

**Associate Software Developer  
National Vocational Qualification  
Level 4 – Curriculum**

By

ICT Industry Skills Council



## Associate Software Developers

**Module 01:** Desktop Application Developer

**Duration:** 240 hours

**Competencies and duration breakdown:**

Competencies	Duration
<b>Solution conceptualizing skills:</b> the candidate needs to be able identify the problem at hand and derive the concept in providing a solution to the understood problem. Further the candidate needs to perform a technical study to determine the technology best suited to generate the best solution for the problem	15
<b>Requirements gathering and Analysis Skills:</b> the candidate must be able to analyze in detail the problem and further gather the requirements and illustrate the gathered requirements using diagrams and descriptions, further the candidate should be able to produce the requirements specification and also perform a requirements validation	27
<b>Designing Skills:</b> the candidate needs to be able to create the system inputs, design the system flow or process, the system output and how the system data needs to be represented. Further the candidate needs to draw up the test plan and the test cases to make it ready for the testing once the system has been build	36
<b>Development Skills:</b> the candidate is given the opportunity to select and acquire the appropriate software's for the system to be developed and further identifies and does the setting up of the required system software. Then develops the system using the software's, develops the database and connects the software solution to the database	90
<b>Software Quality Assurance Skills:</b> Test the developed software to ensure it is according to test plan, document the test results, and perform a user acceptance testing.	24
<b>Software Deployment skills:</b> once the software has been developed and tested and if required retested it is now important to install the software in the user environment. This needs to be done in different stages, such as set up software, set up database, configure network within the company, populate the data and train the users to use the developed software	12
<b>Software Maintenance Skills:</b> correct post implementation errors, analyze change requirements to ensure the post implementation error can be quickly rectified, and further deliver maintenance solutions. The candidate first needs to identify what type of modification, this can be an error correction as stated before, enhancement of the existing system.	12
<b>Software Project Management Skills:</b> identify a project management methodology to be used to develop the software system, plan the project by making simple estimate and also a project schedule, organize the resources to start the project, monitor while the project is underway and control a real world project	24
<b>Total number of hours</b>	<b>240</b>

### Typical work related situations

**Solution conceptualizing skills:** The client organization currently has encountered a problem in relation to the business such as a pastry shop who currently issues a handwritten bill finds that it takes too long and therefore the customers has shown dislike to come to the shop and thinks that ICT can provide a solution for them

**Requirements gathering and Analysis Skills:** the client company has problems and some of them have a solution to the problem as well, but does not know whom they should talk to, there are several manual documents, which has valuable data and information that will surely provide what is needed for the project to start developing. E.g.: the staff at the shop is aware of the problems and wants to talk to someone, there are so many inventory files available and many handwritten receipts as well.

**Designing Skills:** currently the company or shop does not have a system and therefore they need to get an idea of the how the new system will allow them to enter transaction details, show the system generated reports and what needs to be done from the time they enter the data until the reports and generated.

**Development Skills:** the company you work for or hired by needs to solve a business problem by setting up a new software solution and the candidate is asked to develop a software to be used within the enterprise. However the software has already been designed and the student needs to develop the software, but to do so needs to identify, which software is best suited and which database management system would best go with the selected software.

**Software Quality Assurance skills:** the developed software, which was done by you or someone else is giving errors. And the company has appointed you to rectify the problems. You need to find these errors and correct them and ensure that the software serves the purpose that it was really made for. You need to therefore make a plan, prior to testing and use testing/ QA tools to test the software on hand. The user approval to the software needs to be done prior to releasing it back to the company to be used.

**Software Deployment skills:** now the software is made and these is no more errors to be seen,. The customer company wants the system to go live as soon as possible, your duty is to ensure a smooth transition of the software from the development environment to the client environment and further need to provide a guidance to the immediate staff who will be using the system

**Software Maintenance Skills** – the system delivered a few days/ weeks back is giving trouble and the company has asked you to correct those mistakes. At times it may not be errors but system enhancements requested by the company or its clients and you need to change the system accordingly. At certain rare occasions it can be a change within or outside the system for, which the system developed and tested needs to adapt to that needs too.

**Software Project Management Skills** – the company for which you work needs to do software to solve a corporate problem at hand. They have made a team, the team has technical staff to design and develop the software, there is a systems analyst to gather the requirements, there is a technical writer and even a software quality assurance staff member, but the team needs a leader, a figure head to take the project along and ensure that it completes on the stated date and for the amount the company is willing to pay. Your role is clear, what you need to do is manage your team to ensure the stated corporate objectives are met.

