive algorithms; introduction to graphs and trees.
- Introduction to OOD and SOLID design principles
- Introduction to Unified Modelling Language (UML), Agile Programming and Test-Driven Development using case studies
- OOP concepts: Objects, Classes, Inheritance, Polymorphism, Encapsulation, Abstraction.
- Object-Oriented Languages, their advantages and disadvantages.
- Exception and event handling

Evaluation Criteria

Minimum of five marked assignments (MA).

Mini Project (MP): Analyze and design a software system for a non-trivial real-life problem using object oriented design concepts

Overall Assessment Mark, $X = \text{AVG}(3B(\text{MA})) * 0.4 + \text{MP} * 0.6$

Condition for Pass: $X \geq 40$

Module Code/Title: ILX0303 Working with Data

Aim:

Learning Outcomes:

- Explain the role of database systems in information management
- Describe the fundamental concepts of data modelling and different types of database models
- Apply entity-relationship modelling and normalization for simple database requirements
- Use a query language to create, update and query a simple database
- Construct simple applications that requires manipulating data in a DBMS

Outline Syllabus

- Database Design Process & ER Model: Database design and ER diagrams, Entities attributes and entity sets, Relationships and relationship sets, Keys and key constraints,, Entity vs relationship, Conceptual design for large enterprises
- Relational Model: Introduction to relational model, Integrity constraints over relations and enforcing integrity constraints
- ER Model to Relational Model: Introduction to relational model, Entity sets to tables, Relationship sets to tables, Translating relationship sets with key constraints ,Translating weak entities, class hierarchies and ER diagrams with aggregation
- Normalization: Attributes and anomalies, Loss-less join property, Dependency preserving property, 1st , 2nd and 3rd Normal Forms and Boyce-Codd Normal Form (BCNF)
- Query Languages: Data Definition Language (DDL), Data Manipulation Language (DML), Data Query Language (DQL), o SQL Queries, Logical connectives, Security & authorization in SQL, Transaction processing using SQL, Embedding SQL in general purpose languages, Cursors, Dynamic SQL, o JDBC, ODBC, Stored procedures
- Data Base Administration: Indexing, Optimization, Security, Recovery
- Object Oriented and Document Oriented Databases (NOSQL)

Evaluation Criteria

Minimum of three marked assignments (MA)

Mini Project (MP): Design and Develop a database related to a non-trivial real world situation

Overall Assessment Mark, $X = \text{AVG}(2B(\text{MA})) * 0.3 + \text{MP} * 0.4$

Condition for Pass: $X \geq 40$

Module Code/Title: ILX0104 Web Application Development

Aim: Provide students the concepts and application of web application development process using latest tools and techniques.

Learning Outcomes:

- Explain the concepts of the Internet and the World Wide Web (WWW).
- be thorough with the most up-to-date concepts of the web application development
- develop applications that are effectively running with the latest web standards

Outline Syllabus

- Evolution and the fundamental concepts; terms & terminology of the Internet and the WWW; major developments; modern day applications and issues/
- concerns; future trends
- Design tools and frameworks: CSS, HTML, Javascript and React; Development tools: JQuery;
- Development techniques: AJAX;
- Web development life cycle: planning, analysis, design & development,
- testing, implementation & maintenance.

Evaluation Criteria

Mini Project (MP) – development of a web application with documentation

Overall Assessment Mark, X = MP

Condition for Pass: $X \geq 40$

Module Code/Title: ILX0205 Mobile Application Development

Aim: To provide with knowledge and skills required to develop a mobile application to meet a given specification

Learning Outcomes:

- Explain mobile devices, including their capabilities and limitations.
- Outline logical actions needed to convert an idea to a fully functioning mobile application.
- Develop mobile applications on a popular mobile platform using their architectures.
- Evaluate development with another mobile platform.

