LJ University

University with a Difference

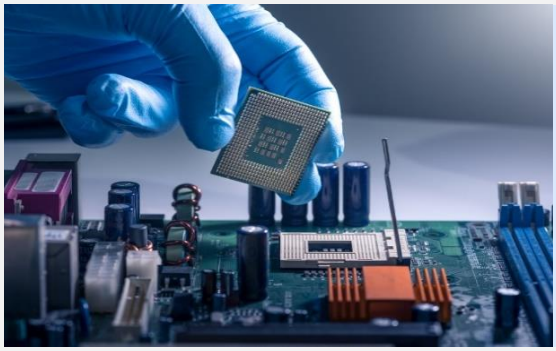
Diploma Engineering
Semester VI

CE, IT, AIML, Cloud Computing & Big Data, Gaming & Animation

HANDBOOK

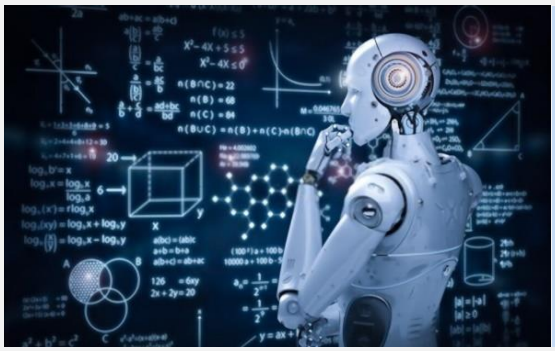
LJ Polytechnic

An Overview of Major Computer & Technology Disciplines



Computer Engineering is a branch of engineering that integrates several fields of computer science and electronic engineering required to develop computer hardware and software. Computer engineers design, test, implement and maintain computer software and hardware systems.

Information Technology (IT) is the use of computers to store or retrieve data and information. IT is typically used within the context of business operations as opposed to personal or entertainment technologies. You can find IT specialization in every branch of education, from IT & Software, Engineering, Aviation and Medicine to MBA and even Hospitality.



Artificial Intelligence (AI) is intelligence demonstrated by machines, as opposed to the natural intelligence displayed by humans or animals. AI applications include advanced web search engines, recommendation systems used by YouTube, Amazon and Netflix, Siri or Alexa, Tesla, and strategic game systems (such as chess and Go).

Cloud Computing & Big Data is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. Big data is a field that treats ways to analyze, systematically extract information from, or otherwise, deal with data sets that are too large or complex to be dealt with by traditional data-processing application software.

Gaming & Animation is the process of developing/designing a game. The effort is undertaken by a developer, ranging from a single person to an international team dispersed across the globe. Animation is a method in which figures are manipulated to appear as moving images. Various tools available in the market today, ease out the tasks of game development and animation.

Disclaimer

This handbook is compiled to provide subject information to the students. Every effort has been made to avoid errors & omissions and ensure accuracy. Any error noted may be brought to the notice of the compiler, which shall be taken care of in the updated edition of this handbook. The sources of information/material are provided in the appendix.

The information contained in this handbook is strictly for education and learning purposes and not for any commercial use.

Furthermore, The University reserves the right to unilaterally and without notice make changes to this handbook at any time.

Evaluation Methodology

Theory Marks

PA: Progressive Assessment

Units' examinations will be conducted during the semester. Each unit examination is compulsory. Unit examination may be taken from objectives, short questions, long questions, etc.

Unit-1 Exam:	Maximum Marks 10
Unit-2 Exam:	Maximum Marks 10
Unit-3 Exam:	Maximum Marks 10
Unit-4 Exam:	Maximum Marks 10
	Total Marks 40

ESE: End Semester Exam

End semester examination will be conducted from all Five (5) units and it is compulsory. It may be taken in the form of objectives, short questions, long questions etc.

End Semester Exam: Maximum Marks 50

CA: Continuous Assessment

Continuous assessment will be evaluated from the activity assigned in the semester and the attendance of that particular subject.