### Knowledge Areas to achieve the competencies

Competencies	Knowledge Areas
<b>Solution conceptualizing skills</b>	We need to think of a problem as a story and draw up a simple diagram that tells the story. A simple conceptual diagram that is draw in methodologies like Soft Systems Method(SSM) developed by Prof. peter checkland can be used
<b>Requirements gathering and Analysis Skills</b>	Use fact finding techniques such as interviews, observations, questionnaires and prepare a requirements document. Draw use case diagram or Data flow diagram (DFD) to depict the requirements and give a requirements prototype using a paper prototype
<b>Designing Skills</b>	Visual Report and Form Designer using .net framework or any similar tool , Activity diagrams using AgroUML, Creation of Entity Relationship diagram and table structures using tools such as smartdraw or a tool which is similar. Further create Mockup and wireframe tools such as Balsamiq Mockups
<b>Development Skills</b>	select Ubuntu as the platform, use netbeans to develop using JAVA(candidates can be taught Java using <a href="https://www.greenfoot.org">https://www.greenfoot.org</a> ) and MySQL as the backend and further create reports using JasperReports, optionally provide system development using C#.net and SQL Server and facilitate Crystal Reports as a report generator
<b>Software Quality Assurance Skills</b>	perform manual testing by including sample test data and real test data, further use testing tools such as Jtest, further if the C#.net is used with SQL server use appropriate testing tool
<b>Software Deployment skills</b>	use netbeans IDE to deploy the developed JAVA code also using database connections for MySQL and further if the option of Microsoft is used use deployment kit for implementation
<b>Software Maintenance Skills</b>	perform a justification on how requested changes can be handled and evaluate the impact that can be caused, knowledge in reading and understanding a change request form
<b>Software Project Management Skills:</b>	draw a work breakdown structure using WBS Schedule Pro, draw a Gantt chart using Ms. Project and perform a project estimation

### Potential useful Teaching Methods

Competencies	Method of Assessment
<b>Solution conceptualizing skills</b>	Give a real world problem, like the pastry shop and ask the candidates to draw up a way to solve this problem using a software solution. Take real world examples of software systems they have seen, like a POS system in a supermarket, a patient management and appointment system at a hospital and ask them to think back and tell the teacher, what if this systems was not present, what will have happened? Make the candidates draw solutions in a creative way
<b>Requirements gathering and Analysis Skills</b>	Once the concept has been draw, give the students a real situation and ask them to solve it. They need to identify from whom details need to be gathered, what must be gathered, when you should gather them and how(what techniques needs) to be used such as interviewing the shop

	owner, like giving a questionnaire to the customers. After gathering the requirements the students need to fill the requirements specification format paper. Further the candidate needs to finalize the gathered requirements with the customer and prioritize the requirements implementation. Further ask the candidate to draw up the use case diagram for the system to show the functional requirements
<b>Designing Skills</b>	Given a problem first ask the candidates to create the storyboard in paper or on mockups. This must be supported with an activity diagram that shows the system activities draw up on a swimlanes. Then ask the candidate to write down 5 things that they need to test in the design, like number of digits in phone number, types of genders....etc and make up a manual test case for each function.
<b>Development Skills</b>	Given a requirements and design for the software system, the candidate needs to develop a solution to the problem using JAVA and MySQL or using C#.net and SQL server or any DBMS of their choice. Make sure that the candidate develops the application within a given time frame (such as 14 days), in industry we use the term as a Sprint. The evaluation can be done on how well he/she has developed the system, within the time frame and marks could be reduced if the expected deadline has been exceeded.
<b>Software Quality Assurance Skills</b>	Once the software is developed, it could be exchanged among students and ask the other student to check the errors of someone else, initially it must be done manually by entering test data and testing if the functions are working as expected, this is a functionality test. Marks could be allocated for students for finding the maximum number of errors in another person's software. The candidates then can use the automated tool(s) and test the mistakes of the programs and will prepare a test report as the output of the stage. These test reports are then given to the rightful owner and the program will be corrected by the author of the program/software. Marks could be allocated to the students based on how quickly they would correct the errors and then the program can be sent once again to the other student for retesting.
<b>Software Deployment skills</b>	Once the system has been tested ask the candidate to deploy the system as a beta version and perform a UAT (user acceptance testing), this can be done by a group of other students/ external parties who needs to use the system for about two days and provide a feedback of the system. Even the institute lecturers can do this activity for the students. Once the system is working as expected perform the actual implementation and ask the candidate to explain to the users how they need to use the system
<b>Software Maintenance Skills</b>	Ask the candidates to make a CR(change request), which is a document that will allow another student to ask for changes to be made in the system, this can be done by the lecturer and the candidate is given a time limit to complete the change request made. Marks can be allocated on how realistic the change request are and to the other student how soon they can accomplish that changes requested with maximum accuracy
<b>Software Project Management Skills:</b>	We need to make the candidate think like a project manager, therefore ask them to make a to-do list of a given project, give an assignment to produce a project work breakdown structure using a software tool, which has been

