Curriculum for Mobile Application Development

Duration: 6 Months

Date: February 2014

Technical Training for Polio-Affectees

The United Nations Industrial Development Organization (UNIDO) is the specialized agency of the United Nations mandated to promote industrial development and global industrial cooperation.

UNIDO's Education Programme strives to promote industry-relevant education and training for the sustainable industrial development of Pakistan.

The UNIDO Education Programme, in collaboration with the National Vocational & Technical Training Commission (NAVTTC) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), has developed ten curricula as part of its Polio-Plus Initiative.

Amongst its main objectives, the United Nations' Polio-Plus Initiative is intended to aid in the rehabilitation of working-age disabled individuals by means of technical training programs in employable skills. With such training, it is projected that these individuals may then positively contribute, both socially and economically, within their respective communities.

In December 2013, teachers of selected Technical Educational & Vocational Training Authority (TEVTA) centres from the priority districts underwent such technical training for the specified ten curricula.

NAVTTC delivered competency-based training to trainers of selected TEVTAs from several high-priority polio districts. The competency standards developed and validated during the curricula development process, now certified as National Standards, are to be used during the training of polio-affected individuals. The workshop was markedly interactive in nature, focusing on group work and presentations while highlighting the intended goal of applicability in such competency-based trainings.

One notable trainer recounted his own experiences working with thousands affected by Polio in Pakistan. Noting their often absence from rigorous economic participation, he referred to these individuals as Pakistan's 'untapped resources'. The trainer also placed special emphasis on the work of disabled working–age individuals in the carpet industry and urged the other trainers to use this as an example during their own training to ensure the successful streamlining of polio-affectees into Pakistan's workforce.

In order to sensitize participants and raise awareness on the matter, participants shared individual experiences linked to polio-affectees and working-age individuals. Most of the high-priority TEVTAs are located in smaller districts of Pakistan where trainers aimed to raise awareness through word-of-mouth. Additionally, they spoke of success stories and considered using these experiences as sources of inspiration during their own trainings for polio-affectees. Trainers were quick to suggest several untapped avenues to maximize the potential of this training.

It is imperative to note that although polio-affectees may require special attention and training, it must be delivered without compromising their dignity and self-esteem.

The idea is to train polio-affectees and equip them with the ability to earn a respectable living. The TEVTAs of these high-priority districts will carry out these trainings through the coordination and support of NAVTTC.

The pattern of the training is such that it will aim to merge the training of Life Skills Curriculum into the training polio-affectees will receive. Earlier in 2012, the Education Programme at UNIDO along with GIZ and NAVTTC developed a Curriculum on Life Skills.

The Life Skills component of this training will impart knowledge on the use of 'soft skills'. This will result in employees who have:

Effective communication skills	A knack for internal and external customer care	Plain "common sense"	A good work ethic	Flexible attitude and are self-driven

Since polio-affectees are disconnected from the mainstream workforce, their inclusion through the use of Life Skills Curriculum will make their transition into Pakistan's mainstream workforce smoother. If trainings consist of five sessions per

week, three will consist of technical training for polio-affectees while the other two will incorporate 'Life Skills' trainings, thereby making it more effective and successful.

UNIDO hopes that the creation of these curricula will serve the purpose for which they were made i.e. the rehabilitation of working-age disabled individuals through technical training programs in employable skills, so that they may contribute socially and economically in their respective communities.

Furthermore, it is hoped that this training will serve to educate and sensitize local communities, particularly illiterate people & workers, on measures for prevention against fatal diseases and the benefits of early intervention while also mobilizing support in local communities for the polio eradication drive.

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Curriculum specification for Mobile Application Development

1. Introduction

The structure of this course

This curriculum comprises 14 modules. The recommended delivery time is 800 hours. Delivery of the course could therefore be full time, 5 days a week, for 6 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery. The full structure of the course is as follow:

Module	Theory Days	Work Place Days	Total Hours
Module 1: Prepare Wire-frames	12	40	52
Module 2: Prepare User Interface Mockups	12	40	52
Module 3: Prepare Navigational Workflow	8	40	48
Module 4: Prepare Use Cases	5	30	35
Module 5: Perform User Interface Testing	5	5	10
Module 6: Prepare Design	15	30	45
Module 7: Perform Breakdown Tasks	5	20	25
Module 8: Perform Coding	40	130	170
Module 9: Perform Unit Testing	5	10	15
Module 10: Perform Database linkage	40	130	170
Module 11: Perform Modules Integration	10	22	32
Module 12: Perform Integration Testing	8	30	38
Module 13: Perform Stress Testing	8	30	38
Module 14: Perform Compatibility Testing	15	35	50

The purpose of the program is to provide participants with the knowledge and skills to develop mobile applications. As the demand for mobile applications increases across the world, the need for developers also rises. This program will provide the essential skills for participants to independently develop mobile phone applications.

Aim of the training provider, trainer or teacher

The aim for the team of staff responsible for delivery of the Mobile Application Development curriculum is to provide knowledge and develop skills. The course will allow participants to gain a comprehensive understanding of all the aspects involved in developing mobile applications. It will also develop the participant's ability to act in a professional and responsible manner.

Teaching staff will provide the technical knowledge and abilities required to solve tasks and problems that are goal-oriented. They will need to use participant-centered, practically oriented methods. They will also need to develop a programme of practical assessment that reflects the learning outcomes stated in the curriculum. Trainees of the Mobile Application Development curriculum will also develop their willingness and ability as individuals to clarify issues, as well as think through and assess development opportunities.

