GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-V

Course Title: Mobile Application Development
(Course Code: 4353203)

Diploma programmer in which this course is offered	Semester in which offered
Information & Communication Technology	5th

1. RATIONALE

This course is indispensable in today's mobile app development landscape as it empowers students with the knowledge and hands-on skills to craft innovative and user-friendly Android applications using MIT App Inventor. Serving as a gateway to mobile app development, the course not only delves into the intricacies of building Android apps but also introduces students to fundamental principles of app design and usability. MIT App Inventor provides a user-friendly, visual programming environment, making it accessible for beginners while offering robust capabilities for creating feature-rich applications. The inclusion of MIT App Inventor in the curriculum caters to the growing demand for skilled Android app developers and individual's adept at translating creative ideas into functional and visually appealing mobile experiences. Moreover, the course places emphasis on collaborative development practices by introducing students to version control and teamwork, fostering skills essential for success in the dynamic field of mobile app development.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Develop interactive and user-friendly Android applications with proficiency in utilizing MIT App Inventor's visual programming environment.

3. COURSE OUTCOMES (COs)

(a) Design basic applications as sets of event handlers, synthesizing effective responses to user-initiated, timer, and external events.

(b) Use component properties, variables, control blocks and logic blocks in app designing.

(c) Design animations with Timer Events and plot various types of charts such as Line charts, Pie charts, and Column charts.

(d) Develop android app by using list, dictionaries and procedures concepts.

(e) Develop android app using location, Bluetooth, Map and web component.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	4	2	0	0	25	25	50

(*):Out of 50 marks under the theory CA, 20 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 30 marks is given based on performance in laboratory during the semester for assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.

5. SUGGESTED PRACTICAL EXERCISES:

The following practical outcomes (PrOs) that are the sub-components of the COs. Some of the PrOs marked '' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

Sr.No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Create a basic app with a button and a label using the Component Designer and implement functionality to display a message on label when the button is clicked.	I	2
2	Define a set of components for a drawing app, including buttons for different colors and shapes. Implement behavior to draw on the screen based on user interactions.	I	2
3	Implement an app where shaking the device triggers an event. Use this event to change the background color of the app.	I	2
4	Create "Hello World" application to "Hello World" in the middle of the screen in the red color with white background.	I	2
5	Create an app with a moving object (e.g., a sprite) that changes its position every second using Timer events. Experiment with different speeds and directions.	II	2
6	Create an app where a pet animal(e.g., a sprite) that moves with sound effect.	II	2
7	Build a translator app where user can enter text in textbox and clicking button gets translated output. Use List picker to select source and target language.	II	2
8	Develop an app to calculate area of Square, rectangle and triangle.	II	2
9	Create an app to display multiplication table of entered number in textbox.	II	2
10	Create a basic calculator app that display result of arithmetic operations like addition, subtraction, multiplication, division and square root as well as power of the given number.	II	2
11	Create bouncing ball app where ball bounce back if edge is detected.	III	2
12	Change the color of the ball based on how fast it is moving in Bouncing ball App.	III	2

13	Create an app to plot bar, line and pie charts.	III	4
14	Create an app to plot graph from given .csv file.	III	2
15	Create a to-do list app with a dynamic list. Allow users to add, remove, and mark tasks as completed.	IV	2
16	Create Resistor color coding app which output resistance in ohm according to selected color bands.	IV	2
18	Implement a procedure for a common action in your app, such as displaying a message. Call this procedure from different parts of your app. Modify the procedure to accept parameters, such as the message to be displayed. Demonstrate use of parameterized Procedures.	IV	4
19	Create an application a) To call a phone number entered by the user. b) To send a text message to phone number entered by user.	V	4
20	Create an app to transfer message using Bluetooth between two mobile phones.	V	2
21	Develop an app to control LED connected with NodeMCU using Bluetooth.	V	2
22	Create an app that uses the Web component to send and Receive data from any IoT cloud server.	V	2
23	Develop an app to monitor the Temperature using NodeMCU and temperature sensor.	V	4
	Total		**56**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Sr.No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system with internet connectivity: Windows 10 or higher Version with 4GB or higher RAM	All

7. AFFECTIVE DOMAIN OUTCOMES

The following sample Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a. Work as a leader/a team member (while doing a micro-project).
b. Follow safety practices.
c. Maintain tools and equipments.
d. Adhere to ethical practices.