	done in class, give marks for the diagram completion and coverage of the most number of activities and sub tasks related to the project, ask the candidate to convert the WBS into a Gantt chart by making estimates of how long the tasks needs to be done, this activity can even be done at the start and then the lecturer can assign the same project back to the candidate asking them to complete the project according to the timelines given by the same candidate.
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### Required Skill set

Competencies	Skills needed
<b>Solution conceptualizing skills</b>	problem solving skills, problem conceptualizing skills, creative skills, communication skills, logical thinking
<b>Requirements gathering and Analysis Skills</b>	Software tools skills, diagramming skills, communication skills, analytical skills, technology skills, human relations skills
<b>Designing Skills</b>	Diagrammatic skills, creative skills, aesthetic skills, technological skills, software tool skills
<b>Development Skills</b>	Logical thinking skills, technical skills this includes programing skills and database skills, creativity skills
<b>Software Quality Assurance Skills</b>	Analytical skills, logical thinking, reasoning skills, technical skills in using automated tools
<b>Software Deployment skills</b>	Communicational skills, technical skills, time management skills, presentation skills
<b>Software Maintenance Skills</b>	Futuristic, analytical skills, communication skills, reasoning and problem solving skills
<b>Software Project Management Skills:</b>	Project planning skills, allocation skills, risk assessment skills, organizing skills

**Program:** Associate Software Developers

**Module 02:** Web Application Developer

**Duration:** 480 hours

**Competencies and duration breakdown:**

### Competencies to be covered

Competencies	Duration
<b>Solution conceptualizing skills:</b> Candidate needs to perform a market analysis to determine why the company wants to develop a web solution, Identify how other web applications look and how it works, determine the target market based on geography and demography, draw up a big picture of the ideation	30
<b>Requirements gathering and Analysis Skills:</b> The candidates must prepare user stories and get user sign off, further detail the user requirements. Identify the user's mental model and document the workflow of the web application, identify functional and non-functional requirements to be implemented. Use an agile process for development, further create screen mockups to provide the basic understanding of the system	42
<b>Designing Skills:</b> the candidate needs to create low fidelity and high fidelity prototypes, design and edit images on the web page, use well established principles for web application designing, draw the system level architecture for the web application to be developed	78
<b>Development Skills:</b> this section will be the longest and will be divided into three main sections, namely: <b>(1) Web Page Development:</b> Build a basic web page adding styles and further add client side scripting into the web page, Introduce client side scripting and scripting libraries and further modern web front-end frameworks. <b>(2)Web Site Development:</b> convert the web page into a static web site, which provides information to visitors and further with a unified design across the whole of the site. E.g.: a cloths shop, which will showcase the cloths that they are selling(not online shopping) <b>(3)Web Application Development:</b> a dynamic web application, which will allow the a visitor to perform an online transaction, such as the same cloths shop with online shopping	240
<b>Software Quality Assurance Skills:</b> The candidate needs to test the simple web page, web site and web application	48
<b>Software Deployment skills:</b> the candidate should be able to acquire a server from a web hosting company, who offers free hosting ( <a href="https://www.000webhost.com/">https://www.000webhost.com/</a> ) there after create the server environment to transfer the files to deploy the web page/ site/ application	42
<b>Total number of hours</b>	<b>480</b>

### Typical work related situations

**Solution conceptualizing skills:** let's assume the client organization has encountered a problem with the corporate sales and wants to improve the sales of the shop. They have consulted you to provide a suitable solution. As the first step the candidate needs to visit the shop/ company to find what they really need and thereafter search on the internet similar web sites to obtain an idea. It is also required to identify the target users who will generally use the web site, this can be done using observation.