Teaching staff will also support trainees in developing characteristics such as self-reliance, reliability, responsibility, a sense of duty and a willingness and ability to criticize and accept criticism well and to adapt their future behavior accordingly.

Teaching also needs to use the Mobile Application Development curriculum to address the development of professional competence. Trainees need to acquire the ability to work in a professional environment.

Entry level for trainees

Intermediate.

Minimum teaching qualification

Teaching staff should have B.CS (4 yrs)/B.SC Engineering (C.S)/ Software Engineering with at least 2 years working experience in relevant field.

Medium of instruction

Instructions must be in English and Urdu. Most of the language, code and terminology will be in English. As a result, trainees must be able to read and write in English in order to successfully complete the course.

Terminology

This course is for Mobile Application development. As a result, there will be many technical terms used with regards to software, language and development. Most of the terms are common with all developers and based on international standards, and as a result students are required to learn the relevant terminology.

Laws and regulations

Training providers, teachers and trainees need to be aware of the laws, regulations and policies pertaining to software copyright.

2. Competency Standards – Mobile Application Development

Definition

Designs, develop/coding, testing and installation are the basic steps for mobile application development.

Objectives of the Course

The objective of the course is to train the person in such a way so that he/she may be able to design, develop, test and install mobile applications.

Competencies gained after completion of course

By the end of the course the Mobile Application Developer should gain the following competencies:

- Requirement Gathering
- Mock-ups and prototypes
- Design
- Coding
- Unit Testing/Debugging
- Deployment/ Installations

Personal Requirements

A Mobile Application Developer needs to develop the following abilities:

- A desire to learn new technologies
- Basic level of aesthetic sense
- Must possess logical thinking
- Work under pressure
- Work in front of a computer screen for long hours
- Problems Solving Skills
- Strong communication skills, Analytical and Research skills

Opportunities for Employment

The Mobile Application is an emerging technology all over the world and there is a high demand in the Information Technology industry for developers in this field as various organizations are using mobile applications. There are also opportunities for start-up entrepreneurship due to the high demand in the market. Many educational institutions are also seeking Mobile Application Development instructors to teach courses at the college and university level.

3. Overview for the Curriculum for Mobile Application Development

Module Title and Aim	Learning Units	
Module 1: Prepare wireframes Aim: The aim of this module is to understand how to prepare the preliminary UI designs and solve challenges regarding layouts.	LU 1: Understand the different wire-framing components used. LU2: Select the right way to position different components according to different mobile platforms.	Time Frame of Modules: 52 Hours Theory Days: 12 Hours Practical Days: 40 Hours

Module Title and Aim	Learning Units	
Module 2: Prepare User Interface Mock-ups Aim: The aim of this module is to provide basic skills, knowledge and understanding when preparing a User Interface Mock up. This will include understanding customer requirements, developing an understanding of the different mobile applications platforms and screen resolutions.	LU1: Learn about different User Experiences common with different mobile platforms. LU2: Learn about different user Interface components used in mobile platforms. LU3: Learn about Design Patterns associated with mobile platforms. LU4: Learn how to use certain tools specially made for making mock-ups. LU5: Learn how to use advanced graphic	Timeframe of Modules: 52 Hours Theory Days: 12 Hours Practical Sessions: 40 Hours

	designing tools for making mock-ups. LU6: Learn how to develop mock-ups for different platforms and screen resolutions.	

Module Title and Aim	**Learning Units**	
Module 3: Prepare Navigational Workflow Aim: The aim of this module is to provide skills and knowledge on how to develop the navigational flows between user interfaces. This will include developing navigational models.	LU1: Learn about guidelines related to designing navigational flow for different platforms. LU2: Learn different gestures, which can be used for navigation. LU3: Learn how to use certain tools made for documenting navigational flow e.g. Microsoft Visio	Timeframe of Modules: 48 Hours _____ Theory Session: 8hours _____ Practical Session: 40 Hours

Module Title and Aim	**Learning Units**	
Module 4: Prepare Use Cases Aim: The aim of this module is to provide basic understanding of Use Case.	LU1: Learn how to make Use Cases. LU2: Learn how to use tools specifically made for creating Use Cases e.g. MS Vysio.	Timeframe of Modules: 35 Hours Theory Days: 5 Hours Practical Sessions: 30 Hours

Module Title and Aim	Learning Units	
Module 5: Perform User Interface Testing Aim: The aim of this module is to evaluate the initial screen design on the basis of targeted platform and user requirement guidelines. Develop an understanding of how to evaluate compatibility, design and user experience.	LU1: Learn how to collect feedback. LU2: Learn how to analyze the feedback and inculcate any changes required.	Timeframe of Modules: 10 Hours Theory Days: 5 Hours Practical Sessions: 5 Hours

Module Title and Aim	Learning Units	
Module 6: Prepare Design Aim: The aim of this module to develop an understanding of the Mobile Application's design as a logical model of the whole system. Students need to understand this model in the form of diagrams such as sequence diagrams, domain models etc.	LU1: Learn how to make Domain Model. LU2: Understand how to create System Sequence diagram and class diagram. LU3: Learn how to use tools specifically made for creating class diagrams e.g. MS Vysio.	Timeframe of Modules: 45 Hours Theory Days: 15 Hours Practical Sessions: 30 Hours