8. UNDERPINNING THEORY:

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit-1 **Introduction to MIT App inventor and an App's Architecture**	1.a Use the App Inventor Environment by designing and configuring components in the Component Designer. 1.b Understand app architecture, distinguishing between various components and their corresponding behaviors. 1.c Demonstrate implementation of event handlers for different event types.	1.1 The App Inventor Environment: Component designer, Blocks editor 1.2 App Architecture: Components, Behavior 1.3 An App as a set of event handlers 1.4 Event types: User initiated events, Timer events, Animation events, external events 1.5 Event Handlers response: Repeat block, interact with web, remember things, ask questions
Unit-II Properties, Variables and Decision making	2.a Change the properties of components in the App Inventor environment. 2.b Defining variables, demonstrating the process of setting and getting variables, and distinguishing between local and global variables. 2.c Construct expressions by setting variables to expressions, as well as building complex expressions. 2.d Evaluate conditions using if and elseif blocks, implement programming logic within nested conditions	2.1 Properties of component 2.2 Defining variables, Setting and getting variables, local and global variables 2.3 Setting and Displaying variable using an expression, Building complex expressions 2.4 Testing Conditions with control blocks 2.5 Programming Conditions Within Conditions 2.6 Programming Complex conditions
Unit–III Creating animated apps and charts	3.a Use the Canvas Components for precise positioning of objects. 3.b Control movement of object on canvas 3.c Plot bar, column and line chart	3.1 Adding a Canvas Component to Your App 3.2 The Canvas Coordinate System 3.3 Animating Objects with Timer Events 3.4 Creating Movement: Speed, collision detection, EdgeReached, CollidingWith,

		NoLongerCollidingWith 3.5 Plot charts: Line chart, Pie chart, Column chart
Unit-IV Lists, Dictionaries, Procedures and Reusing Blocks	4.a Create and manipulate list 4.b. Use dynamic list by adding and removing element from lists 4.c Use dictionaries and differentiate their use from regular lists. 4.d Create procedure and call it	4.1 Creating a List Variable 4.2 Selecting an Item in a List, Using an Index to Traverse a List 4.3 Defining a Dynamic List, Adding an Item, displaying a List, Removing an Item from a List 4.4 Dictionaries 4.5 Defining a Procedure, Calling a Procedure 4.6 Adding Parameters to Your Procedure, Returning Values from a Procedure 4.7 Reusing Blocks Among Apps
Unit-V Communicating with the Sensors and Web	5.a Apply location sensing techniques to create a mobile app that responds to changes in the user's location. 5.b Use accelerometer, Bluetooth and web components in app	8.1 Sensing Location and displaying it with App Inventor 8.2 Using the Accelerometer 8.3 Using Bluetooth 8.4 The Web Component

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN:

Unit No.	**Unit Title**	**Teaching/ Practical Hours**	**Distribution of Theory Marks**			
			R Level	**U Level**	**A Level**	**Total Marks**
I	Introduction to MIT App inventor and an App's Architecture	10	**---Not Applicable---**			
II	Properties, Variables and Decision making	12				
III	Creating animated apps and charts	10				
IV	Lists, Dictionaries, Procedures and Reusing Blocks	10				
V	Communicating with the Sensors and Web	14				
	Total	**56**				

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student- related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Explore App Inventor Extensions:

b) Develop a Collaborative Mobile App

c) Contribute to the App Inventor Community:

d) Undertake course "Developing Android Apps with App Inventor" available on courser platform. (https://www.coursera.org/learn/app-inventor-android)

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (MOOCs) may be used to teach various topics/sub topics.

b) Guide student(s) in undertaking micro-projects.

c) Managing Learning Environment

d) Encourage students to do Group learning by sharing so that teaching can easily be enhanced.

e) About 20% of the topics/sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-learning, but to be assessed using different assessment methods.

f) With respect to section No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.

g) Guide students on how to address issues on environment and sustainability using the knowledge of this course

h) Arrange expert lectures by experts working professionally in the area of Android app development.

i) More focus should be given on practical work which will be carried out in laboratory sessions. If possible some theory sessions may be conducted in labs so that theory and practice can go hand in hand.

j) Faculty should allow students to use their creativity and let them struggle to learn on their own during practical sessions. However, faculty should remain around the students and should help them when they are stuck.

k) Arrange a webpage development competition by making groups of four students each and award the winning group. Give publicity to this competition at institute/city level.