**Requirements gathering and Analysis Skills:** The candidates needs to first talk to the shop/ company owner or any person that the company has designated in order to get the first impression of why the system needs to be developed in detail. Further the candidate needs to talk to a few staff members to identify how the customers in general do transactions with the shop. Talking to customers or giving them a small questionnaire will be ideal to gather their viewpoint with regard to how buying cloths online would be different. A few prototypes can be sketched to demonstrate the candidates understanding to the client. To gather the non-functional requirements the candidate needs to clearly identify the usability of the system, interoperability with other devices if required, responsiveness...etc

**Designing Skills:** the candidate after gathering the requirements of the system now needs to commence the system interface design and get the users feedback. It is best to draw up a workflow of the entire system and obtain user clarification to proceed. Include the database design by linking the interfaces with the system structures

**Development Skills:** candidate must commence the development of a web page, ideally the home page. Ensure that there is regular feedback from the users. The client now wants the web site to be done and therefore the candidate needs to complete the development of the web site with at least 5 pages, this will be informative. Once the client is happy with the web site he/she needs to further it to a web application, ideally with online shopping and even online payment. So now the client's customer need not come to the shop, but can buy online and get the item delivered to their door step.

**Software Quality Assurance skills:** the web application is completed, but before going live the client wants the application to have no errors and therefore ask you to ensure the correctness. This can be done using a manual testing by the candidate and then by a potential audience. Automated testing should also be done to ensure correctness.

**Software Deployment skills:** now the software is made and these is no more errors to be seen,. The customer company wants the system to go live as soon as possible, your duty is to ensure a smooth transition of the software from the development environment to the client environment and further need to provide a guidance to the immediate staff who will be using the system. Since the system is a web application we need to host the system in a sever and do a trail run prior to confirmation of use to the real users

Competencies	Knowledge Areas
<b>Solution conceptualizing skills</b>	Use SWOT (Strength weakness opportunities and Threats) analysis for the company to determine the need of making the system web based, draw a comparison matrix to identify what others offer versus what we have at present. The students should be able to draw a conceptual diagram to demonstrate the key features of the system
<b>Requirements gathering and Analysis Skills</b>	Use fact finding techniques such as interviews, observations, questionnaires and prepare a requirements document. Draw use case diagram or Data flow diagram (DFD) to depict the requirements and give a requirements prototype using a paper prototype, constructing a storyboard will also be needed to identify the flow of the events. Further use SCRUM, which is a agile method to further proceed with the design and the development.
<b>Designing Skills</b>	to create the low and high fidelity prototypes use Balsamiq mockup forms, use photoshop or similar software tool for designing and editing images on page, learn how to apply SOLID principles of web, use MVC architecture for the architectural design
<b>Development Skills</b>	<b>Web Page Development</b> - HTML, CSS, JavaScript. <b>Web Site Development</b> - Joomla, using Php, MySQL and Apache and/or further develop the same using windows environment such as expression web or even Adobe Dreamweaver <b>Web Application Development</b> – Php frameworks such as CodeIgnitor, HTML5, CSS3 and/or using visual studios' ASP.net and SQL Server
<b>Software Quality Assurance Skills</b>	use the web browsers development and debugging tools to test the web page, perform a manual test for the web site developed using Joomla and use selenium to test the web application, further use visual studio environment to carry out the testing for windows based application development
<b>Software Deployment skills</b>	use FTP or SSH to transfer the files to the server, Deploy the web site done using WordPress via Cpanel

### Potential useful Teaching Methods

Competencies	Method of Assessment
<b>Solution conceptualizing skills</b>	Give a real world problem, like the cloths shop and ask the candidates to draw up a way to solve this problem using a software solution. Take real world examples of software systems they have seen, like <a href="http://www.ebay.com">www.ebay.com</a> or <a href="http://www.nike.com">www.nike.com</a> and ask the candidate to draw up an ideation for the cloths shop to create a web page, then a website and a web application. Ask them what would happen if these listed companies did not have a website and a web application, ask the candidate to list the benefits companies like Nike and ebay will have because of a web based solution
<b>Requirements gathering and Analysis Skills</b>	Once the concept has been draw, give the students a real situation and ask them to solve it. They need to identify from whom details need to be gathered, what must be gathered, when you should gather them and how (what techniques needs) to be used such as interviewing the cloths shop owner, like giving a questionnaire to the customers who visit the cloths shop. After gathering the requirements the students need to fill the requirements