Module Title and Aim	Learning Units	
Module 7: Perform Breakdown of Tasks Aim: The aim of this module is to provide participants with a basic understanding of how to break down a task into smaller modules and sub tasks.	LU1: Learn Work Bench Sheet LU2: Learn how to divide the complete functionality into modules LU3: The ability to divide bigger modules into smaller features LU4: Learn Gantt Charts	Timeframe of Modules: 25 Hours Theory Days: 5 Hours _____ Practical Session: 20 Hours

Module Title and Aim	Learning Units	
Module 8: Perform Coding Aim: The aim of this module is to develop mobile applications, tasks, and modules as per design, using relevant programming languages.	LU1: Learn programming languages of different platforms i.e. IOs, Android, Windows and Blackberry. LU2: Learn programming standards. LU3: Learn how to code the functionality in different platforms.	Timeframe of Modules: 170 Hours Theory Days: 40 Hours _____ Practical Session: 130 Hours

Module Title and Aim	Learning Units	
Module 9: Perform Unit Testing Aim: The aim of this module is to develop the knowledge and skills required to test individual modules with an application.	LU1: Learn to write unit testing. LU2: Debug the doe with breakpoint. LU3: How to analyze unit test results and fix the issues.	Timeframe of Modules: 15 Hours Theory Days: 5 Hours Practical Sessions: 10 Hours

Module Title and Aim	Learning Units	
Module 10: Perform Database linkage Aim: The aim of this module is to develop strong understanding and skills to be able to implement different data layers to facilitate as a bridge between database and business logic.	LU1: Learn how to make database connection. LU4: Learn how to make DB adapters.	Timeframe of Modules: 170 Hours Theory Days: 40 Hours Practical Sessions: 130 Hours

Module Title and Aim	Learning Units	
Module 11: Perform Integration Tasks Aim: The aim of this module is to connect and integrate all the developed features/modules into a single mobile application.	LU1: Learn how to connect different features/modules.	Timeframe of Modules: 32 Hours Theory Days: 10 Hours Practical Sessions: 22 Hours

Module Title and Aim	Learning Units	
Module 12: Perform Integration Testing Aim: The aim of this module is to provide basic knowledge, skills and understanding of how to integrate tested software modules and then test integration as well.	LU1: Learn how to integrate unit-tested modules. LU2: Understand the difference between the Top-Down and Bottom-Up Approach. LU3: Prepare Test Cases.	Timeframe of Modules: 38 Hours Theory Days: 8 Hours Practical Sessions: 30 Hours

Module Title and Aim	Learning Units	
Module 13: Perform Stress Testing Aim: The aim of this module is to develop a basic understating of how to conduct stress testing to determine the ability of the application to maintain a certain level of effectiveness under unfavorable conditions.	LU1: Learn how to decide stress testing components. LU2: Learn tools specifically designed for making stress tests e.g. Monkey Runner. LU3: Prepare Test Cases.	Timeframe of Modules: 38 Hours Theory Days: 8 Hours Practical Sessions: 30 Hours

Module Title and Aim	Learning Units	
Module 14: Perform Compatibility Testing Aim: The aim of this module is to develop skills to ensure applications work across different devices, considering different sizes, resolutions, iOS versions and hardware specifications.	LU1: Learn how to test the App on iOS device LU2: Learn how to test the App on an Android device. LU3: Learn how to test the App on a Blackberry device. LU4: Learn how to test the App on Windows devices. LU5: Prepare Test Cases.	Timeframe of Modules: 50 Hours Theory Days: 15 Hours Practical Sessions 35 Hours

4. Teaching and Learning Guide for Mobile Application Development

The aim of the training course is to enable trainees to develop mobile applications. After successful completion of the course, trainees will be able to apply the knowledge and skills acquired in a practical work setting.

The teaching methodologies adopted by trainers should include practical and theory sessions supported by appropriate resources, as indicated in the 'Materials Required' column of the Learning Unit specifications. Trainers should also illustrate theory sessions with examples of how the learning could be applied in the workplace. Practical methodologies should be set in an appropriate environment and supported by appropriate resources, also indicated in the "Materials Required" column of the Learning Unit specifications. Methods that directly promote capacity building for the student are essential and therefore should be included appropriately in the teaching approach.

4.1 Module 1: Preparing Wire Frames

Objective of the module: The aim of this module is to understand how to prepare the preliminary UI designs and solve challenges regarding layouts.

Duration: 52 hours **Theory:** 12 hours **Practical:** 40 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Understand the different wire-framing components used in mobile platforms.	P1. Identify different user interaction components with respect to the relevant wire-framing components. P2. Identify how these components fit together to make a wire-frame.	K1. Basic Understanding of all the user interface components that are common in all mobile platforms. K2. Understanding of all the user interface components that are different in different mobile platforms. K3. Understanding the linkage between all the different wire-framing components.	Total: 10 Hours Theory: 4 Hours Practical: 2 Hours	Software for designing layouts would include; Adobe Photoshop, Pencil Tool, Paint and Interface builder. User Manuals and Tutorial guides for each software and instructions on how to install a set up.	**Theoretical Learning**: Classroom with multimedia aid, white board, audio-visual facilities and flip charts.