Activity Assessment / Attendance: Maximum Marks 10

Practical Marks

PV: Practical Viva

Practical viva will be conducted through group task. Thereafter viva will be conducted individually based on the given task of the concerned subject.

Practical Viva: Maximum Marks 30

TW: Term Work

Term work will be considered from the assignment and laboratory work done by the student during the semester of that particular subject.

Term Work: Maximum Marks 20

EVALUATION SCHEME

The performance of students is evaluated on the basis of continuous and semester-end examinations with letter grades O+++, O++, A++, B, etc. Which have numerical equivalents called grade points as indicated below:

Percentage		Grade Point	Grade	Class
95	100	10	O+++	First Class with Distinction
90	94	9.5	O++	
85	89	9	O+	
80	84	8.5	O	
75	79	8	A++	
70	74	7.5	A+	
65	69	7	A	First Class
60	64	6.5	B++	
55	59	6	B+	Higher Second Class
50	54	5.5	B	Second Class
45	49	5	C	
40	44	4.5	D	
35	39	4.0	E	Pass Class
less than 35		0	F	Fail

The performance of a student in a semester is indicated by a number called SPI (Semester Performance Index). The SPI is the weighted average of the grade points obtained in all the subjects taken by the student during the semester. Example: Suppose in a given semester a student has taken subjects having credits C1, C2, C3, C4, C5..... And the numerical equivalent of grades obtained in those subjects are G1, G2, G3, G4, and G5 respectively.

Then his/her $\text{SPI} = \frac{\text{Grade Points Earned}}{\text{Total Offered Credits}} = \frac{\sum_{i=1}^{n} Ci\ Gi}{\sum_{i=1}^{n} Ci}$

SPI will be calculated (after re-examination, if any) up to two decimal places on the basis of the final grades.

An overall assessment from the time the student entered the course is obtained by calculating PPI (Progressive Performance Index). The PPI is the weighted average of the grade points obtained in all the subjects taken by the student since he/she entered the course. It is calculated in the same manner as the SPI. The CGPA (Cumulative Grade Points Average) is the weighted average of the grade points obtained in all the subjects in the last six semesters of the course.

Detention:

Formula for conversion of equivalent percentage of PPI

An equation to find equivalence between PPI or CGPA may be obtained as follows:

Percentage Marks = (PPI or CGPA — 0.5) x 10. SPI or PPI or CGPA equivalent class shall be as follows:

Below 4.00 : Fail
4.00 – 4.49 : Pass Class
4.50 – 5.50 : Second Class
5.51 – 6.00 : Higher Second Class
6.01 – 7.49 : Firsrt Class
7.50 and above : First Class with Distinction