	<p>specification format paper. Further the candidate needs to finalize the gathered requirements with the customer and prioritize the requirements implementation. Further ask the candidate to draw up the use case diagram for the system to show the functional requirements. Ask the candidate to analyze current web based applications and be upto date with what functions and features that can be used when we are developing a web application</p>
<b>Designing Skills</b>	<p>Given the set of requirements ask the candidate to create the mockups using balsamic mockups and further give an assignment for the candidate to edit images using image editing software's such as photoshop/illustrator/coraldraw. Ask the candidate to explain web designing principles and further usability principles and ask them to justify the usage of these principles in a design and a development of a web based application.</p>
<b>Development Skills</b>	<p><b>Web Page Development</b> – as an assignment give the student to make 3 web pages for three different companies and see how well they use the colors, font and usability principles they have adapted during the study process. Pages for a cakes shop, cloths shop and a vehicle service station.</p> <p><b>Web Site Development</b> – ask the students to search for wordpress or joomla templates from the web for the three designed webpages and convert them to websites, which are fully functional. Further the student can decide if they want to use windows or adobe environments to further develop the websites</p> <p><b>Web Application Development</b> – the candidate can take one of the websites and convert it to a fully developed web application using codeignitor or even visual studio, which needs to have the CRUD functions of a general development fully implemented and further in addition function such as online payment module, would also be needed for a general development</p>
<b>Software Quality Assurance Skills</b>	<p>Once the web software is developed, it could be exchanged among students and ask the other student to check the errors of someone else, initially it must be done manually by entering test data and testing if the functions are working as expected, this is a functionality test. Marks could be allocated for students for finding the maximum number of errors in another person's software. The candidates then can use the automated tool(s) such as selenium and test the mistakes of the programs and will prepare a test report as the output of the stage. These test reports are then given to the rightful owner and the program will be corrected by the author of the program/software. Marks could be allocated to the students based on how quickly they would correct the errors and then the program can be sent once again to the other student for retesting. Quality is not only if the features are right, but also ensuring that the web application is made to be used by the intended users.</p>
<b>Software Deployment skills</b>	<p>Give the student to configure the Apache, MySQL and Php and deploy the developed system in a PHP framework like codeignitor. If the web application is developed using ASP.net and SQL server then deploy the application using visual studio</p>

## Required Skill set

<b>Competencies</b>	<b>Skills needed</b>
<b>Solution conceptualizing skills</b>	problem solving skills, problem conceptualizing skills, creative skills, communication skills, logical thinking, analytical skills
<b>Requirements gathering and Analysis Skills</b>	Software tools skills, diagramming skills, communication skills, analytical skills, technology skills, human relations skills, creative skills, team skills for a brainstorming sessions, documentation skills, realism
<b>Designing Skills</b>	Diagrammatic skills, creative skills, aesthetic skills, technological skills, software tool skills, documentation skills
<b>Development Skills</b>	Logical thinking skills, technical skills this includes programing skills and database skills and skills of using frameworks, creativity skills
<b>Software Quality Assurance Skills</b>	Analytical skills, logical thinking, reasoning skills, technical skills in using automated tools
<b>Software Deployment skills</b>	Communicational skills, technical skills, time management skills, presentation skills