		K4. Understand how to represent the wire-framing components and the linkages between them.			
LU2: Select the right way to position different components according to different mobile platforms.	P3: Understand the different guidelines for positioning different user interfacing components with respect to different mobile platforms. P4: Understand how the position of user interface elements affects the accessibility of the elements, which in turn	K5. Understand the basic rules that need to be taken care of when positioning different components. K6. Understand the importance of following user interface components guidelines. K7. Understand the term 'accessibility' and its importance.	Total: 2 Hours Theory: 2 Hours Practical: 0 Hours		

	affects the user behavior.	K8: Understanding user behaviors. K9: Knowledge of user interface designs, layouts and patterns. K10: Knowledge of graphic designing tools.			

4.2 Module 2: Prepare User Interface Mockups

Objective of the Module: Develop the UI interfaces as per customer requirement, which may include mobile application platform, screen resolution, colour schemes, themes, CSS, HTML layouts and controls/widgets placement.

Duration: 52 hours **Theory:** 12 hours **Practical:** 40 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Learn about different user experiences common with different mobile	P1. Identify different user experiences that are linked with different mobile	K1. Basic understanding of all the user experience rules that are common in all mobile	Total 5 Hours Theory: 5 Hours	Software Tools: Adobe Photoshop etc.	**Theoretical Learning:** Classroom with multimedia aid, white board,

platforms.	platforms. P2. Create mock ups with a positive user experience. P3. Illustrate customer's UI interface requirements.	platforms. K2. Understanding of all the user experience rules that are different in different mobile platforms. K3. Understand the term "user experience" and its relevance when creating mockups. K4. Understand the way to analyze customer requirements and ensure the design meets them. K5. Describe market trends. K6. Develop analytical skills.	Practical: 0 Hours		audio-visual facilities and flip charts.

		K7. Creative designing skills. K8. Use tools language for designing UI interfaces. K9. Describe color pattern theory. K10. UI design layouts/patterns knowledge.			
LU2: Learn about different user interface components used in mobile platforms.	P1. Identify different user interface components. P2. Identify how these components fit together to make a mockup.	K1. Basic understanding of all the user interface components that are common in all mobile platforms. K2. Understanding of all the user interface components that are different in different mobile platforms.	Total: 2 Hours Theory: 2 Hours Practical: 0 Hours		

		K3. Understanding the linkage between all the different mockup components.			
LU3: Learn about design Patterns associated with mobile platforms.	P1. Identify the different design patterns associated with the different mobile platforms. P2. Use the different design patterns associated with the different mobile platforms.	K1. Basic understanding of all the design patterns that are common in all mobile platforms. K2. Understanding of all the design patterns that are different in different mobile platforms. K3. Understand how to apply the different design patterns. K4. Understand the importance of following the design patterns.	Total: 4 Hours Theory: 4 Hours Practical: 0 Hours		

LU4: Learn how to use certain tools specially made for making mock-ups e.g. Pencil	P1. Trainees should be able to understand how the tools are used for making mock ups P2.Trainees should be able to install all tools required for making mock ups P3. Trainees should be able to configure all tools required for mock ups.	K1. Understand the basic components of the tools used for creating mock-ups. K2. Understand the advanced features of the tools used for refining mock ups. K3. Learn the procedure for installation of the tools used for making mock ups. K4. Learn the procedure for configuration of the tools used for making mock ups.	Total: 7 Hours Theory: 1 Hour Practical: 6 Hours	Software Tool: Pencil Tool	

4.3 Module 3: Prepare Workflow

Objective of the Module: The aim of this module is to provide skills and knowledge how to develop navigational flows between user interfaces. This will include developing navigational models.

Duration: 48 hours **Theory:** 8 hours **Practical:** 40 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Learn about guidelines related to designing navigational flow for different platforms.	P1. Identify the different guideline for designing navigational flows associated with the different mobile platforms. P2. Use the different guideline for designing navigational flows associated with the different mobile platforms.	K1. Basic understanding of all the guidelines for designing navigational flows that are common in all mobile platforms. K2. Understanding of all the guideline for designing navigational flows that are different in different mobile platforms. K3. Understand how to apply the different guidelines for designing	Total: 5 Hours Theory: 3 Hours Practical: 2 Hours	Software Tools: MS Excel MS Visio	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.

		navigational flows. K4. Understand the importance of following the guidelines for designing navigational flows. K5: Knowledge of navigation patterns and models.			
LU2: Learn different gestures, which can be used for navigation.	P1. Identify different gestures associated with different mobile platforms. P2. Use different gestures in the designing of the user experience of the application.	K1. Basic understanding of all the gestures that are common in all mobile platforms. K2. Understanding of all the gestures that are different in different mobile platforms. K3. Understanding how to apply the	Total: 2 Hours Theory: 2 Hours Practical: 0 Hours		

		different gestures for making an effective user experience. K4. Understanding the diverse effects of excessive usage of gestures on the user experience.			
LU3: Learn how to use certain tools made for documenting navigational flow.	P1. Trainees should be able to understand how the tools are used for making navigational flows. P2. Trainees should be able to install all tools required for making navigational flows. P3. Trainees should be able to	K1: Knowledge of flow charts. K2. Understanding the basic components of the tools used for creating flow charts. K3. Understanding the advanced features of the tools used for refining flow charts. K4. Learn the procedure for the	Total: 4 Hours Theory: 0 Hours Practical: 4 Hours	Microsoft Visio	

	configure all tools required for navigational flows.	installation of the tools used for making flow charts. K5. Learn the procedure for configuration of the tools used for making flow charts.			