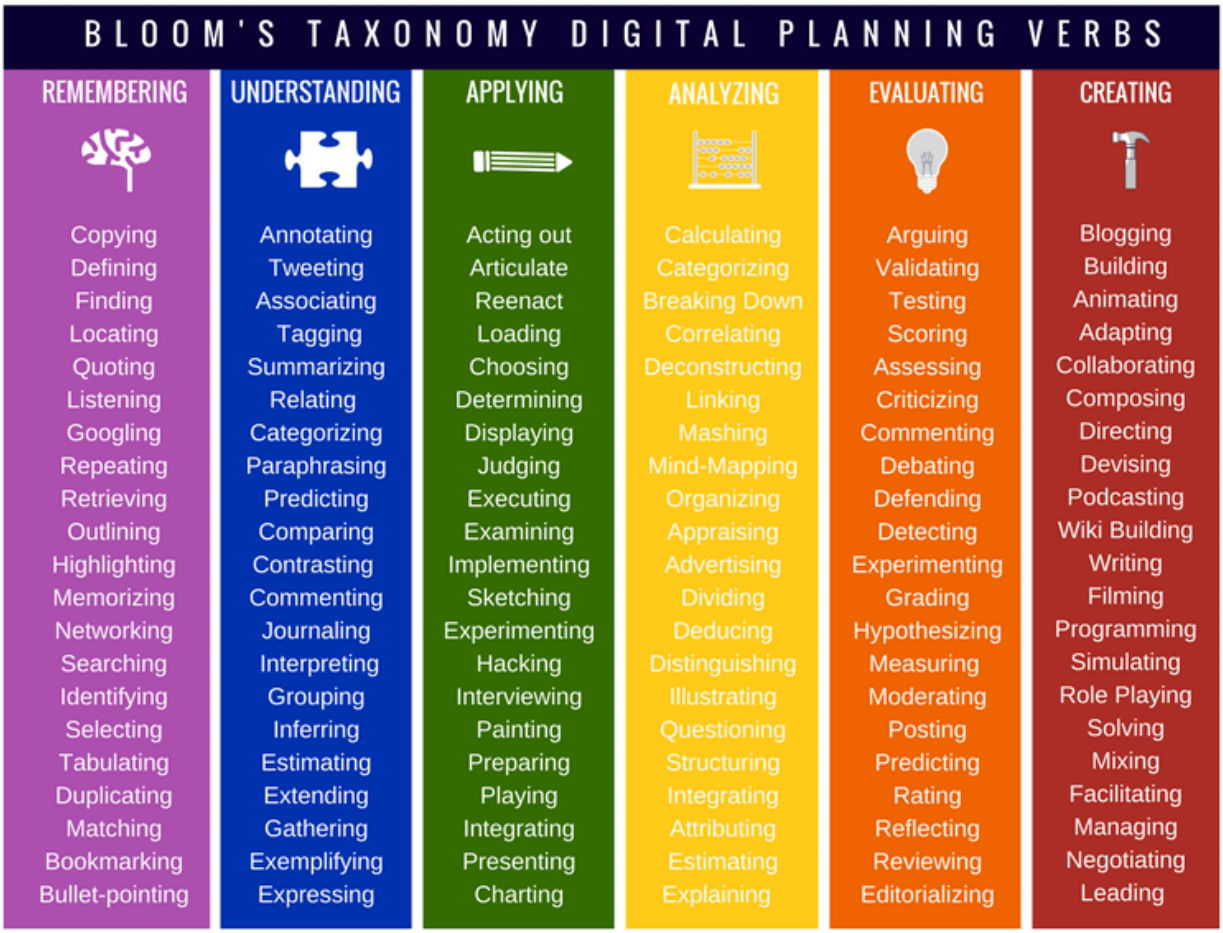
For all courses, where the duration of the course is more than 2 years, the degree shall be awarded to the students on the basis of CGPA of the last six semester's performance in the exams.

In case of the courses where duration is of two years, the degree shall be awarded to students based on PPI considering the performance in all four semesters.

About Bloom's Taxonomy

Bloom's Taxonomy is a classification of the different objectives and skills that educators set for their students (learning objectives). The taxonomy was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago. The terminology has been recently updated to include the following six levels of learning. These 6 levels can be used to structure the learning objectives, lessons, and assessments of your course.

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
2. **Understanding:** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
3. **Applying:** Carrying out or using a procedure for executing, or implementing.
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing.
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.



LJ University
University with a Difference

MOBILE COMPUTING AND APP DEVELOPMENT

LJ Polytechnic

Prepared and Compiled by
CE & IT Department

Course

Course Name	Mobile Computing and App Development					
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses
BSC: Basic Science Courses
ESC: Engineering Science Courses
PCC: Program Core Courses
OEC: Open Elective Courses
PEC: Program Elective Courses

Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**							
				Theory Marks				**Practical Marks**			**Total Marks**
L	**T**	**P**	**Total Credit**	**ESE**	**CA**	**PA**	**Total**	**PV**	**TW**	**Total**	
3	-	4	5	50	10	40	100	30	20	50	150

Legends: ESE: End Semester Exam
CA: Continuous Assessment (Attendance + Activity)
PA: Progressive Assessment
PV: Practical Viva
TW: Term Work