Outline Syllabus

- Characteristics of mobile applications and history of mobile application frameworks, Overview of the Android and React Native frameworks
- Overview of the Android and React Native frameworks, Application models of mobile application frameworks
- User-interface design for mobile applications
- Managing application data, Integrating with cloud services
- Integrating networking, the OS and hardware into mobile-applications
- Addressing enterprise requirements in mobile applications: performance, scalability, modifiability, availability and security,

- Testing methodologies for mobile applications , publishing, deployment in App Store, maintenance, and management
- Payment methods in mobile application development, m-Commerce payment methods, wallet payments, security in mobile payment methods

Evaluation Criteria

Minimum of three assignments

Mini Project (MP): Develop a mobile application as a solution to a real world problem

Overall Assessment Mark, $X = \text{AVG}(2B(\text{MA})) * 0.4 + \text{MP} * 0.6$

Condition for Pass: $X \geq 40$

Module Code/Title: ILI0306 Industry Knowledge

Aim: The focus of this module is to prepare and make students work-ready by exposing them to the key ingredients of Agile Software Development/ Engineering work environment.

Learning Outcomes:

- Apply software development lifecycle in software (product) development.
- Use Agile Software Engineering methodology in software development.
- Appreciate the need and use of software/ product version control, continuous integration, delivery and deployment.

Outline Syllabus

- Software requirements; design; construction; testing; maintenance; configuration management; engineering management; quality; best practices
- Agile SE; the Agile philosophy; Agile SE best practices
- Version control, CI and CD; VC, CI and CD philosophy and best practices
- Industry best Practices: Several workshops on various topics (such as tools, techniques, demonstrations and other areas such as work culture, work-life balance, coping with stress, etc.) to be arranged with the industry, both on-campus and off-campus (at the job site, out-door gatherings-and etc.)

Evaluation Criteria

Mini Project (MP): A Collaborative Mini Project with documentation, presentation and viva; Log Book (with reflective report) signed by the assigned on-campus and industry supervisors

Overall Assessment Mark, $X = \text{MP}$

Condition for Pass: $X \geq 40$

Module Code/Title: ILI037 Entrepreneurship

Aim: The focus of this module is to inculcate a culture of entrepreneurship and provide the necessary skills and tools to take an idea and build a viable enterprise

Learning Outcomes:

- Understand how to translate a problem into an opportunity
- Validate the business idea through customer and market validation and
- Prepare a business plan
- Pitch to potential investors

Outline Syllabus

- Developing a Business Idea: Identify the business opportunity, generate an idea, evaluate the idea
- Develop a strong business model: Align the business to impact, Develop a Unique Value Proposition (UVP), Business Model Canvas (BMC), Customer validation, Market Validation, Building a Minimum Viable Product (MVP), Hypothesis Testing with A/B Testing
- Write a business plan: Executive summary, Company Analysis, Product or Service Analysis including UVP, Industry Analysis, Customer Analysis and market segmentation, Competitor Analysis; Branding and Marketing strategy, Operational Plan; Management team. Financial Plan: cost/Revenue Projections, Strategy, Investments
- Marketing and Sales Strategy: Marketing techniques, tactics, resources, distribution strategies
- Financial Literacy: Basic Bookkeeping, Managing cash flow, Statutory payments, Financial Reporting
- Legal status and taxation: Intellectual Property Law-Patents, Copyrights
- Trademarks and Trade secrets, Founder and shareholder agreements and/or term sheets
- Pitching for Investors: Executive summary, Storytelling, making presentations

Evaluation Criteria

Mini Project (MP): A Collaborative Mini Project with documentation, presentation and viva; Log Book (with reflective report) signed by the assigned on-campus and industry supervisors in developing a startup venture

Overall Assessment Mark, $X = MP$

Condition for Pass: $X \geq 40$

Panel of Resource Persons

1.	Dr. D.D.M Ranasinghe	Head, Department of Electrical and Computer Engineering
2.	Dr. H.U.W Rathnayake	Senior Lecturer, Department of Electrical and Computer Engineering
3.	Dr. L.S.K. Udugama	Senior Lecturer, Department of Electrical and Computer Engineering
4.	Dr. A.P. Madurapperuma	Senior Lecturer, Department of Electrical and Computer Engineering
5.	Ms. Nadeera Meedin	Lecturer (Probationary), Department of Electrical and Computer Engineering
6.	Mr. Peter Argent	Academic Director Fidenz Academy Nawala, Nugegoda
7.	Chatura Dilan Perera	Chief Technology Officer Ceyleon Pvt Ltd. Colombo 5
8.	Nuwan Perera	Director Software Development IFS R&D International Limited 501, Galle Road, Colombo 6, SRI LANKA
9.	Ms. Nadeeshani Pragharatne	Manager Industry Liaison Center (ILC)