4.4 Module 4: Perform Testing

Objective of the Module: The aim of this module is to evaluate the initial design on the basis of targeted platform and user requirement guidelines. Develop an understanding on how to evaluate compatibility, design and User experience.

Duration: 35 hours **Theory:** 5 hours **Practical**: 30 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Learn how to make forms for the collection of feedback.	P1.Plan user feedback forms. P2. Structure correct questions in order to gain accurate information.	K1. Understanding the usage of different types of questions and its uses.	Total: 3 Hours Theory: 2 Hours Practical: 1 Hour	Ranorex	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
LU2: Learn how to analyze the feedback and inculcate any changes required.	P1. Extract useful information from the user feedback.	K1. Understanding user cognitive processes. K2. How to extract useful conclusions from the feedback.	Total: 3 Hours Theory: 3 Hours Practical: 0 Hours		

4.5 Module 5: Prepare Architecture

Objective of the Module: The aim of this module is to develop an understanding of the Mobile Application's architecture as a logical model of the whole system. Students need to understand this model in the form of diagrams such as sequence diagrams, domain models etc.

Duration: 10 hours **Theory:** 5 hours **Practical:** 5 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Learn how to make Domain Model, Systems sequence diagrams and Class diagrams	P1. Incorporate all the user requirements into the architecture. P2. Should be flexible for further changes and enhancement. P4. Demonstrate that architecture is built in a way that reduces any chance of uncertainty.	Knowledge of any modeling language (Unified Modeling language). Understand how to make architecture flexible. Understand the importance of making an architecture document.	Total: 9 Hours Theory: 6 Hours Practical: 3 Hours	MS Visio,	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
LU2: Learn how to use tools specifically made	Trainees should be able to understand how the tools are	K1: Knowledge of class diagrams.	Total: 6 Hours	MS Visio	

for creating class diagrams e.g. Enterprise Architect.	used for making all the diagrams required for representing architecture. Trainees should be able to install all tools required for making diagrams required for representing architecture. Trainees should be able to configure all tools necessary for diagrams required for representing architecture.	K2. Understand the basic components of the tools used for creating class diagrams. K3. Understand the advanced features of the tools used for refining class diagrams. K4. Learn the procedure for the installation of tools used for making class diagrams. K5. Learn the procedure for configuration of the tools used for making class diagrams.	Theory: 0 Hours Practical: 6 Hours		

4.6 Module 6: Perform Breakdown Feature

Objective of the Module: The aim of this module is to provide participants with a basic understanding of how to break down a task into smaller modules and sub tasks

Duration: 45 hours **Theory:** 15 hours **Practical:** 30 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn how to make Work Breakdown Structure (WBS)	P1. Ensure subtask contains related features only. P2. Check that the interdependency between sub tasks be managed efficiently.	K1. Knowledge of domain and application. K2. Knowledge of Rapid Application development. K3. Experience and skills of system analysis.	Total: 4 Hours Theory: 2 Hours Practical: 2 Hours	MS Visio	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
Learn how to divide the complete functionality into modules for better time estimation.	Manage the project effectively. Identify the major modules of functionality.	Understand the importance project management. Learn how to identify the major modules of functionality.	Total: 2 Hours Theory: 2 Hours Practical: 0 Hours		

4.7 Module 7: Perform Database linkage

Objective of the Module: The aim of this module is to develop the skills of trainees to enable them to implement different data layer to facilitate as a bridge between database and business logic.

Duration: 25 hours **Theory:** 5 hours **Practical:** 20 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Learn how to make database connection.	P1. Prevent dead lock through session management. P2. Correctly handle multiple connections. P4. Effectively manage database operations.	K1. Knowledge of DBMS. K2. Knowledge of Integration of SQL script with programming language. Ability to handle concurrent database connections.	Total: 6 Hours Theory: 0 Hours Practical: 6 Hours	MS SQL Server SQL Language SQL Editor Visual Studio	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
Learn how to write business object.	P3. Ensure re-usability of CRUD operation with centralized function. Create business	K3. Understanding of store procedures. Understanding n-tier architecture. Understanding the	Total: 7 Hours Theory: 1 Hour Practical:		

	layers for interacting with the database.	term 'CRUD.' Understanding how to develop a business layer.	6 Hours		
Groups and roles, Access Rights	Define the different groups of users. Define the different roles of users. Assign different access rights to users.	Understand what is meant by groups and its purpose. Understand what are roles and their purposes. Understand what are access rights and how it helps securing the data.	Total: 8 Hours Theory: 2 Hours Practical: 6 Hours		

4.8 Module 8: Perform Coding of Features

Objective of the Module: The aim of this module is to teach the trainees how to develop separate features/modules of a mobile application using relevant programming languages.

Duration: 170 hours **Theory**: 40 hours **Practical:** 130 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn how to code the functionality in different platforms.	P1. Followed Coding standards. P2. Fulfilled functional and non-functional requirements. P3. Demonstrate optimized and robust code. P4. Check readability and re-usability of code. P5. Make logically optimized programs.	K1. Knowledge of relevant language. K2. Knowledge of relevant platform and framework. K3. Knowledge of best coding practices. K4. Developing logical thinking when making codes.	Total: 26 Hours Theory: 8 Hours Practical: 18 Hours	IDE that supports language	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.