**Program:** Associate Software Developers

**Module 03:** Mobile Application Developer

**Duration:** 240 hours

**Competencies and duration breakdown:**

**Competencies to be covered**

<b>Competencies</b>	<b>Duration</b>
<b>Solution conceptualizing skills:</b> The candidate needs to perform a market analysis to determine why the company wants to develop a mobile solution, Identify how other mobile applications look and how it works, determine the target market based on geography and demography, perform an App monetization policy, App monetizing means how we can earn money from the App that we develop.	<b>15</b>
<b>Requirements gathering and Analysis Skills:</b> the candidate needs to pick the features, which needs to go into the Mobile App, identify the UI and UX requirements from users by considering the users mental model, document the workflow of the App features, identify the non-functional requirements, identify what types of App is best suited for the requirements(Native App, Hybrid App or Responsive Web Site), Native Mobile App's are also called single platform App's and only run on one platform for which it was developed, while the hybrid mobile App can be execute in multiple platforms. Responsive web sites are web applications, which are responsive	<b>24</b>
<b>Designing Skills:</b> all candidates must conceptualize the main features and create a low fi prototype(a low fi is a prototype, which has minimum features and will be thrown away after detailed requirements are captured), further enhance it to a hi-fi prototype(these are prototypes that resemble the real system and can be further improved to become the final system with a few fixes), create the navigation map, decide the colors which needs to go into the design, design interactions of visual design, create a system level architecture.	<b>36</b>
<b>Development Skills:</b> Develop simple Native Mobile App, enhance the mobile app development by adding social media connectivity and further connection to databases	<b>102</b>
<b>Software Quality Assurance Skills:</b> The candidate must test the mobile hardware, mobile software, testing mobile Applications on different mobile devices, performing mobile App testing such as usability, performance, security	<b>42</b>
<b>Software Deployment skills:</b> follow the App submission process, build an App archive, deploy the Mobile App.	<b>21</b>
<b>Total number of hours</b>	<b>240</b>

### Typical work related situations

**Solution conceptualizing skills:** let's think of a cab service company. They would want more people hiring cabs from them. They have seen the potential pickme has just due to the mobile app they have developed. The candidate needs to then analyze how pickme works and can further analyze how uber cab service works using the mobile app they have developed. The candidate needs to find out how revenue can be generated using the mobile app he/she intends to develop.

**Requirements gathering and Analysis Skills:** the candidate now has to talk to the cab service owner and find out the basic requirements, such as what color and font is best suitable for the mobile app, company logo and how the app needs to really work. The research on pickme and uber will be really helpful at this point. The candidate also needs to speak with customers of the cab service who might regularly travel with them and find out more requirements as to why they travel with this cab service and what is special about their service and further what needs to be included if the service is to be made better. We would also need to do an analysis on what mobile devices the customers would access in order to determine if we are to develop a Native Mobile App or Hybrid Mobile app or even a responsive website. Also the candidate will have to look into external requirements such as signal receiving for mobile devices, roads maps available and how updated they are.

**Designing Skills:** lets assume that all the requirements has been captured and now we need to proceed to the design of the mobile app. Before finalizing the design and proceeding to development the candidate needs to draw up a series of screens that would tell the whole story from the time a customer would search for a cab until the end of the journey and even till a journey feedback, like what pickme has. Further make the prototypes more dynamic so that the users can give a more productive feedback. Draw up a full system diagram that will show how the mobile app intends to work and get approval before the work starts.

**Development Skills:** the candidate now needs to make the mobile app as according to the agreed set of requirements and the agreed design of the system. The development process needs to be carefully done since the mobile app may be even used by people with less IT literacy.

**Software Quality Assurance skills:** now the mobile app has been developed, but the owner of the cab service is still reluctant to publish the app and wants you to do a thorough testing to ensure its accuracy and completeness. If we have developed a Native mobile app, we would need to run the App in different screen sizes to determine how well it would work and what color output is generated. We need to check on the font face and size and also the design of the mobile app and most importantly the usability of the system. The mobile app is tested by you now we need the staff and the owner of the cab service test the app and after which everything is confirmed we need to publish the mobile app in a temporary server for a few potential set of customers to use.

**Software Deployment skills:** the mobile app is made and there are no errors the app was able to fulfill all the set of requirements and has passed the UAT. The owner wants the app to be used by the actual customers of the company and now has asked you to make the app accessible to all public users