Contents

Unit No.	Topics	Sub-Topics	Learning Outcomes	% Weightage	Hours
1	**Overview of Mobile OS**	1.1. Introduction 1.2. Application development Framework 1.3. Application Components 1.4. The manifest file 1.5. Permission Model 1.6. Downloading and Installing SDK 1.7. Exploring the Development Environment 1.8. Developing and Executing the First Application	● To understand mobile applications architecture and components ● To understand how to download & install SDK ● To install application and execute	15	6
2	**Designing Applications**	2.1. Working with Activities 2.2. Redirecting to other Activity and Passing Data 2.3. Layouts 2.4. Navigation & Fragments 2.5. Themes 2.6. Notifications 2.7. Invoking Built-in Applications	● To understand activities ● To understand Activity life cycle ● To understand layouts ● To understand Navigation & Fragments ● To understand theming	20	9
3	**Working with Views**	3.1. Working with View Groups 3.2. Designing different types of Views 3.3. Implementing Screen Orientation 3.4. Designing the Views Programmatically	● To understand how to use View Groups ● To implement screen orientation	25	10

4	**Working with Graphics & Animation**	4.1. Working with Graphics 4.2. Using the Drawable Object 4.3. Using the Shape Drawable Object 4.4. Working with Animation 4.5. Using Media Player	• To understand working with graphics, animation	15	7
5	**Events & Database Connectivity**	5.1. Handling Events 5.2. Building Data with the Adapter View Class 5.3. Introducing the Data Storage Options 5.4. Using the Internal & External Storage 5.5. Using the SQLite Database 5.6. Working with Content Provider 5.7. Web Services and JSON Parsing 5.8. Connect Web Services	• To understand events • To understand database connectivity • To connect with Web Services	25	10
				Total Hours	**42**

Suggested Specification Table with Hours

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Overview of Mobile OS	6	40	30	20	-	5	5
2	Designing Applications	9	30	30	20	10	5	5
3	Working with Views	10	20	30	30	10	5	5
4	Working with Graphics & Animation	7	20	20	20	10	15	15
5	Events & Database Connectivity	10	20	20	30	10	10	10

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

Textbooks

1) Android Programming: The Big Nerd Ranch Guide, Bryan Sills, Brian Gardner, Kristin Marsicano, Chris Stewart Addison-Wesley Professional
2) Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin, Third Edition (Grayscale Indian Edition) Dawn Griffiths, David Griffths Shroff/O'Reilly

Reference Books

1) Android Application Development All-in-One For Dummies, Wiley, Barry Burd, (Latest Edition), John Paul Mueller
2) Hello, Android, ED Burnette (Latest Edition), Pragmetic Bookshelf,
3) Kotlin Programming, The Big Nerd Ranch Guide, Josh Skeen, David Greenhalgh, (Latest Edition), Pearson Education,

Open Sources (Website, Video, Movie)

1) https://developer.Android.com/
2) https://www.udemy.com/share/101TNy/
3) https://www.coursera.org/learn/kotlin-for-java-developers

Introduction

The use of mobile communications and mobile applications is increasing day by day. Therefore, it is essential for students to understand how mobile communications work and how to create mobile applications for the mobile device. This course covers the concepts needed to understand mobile communications and develop mobile applications. It is therefore a required course for computer engineers who wish to work in the field of mobile application development and mobile communications.

Objectives

- ✓ The theory should be taught and practiced in such a way that students are able to achieve different learning outcomes in the cognitive, psychomotor and affective domains to demonstrate the following learning outcomes.

- ✓ Understand how different mobile technologies work.
- ✓ Understand the lifecycle of an activity.
- ✓ Designing an Application and Perform operations on GUI objects.
- ✓ Perform event driven programming.
- ✓ Connect application with data source and manage the data.