LU4: Learn how to use tools specifically made for coding.	Trainees should be able to understand how the tools are used for coding. Trainees should be able to install all tools required for coding. Trainees should be able to configure all tools required for coding.	K1: Knowledge of coding. K2. Understand the basic components of the tools used for creating codes. K3. Understand the advanced features of the tools used for refining codes. K4. Learn the procedures for installation of the tools used for making codes. K5. Learn the procedures for configuration of the tools used for making codes	Total: 26 Hours Theory: 5 Hours Practical: 21 Hours		

4.9 Module 9: Perform Feature Integration

Objective of the Module: The aim of this module is to connect/integrate all the developed features/modules into a single mobile application.

Duration: 15 hours **Theory:** 5 hours **Practical**: 10 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn how to connect different features/module.	P1. Organized and integrated modules into proper sequence. P2. Conducted Rapid testing on integrated features.	K1. Knowledge of information and application flow. K2.Understand exception handling. K3. Knowledge of sub versioning of application and module. K4. Knowledge of Rapid Application development.	Total: 10 Hours Theory: 4 Hours Practical: 6 Hours	SVN GIT MVs	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.

4.10 Module 10: Prepare Use Cases

Objective of the Module: The aim of this module is to provide basic understanding of Use Case Development.

Duration: 170 hours **Theory**: 40 hours **Practical:** 130 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Learn how to make Use Cases.	P1: Covered all events performed by user as per requirement. P2: Ensured the test cases meets workflow requirements. P3: Checked that the test cases cover functional and non-functional requirements.	K1: The ability to analyze and understand requirements. K2: Understand use case diagrams. K3: Use relevant tools to create basic drawings.	Total: 2 Hours Theory: 2 Hours Practical: 0 Hours		**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
LU2: Learn how to use tools specifically made for creating use cases e.g. Enterprise	Trainees should be able to understand how the tools are used for making use cases.	K1: Knowledge of use cases. K2. Understand the basic components of the tools used for	Total: 6 Hours Theory: 0 Hours	MS Project, MS Visio	

Architect	Trainees should be able to install all tools required for making use cases. Trainees should be able to configure all the tools required for use cases.	creating use cases. K3. Understand the advanced features of the tools used for refining use cases. K4. Learn the procedure for installation of the tools used for making use cases. K5. Learn the procedure for configuration of the tools used for making use cases.	Practical: 6 Hours		

4.11. Module 11: Perform Unit Testing

Objective of the Module: The aim of this module is to develop knowledge and skills to test individual modules within an application.

Duration: 32 hours **Theory:** 10 hours **Practical:** 22 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn to write unit tests.	P1: Correctly aligned compliance with application requirements. P2: Correctly define logic as per requirement. Correctly define units. P3: Tested all the units.	K1: Clear understanding of the scope of target units. K2: Working knowledge of debugging codes. K3: Awareness of latest unit testing techniques. Understandings of what the units are.	Total: 5 Hours Theory: 2 Hours Practical: 3 Hours	Dalvik Debug Monitor Service	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
Learn how to use tools specifically made for running unit tests.	Trainees should be able to understand how the tools are used for running a unit test.	K2. Understanding the basic components of the tools used for running unit tests. K3. Understanding	Total: 3 Hours Theory: 0 Hours		

	Trainees should be able to install all tools required for running a unit test. Trainees should be able to configure all tools required for diagrams required for representing architecture.	the advanced features of the tools used for refining unit tests. K4. Learn the procedure for installation of the tools used for making unit tests. K5. Learn the procedure for configuration of the tools used for making a unit test.	Practical: 3 Hours		
How to analyze unit test results and fix the issues.	Analyze unit test results and fix issues according to the unit tests.	Understanding the importance of unit testing. The ability to analyze test results. Learn how to fix issues and identify bugs.	Total: 5 Hours Theory: 2 Hours Practical: 3 Hours		

4.12. Module 12: Perform Integration Testing

Objective of the Module: The aim of this module is to provide basic knowledge, skills and understanding on how to integrate software module and integration testing.

Duration: 38 hours **Theory:** 8 hours **Practical:** 30 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn how to integrate unit-tested modules.	P1. Checked that all integrated application modules should work together properly as per requirement. P2. Maintained performance after integration. P3. Ensured that individual modules are functional.	K1. Working knowledge of all modules involved in integration. K2. Able to do unit testing. K3. Knowledge of workflow of information between integrated modules.	Total: 1 Hours Theory: 1 Hours Practical: 0 Hours	Dalvick Debugging Tool	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
Top-Down and Bottom-Up Approach	P1. Differentiate between top-down and bottom-up	K1. Understand what a top-down and bottom-up approach	Total: 1 Hour		

	approach. P2. Identify the utility of different approaches.	is and identify which approach suits the requirement. K2. Understand the advantages and disadvantages of the top-down Approach Understand the advantages and disadvantages of the bottom-up approach	Theory: 1 Hour Practical: 0 Hours		

4.13 Module 13: Perform Stress Testing

Objective of the Module: The aim of this module to develop a basic understating on how to conduct stress testing to determine the ability of the application to maintain a certain level of effectiveness under unfavorable conditions.