## Knowledge Areas to achieve the competencies

Competencies	Knowledge Areas
<b>Solution conceptualizing skills</b>	perform a SWOT analysis and determine the best mobile App to develop, perform a feasibility study using TOSEL(technical, operational, schedule, economical and legal) to arrive at the App monetization policy and also on the practical usage of the mobile app.
<b>Requirements gathering and Analysis Skills</b>	using web search to compare similar systems to obtain features, use prototyping to know the look and feel of the UI and UX, prepare the workflow through Mobile Mock up software's such as Balsamiq and use interviews, questionnaires and other fact finding techniques to gather functional and non-functional requirements
<b>Designing Skills</b>	Conceptualize the main features and create a low fi prototype using paper prototypes, further enhance it to a hi-fi prototype using software's such as Balsamic mockups, create the navigation map, decide the colors which needs to go into the design using psychology of colors, design interactions of visual design using Mobile App user interface design principles (refer <a href="http://www.creativebloq.com/mobile/10-principles-mobile-interface-design-4122910">http://www.creativebloq.com/mobile/10-principles-mobile-interface-design-4122910</a> and many other links related to developing a creative mobile app), create a system level architecture using MVC Architecture.
<b>Development Skills</b>	use JAVA to develop a simple native mobile app, Use JavaScript/jQuery ,HTML5 and CSS3 to further the mobile App development, use a mobile App development framework such as Cordova, Xamarim, integrating social media connectivity and sign-ins to the mobile App using Google API console, creating, connecting and manipulating the mobile App with the database
<b>Software Quality Assurance Skills</b>	testing the mobile hardware, mobile software, testing mobile Applications on different mobile devices such as TestObject, APPIUM, performing mobile App testing such as usability, performance, security using mobile emulators to test the mobile App
<b>Software Deployment skills</b>	follow the App submission process in App store and Google's Play store, build an App archive, deploy the Mobile App on Google's play store or App Store

## Potential useful Teaching Methods

Competencies	Method of Assessment
<b>Solution conceptualizing skills</b>	Lets think of the cab service example and ask the candidates list down 10 features that is special in a similar system like pickme or uber and further compare the mobile app's of both and suggest the best set of functions for the new cab service to have for their customers. Allow the students to obtain knowledge from different areas of domain such as social media apps, apps made for weather forecasting and have an understanding on how mobile apps need to look like. Give an assignment to the students and ask them identify five ways to earn money from the mobile app they have developed
<b>Requirements gathering and Analysis Skills</b>	Allow the candidates to experience the UI/ UX of different mobile apps and ask them to determine the best look for the mobile app they are about to develop. Allow the candidates to go online and search for mobile app UI principles and further acquire more knowledge with regard. After giving the candidates a clear practical knowledge of the difference between the Native Mobile App, Hybrid Mobile App and responsive web sites, ask them to come up with opinions of how these would best look like and the features they need to have
<b>Designing Skills</b>	Ask the candidates to make a storyboard of the mobile app first using paper and pencil and thereafter using software's such as Balsamic and further ask them to explain why such a design was used. Advise them to create UI with minimalistic features. Make it as a small competition and select the best UI for the cab service mobile App
<b>Development Skills</b>	Ask the candidate to convert the design they have picked and complete the mobile App development within a certain time frame. It would be ideal to have the competition continued and recognize the students who has really done really well. We could invite the ICT industry to further experience the talents of those students
<b>Software Quality Assurance Skills</b>	Once the web software is developed, it could be exchanged among students and ask the other student to check the errors of someone else, initially it must be done manually by entering test data and testing if the functions are working as expected, this is a functionality test. Marks could be allocated for students for finding the maximum number of errors in another person's software. The candidates then can use the automated tool(s) such as TestObject or any similar testing tool and test the mistakes of the programs and will prepare a test report as the output of the stage. These test reports are then given to the rightful owner and the program will be corrected by the author of the program/software. Marks could be allocated to the students based on how quickly they would correct the errors and then the program can be sent once again to the other student for retesting. Quality is not only if the features are right, but also ensuring that the web application is made to be used by the intended users.
<b>Software Deployment skills</b>	Ask the candidates to create an account and submit the app online and the lecturer or instructor can download the app and see the usability of the app. It is always important to make the work practical and enjoyable

## Required Skill set

<b>Competencies</b>	<b>Skills needed</b>
<b>Solution conceptualizing skills</b>	problem solving skills, problem conceptualizing skills, creative skills, communication skills, logical thinking, analytical skills
<b>Requirements gathering and Analysis Skills</b>	Software tools skills, diagramming skills, communication skills, analytical skills, technology skills, human relations skills to understand the users different mental models, creative skills, team skills for a brainstorming sessions, documentation skills, realism
<b>Designing Skills</b>	Diagrammatic skills, creative skills, aesthetic skills, technological skills, software tool skills, documentation skills
<b>Development Skills</b>	Logical thinking skills, technical skills this includes programing skills and database skills and skills of using frameworks, creativity skills, team working skills if the center wants to have a competition among the students
<b>Software Quality Assurance Skills</b>	Analytical skills, logical thinking, reasoning skills, technical skills in using automated tools
<b>Software Deployment skills</b>	Communicational skills, technical skills, time management skills, presentation skills