12. SUGGESTED PROJECT LIST

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based (group of 3 to 5). However, in the fifth and sixth semesters, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs

which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total work load on each student due to the micro-project should be about 16 (sixteen) student engagement hours (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

(a) Create a flashcard quiz app that allows users to create decks of flashcards for studying. Include features like multiple-choice questions, scoring, and the ability to track progress over time.

(b) Create an app that connects to a weather station using IoT devices. Users can view real- time weather data, including temperature, humidity, and atmospheric pressure. The IoT component could involve sensors connected to a microcontroller.

(c) Design a fitness tracker app that allows users to input and track their daily exercise routines. Include features like setting fitness goals, tracking calories burned, and providing visual representations of progress.

(d) Develop an app that allows users to control smart home devices such as lights, fans, and thermostats. Integrate the app with IoT platforms like Arduino or Raspberry Pi to demonstrate remote control and automation of home appliances.

(e) Build an app that allows users to set location-based reminders. Users should be able to input a location and a reminder message, and the app should notify them when they are near the specified location.

(f) Build an app for monitoring and managing indoor plants. Use IoT devices to measure soil moisture, light levels, and temperature. The app can provide users with notifications when it's time to water the plants or adjust environmental conditions.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	App Inventor 2: Create your own android apps	David Wolber, Hal Abelson, Allen Spertus, Liz Looney	O'Reilly, 2015, 9781491906842
2	Learn to Program with App Inventor	Lyra Blizzard Logan	No Starch Press, 2020, 978-1-59327-968-4
3	Building a mobile app: design and program your own app	Sarah Guthals	John Wiley & Sons, Inc., 2017, 978-1-119-37642-2
4	MIT App Inventor Projects 50+ Android and iOS Apps with Rasberry Pi, ESP32 and Arduino	Dogan Ibrahim	Elektor Publication, 2020, 978-1-907920-89-9
5	App Inventor 2 Essentials	Felicia Kamriani, Krishnendu Roy	Packt Publishing, 2016, 978-1-78528-110-5

14. SOFTWARE/LEARNING WEBSITES

1. https://appinventor.mit.edu/
2. https://www.youtube.com/user/MITAppInventor
3. https://appinventor.mit.edu/explore/ai2/tutorials

15. PO-COMPETENCY-CO MAPPING:

Semester V	**Android App Development(Course Code:4361104)**						
	POs						
Competency & Course Outcomes	**PO1 Basic & Discipline specific knowledge**	**PO2 Problem Analysis**	**PO 3 Design / development of solutions**	**PO4 Engineering Tools, Experimentation &Testing**	**PO5 Engineering practices for society, sustainability & environment**	**PO6 Project Management**	**PO 7 Life-long learning**
Competency	**Develop interactive and user-friendly Android applications with proficiency in utilizing MIT App Inventor's visual programming environment.**						
Course Outcomes CO1-Design applications as sets of event handlers, synthesizing effective responses to user-initiated, timer, and external events.	2	3	3	2	1	2	1
CO2-Use component properties, variables, control blocks and logic blocks in app designing.	3	2	3	2	1	1	1
CO3-Design animations with Timer Events and plot various types of charts such as Line charts, Pie charts, and Column charts.	2	2	3	3	2	1	1
CO4 - Develop android app by using list, dictionaries and procedures concepts.	2	2	3	2	1	2	1
CO5- Develop android app using location, Bluetooth, Map and web component.	2	2	3	3	3	2	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Contact No.	Email
1.	Mr. Mihir R. Panchal, Lecturer in EC	Government Polytechnic For Girls, Ahmedabad	9723340568	panchalmihir031@gmail.com