Duration: 38 hours **Theory:** 8 hours **Practical:** 30 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn how to decide stress testing components.	P1. Verify reasonable application performance in low stress, medium stress and high stress conditions. P2. Test application's robustness in worst possible conditions. P3. Ensure the application's effectiveness under unfavorable conditions.	K1. Complete knowledge of software quality assurance. K2. Preparing test data and training data. K3. Knowledge of implementation and design capacity testing.	Total 4 Hours Theory: 1 Hour Practical: 2 Hours	Monkey testing. Stability test stress. Check tools. Native mobile tools.	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.
Learn tools specifically designed for making stress	P1. Trainees should be able to understand how the tools are used for making a stress	K2. Understand the basic components of the tools used for	Total: 3 Hours Theory:		

tests. e.g. Monkey Runner	test. P2. Trainees should be able to install all tools required for making a stress test. P3. Trainees should be able to configure all tools required for making a stress test.	creating stress tests. K3. Understand the advanced features of the tools used for refining stress tests. K4. Learn the procedure for installation of the tools used for making stress tests. K5. Learn the procedure for configuration of the tools used for making stress tests.	0 Hours Practical: 3 Hours		

4.14 Module 14: Perform Compatibility Testing

Objective of the Module: The aim of this module is to develop skills to ensure application work across different devices, considering different sizes, resolutions, OS versions and hardware specifications

Duration: 50 hours **Theory**: 15hours **Practical**: 35 hours

Learning Units	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
Learn how to test the application on iOS.	P1. Verify readability across all the devices. P2. Maintain user experience across all the devices. P3. Perform testing to make sure application is properly functional across all the targeted platforms. P4. Ensure features of application worked as desired on all the targeted devices.	Knowledge of different hardware. Knowledge of different iOS versions. Knowledge of different screen sizes. The ability to test the application on different hardware, iOS and screen, and which hardware supports the iOS version.	Total: 5 Hours Theory: 2 Hours Practical: 3 Hours	Android studio. Debugging tools for iOS and hybrid application.	**Theoretical Learning:** Classroom with multimedia aid, white board, audio-visual facilities and flip charts.

Learn how to test the application on Androids.	P1. Verify readability across all the devices. P2. Maintain user experience across all the devices. P3. Perform testing to make sure application is properly functional across all the targeted platforms. P4. Ensure features of application worked as desired on all the targeted devices.		Total 5 Hours Theory: 2 Hours Practical: 3 Hours		
Learn how to test the application on Blackberry.	P1. Verify readability across all the devices. P2. Maintain user experience across		Total: 5 Hours Theory: 2 Hours		

	all the devices. P3. Perform testing to make sure the application is properly functional across all the targeted platforms. P4. Ensure features of application worked as desired on all the targeted devices.		Practical: 3 Hours		

5. General assessment guidance for the Mobile Application development

Good practice in Pakistan makes use of sessional and final assessments, the basis of which is described below. Good practice by vocational training providers in Pakistan is to use a combination of these sessional and final assessments, combined to produce the final qualification result.

Sessional assessment is going on all the time. Its purpose is to provide feedback on what students are learning:

- To the student: to identify achievements and areas requiring further work.
- To the teacher: to evaluate the effectiveness of teaching to date and to focus future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy. The final assessment is the assessment, usually conducted upon completion of a course or module, which indicates whether the student has passed or not. It is – or should be – undertaken with reference to all the objectives or outcomes of the course, and is usually fairly formal. Considerations of security – ensuring that the student who gets the credit is the person who did the work – assume considerable importance in the final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted.

For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of a Mobile Application Developer include:

- Work performances, for example integrating database, or preparing wireframes.
- Demonstrations, for example demonstrating correct coding, database linkages.
- Direct questioning, where the assessor would ask the student why he is developing applications in such a way.
- Paper-based tests, such as multiple choice or short answer questions on technical issues.

Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly.

Examples for indirect assessment of a Mobile Application developer include:

- Work products, such as a completed application.
- Workplace documents, such as application documentation.

Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the person being assessed produced the work products.)

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

Validity means that a valid assessment assesses what it claims to assess. For example, if the cooking ability is to be assessed and certificated, the assessment should involve performance criteria that are directly related to that cooking activity. An interview about different nutrients would not meet the performance criteria.

Reliability means that the assessment is consistent and reproducible. For example, if the work performance of preparing fish for cooking has been assessed, another assessor (e.g. the future employer) should be able to see the same work performance and witness the same level of achievement.

Flexibility means that the assessor has to be flexible concerning the assessment approach. For example, if there is a power failure during the assessment, the assessor should modify the arrangements to accommodate the student's needs.

Assessment strategy for the Mobile Application Development Curriculum

This curriculum comprises 14 modules:

Module 1: Prepare Wire-frames
Module 2: Prepare User Interface Mockups
Module 3: Prepare Navigational Workflow
Module 4: Prepare Use Cases
Module 5: Perform User Interface Testing
Module 6: Prepare Design
Module 7: Perform Breakdown Tasks
Module 8: Perform Coding
Module 9: Perform Unit Testing
Module 10: Perform Database linkage
Module 11: Perform Modules Integration
Module 12: Perform Integration Testing
Module 13: Perform Stress Testing
Module 14: Perform Compatibility Testing

Sessional assessment

The sessional assessment for all 14 modules shall be in two parts: a theoretical assessment and practical assessment. The sessional marks shall contribute to the final qualification.

Theoretical assessment for all learning modules must consist of a written paper lasting at least one hour per module. This can be a combination of multiple choice and short answer questions.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under 'Planning for Assessment.'

Final assessment

Final assessment shall be in two parts: a theoretical assessment and practical assessment. The final assessment marks shall contribute to the final qualification.

The final theoretical assessment shall consist of one 3-hour paper, consisting of multiple choice and short answer questions, covering all modules.

For the final practical assessment, each student shall be assessed over a period of two days, to develop a complete Mobile Application using all the 14 modules listed below:

Module 1: Prepare Wire-frames
Module 2: Prepare User Interface Mockups
Module 3: Prepare Navigational Workflow
Module 4: Prepare Use Cases
Module 5: Perform User Interface Testing
Module 6: Prepare Design

Module 7: Perform Breakdown Tasks
Module 8: Perform Coding
Module 9: Perform Unit Testing
Module 10: Perform Database linkage
Module 11: Perform Modules Integration
Module 12: Perform Integration Testing
Module 13: Perform Stress Testing
Module 14: Perform Compatibility Testing

Planning for assessment

Sessional assessment: assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to determine ways to combine modules into a cohesive two-day final assessment programme for each group of five students. Training providers must agree on the dimensions for practical assessments in advance.

Planning aid for sessional assessment

Module 1: Prepare Wire-frames			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU 1: Understand the different wire-framing components used.			
LU2: Select the right way to position different components according to different mobile platforms.			

Module 2: Prepare User Interface Mockups			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn about different user experiences common with different mobile platforms.			
LU2: Learn about different user interface components used in mobile platforms.			
LU3: Learn about design patterns associated with mobile platforms.			
LU4: Learn how to use certain tools specially made for making mock-ups.			
LU5: Learn how to use advanced graphic designing tools for making mock-ups.			
LU6: Learn how to develop mock ups for different platforms and screen resolutions.			

Module 3: Prepare Navigational Workflow			
LU1: Learn about guidelines related to designing navigational flow for different platforms			
LU2: Learn different gestures, which can be used for navigation.			
LU3: Learn how to use certain tools made for documenting navigational flow e.g. Microsoft Visio			

Module 4: Prepare Use Cases			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to make use cases.			
LU2: Learn how to use tools specifically made for creating use cases e.g. MS Vysio			

Module 5: Perform User Interface Testing			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to collect feedback.			
LU2: Learn how to analyze the feedback and inculcate any changes required.			

Module 6: Prepare Design			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to make a domain model.			
LU2: Understand how to create system sequence diagrams and class diagram.			
LU3: Learn how to use tools specifically made for creating class diagrams e.g. MS Vysio			

Module 7: Perform Breakdown Tasks			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn Work Bench Sheet			
LU2: Learn how to divide the complete functionality into modules.			
LU3: The ability to divide bigger modules into smaller features.			
LU4: Learn Gantt Charts.			

Module 8: Perform Coding			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn programming languages of different platforms i.e. iOS, Android, Windows and Blackberry.			
LU2: Learn programming standards.			
LU3: Learn how to code the functionality in different platforms.			

Module 9: Perform Unit Testing			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn to write unit testing.			
LU2: Debug the doe with breakpoint.			
LU3: How to analyze unit test results and fix the issues.			

Module 10: Perform Database linkage			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to make database connection.			
LU2: Learn how to make DB adapters.			

Module 11: Perform Modules Integration			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to connect different features/modules.			

Module 12: Perform Integration Testing			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to integrate unit-tested modules.			
LU2: Understand the difference between the Top-Down and Bottom-Up Approach.			
LU3: Prepare test cases.			

Module 13: Perform Compatibility Testing			
Learning Units	Hours of theoretical	Hours of practical	Schedule Dates

	assessment	assessment	
LU1: Learn how to decide stress testing components.			
LU2: Learn tools specifically designed for making stress test e.g. Monkey Runner.			
LU3: Prepare test cases.			

Module 14: Perform Stress Testing			
Learning Units	Hours of theoretical assessment	Hours of practical assessment	Schedule Dates
LU1: Learn how to test the App on an iOS device.			
LU2: Learn how to test the App on an Android device.			
LU3: Learn how to test the App on a Blackberry device.			
LU4: Learn how to test the App on Windows devices.			
LU5: Prepare test cases.			

6. Tools and Equipment

Hardware

- Server Machine (Specification as per TEVTA policy)
- Work Station/Desktop Computer with LCD Display (Specifications as per TEVTA policy)
- MS Office 2007 (Installed on each PC)
- Operating System (Windows, Linux or other Operating Systems)
- DSL Internet Connection (Minimum 1 MB)
- Programming Languages including HTML, CSS, JavaScript, JQuery, PHP (Licensed Software installed on each PC)
- Web Servers including IIS, Apache (Licensed software installed on each PC)
- Databases including MySQL, ERWIN (Licensed software installed on each PC)
- Graphic Designing including Adobe Photoshop, Corel Draw
- FTP Client including Filezilla, File Manager (Licensed software installed on each PC)
- Web browser including Internet Explorer, Google Chrome, Mozilla Firefox, Netscape, Opera (installed on each PC)
- Web hosting manager/control panel
- Security scanning tools including Antivirus (each PC)
- Firewall (each PC)
- Wires, data cables, power plugs, power supply
- UPS
- Generator
- Air Conditioner (2 Tons)
- Networking

Software

- MS Office
- MS Vysio
- Adobe Photoshop
- My SQL

Accessories/Devices

- Mobile Phones (Android/iOS/Windows/Blackberry Devices)
- Connectors
- Multimedia
- Printer
- Audio/visual aid
- White Board
- Pin Board
- Flip Chart Board
- Hard copy of Training Material