Subject's Learning Outcomes

- ✓ This course is aimed to make students aware of Mobile computing and App Development.
- ✓ The course highlights the mobile applications architecture and components of android, SDK installation and execute
- ✓ The course further understanding of Navigation, Fragments, Layouts
- ✓ The course provides to understand working with graphics, animation, events
- ✓ The course provides to understand database connectivity and web Services




1 Overview of Mobile OS

Practical List

1. Create “Hello World” application that displays “Hello World” in the middle of the screen using Text View Widget in the red color.

Short Questions

Q. No.	Sample Questions	Bloom’s Taxonomy
1.	What is an Android and List Versions Name of it.	Understand
2.	What programming language is primarily used for Android app development?	Apply
3.	What is the official app distribution platform for Android?	Remember
4.	What is an Android emulator used for?	Apply
5.	What is the Android version naming convention based on?	Remember
6.	What is Manifest file?	Understand
7.	What does SDK stand for?	Remember
8.	What is the primary purpose of an SDK?	Understand

Long Questions

Q. No.	Sample Questions	Bloom’s Taxonomy
1.	Explain Architecture of android with a neat diagram.	Understand
2.	List and Explain various components of Android.	Remember
3.	Explain SDK with its components.	Apply
4.	What are the Advantages of Android?	Understand
5.	List features of android.	Remember
6.	What is OHA? Explain OHA in brief.	Understand

Essential Assignments

1. What are the Advantages and Disadvantages of Android.
2. Explain SDK with its components.
3. Explain Permission model in Android.
4. Explain Architecture of android with diagram.
5. Explain Features of android in details.
6. What are the benefits for creating mobile application in android?

Desirable Assignments

1. What are the main differences between the Dalvik Virtual Machine (DVM) and the Android Runtime (ART).
2. What is the Android Manifest file, and why is it a critical component of Android app development?
3. Explain the purpose of Gradle in Android app development. How does it simplify dependency management.
4. Explain the difference between normal permissions and dangerous permissions in Android.
5. Explain Android manifest.xml in eight points.

Activities

1. Demonstration of software development kit(SDK) and installation.

Learning Outcomes

- ❖ Knowledge about Basics and history of Android will be acquired.
- ❖ To understand how to download & installation of SDK will be gained.
- ❖ To install application and execute will be acquired.

2 Designing Applications

Practical List

1. Create application for demonstration of activity life cycle.
2. Create an application for demonstration of different Layouts.
3. Create an application that will get the text entered in Edit Text and display that text using Toast (Message).
4. Create an application for demonstration of explicitly starting new activity using Intent.

Short Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What is an Android Activity?	Understand
2.	What is the primary purpose of an Activity in Android?	Understand
3.	Name two common layout types in Android and describe their characteristics.	Remember
4.	What is the primary purpose of using layouts in Android app development?	Understand
5.	What is an Android layout?	Understand
6.	What is Android navigation, and why is it important in app development?	Understand
7.	What is an Android Fragment?	Understand
8.	How do fragments differ from activities in Android?	Apply
9.	What is the used of fragments in Android app development?	Understand
10.	What is the purpose of defining themes in the styles.xml file of an Android app?	Understand

Long Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	Explain Activity life cycle.	Understand
2.	What is Layouts and explain all layouts with details.	Understand
3.	What is Notifications in Android	Understand
4.	What is Intents? and explain its types	Understand
5.	Explain Fragments with details	Understand
6.	What is Toast? Write it's syntax.	Understand

Essential Assignments

1. Explain Activity life with diagram.
2. What is Layouts? explain all layouts with example.
3. Explain Navigation and its types with example.
4. How to create Notifications in Android explain in details.
5. Explain Toast with example.
6. Explain implicit and explicit intent with example.
7. What is Theme? Write it's syntax.
8. Explain Fragments with example.

Desirable Assignments

1. Discuss following callback methods with respect to activity: (i) onCreate() (ii) onStart() (iii) onResume() (iv) onStop() (v) onDestroy.
2. Describe the advantages and limitations of using nested fragments in Android app development.
3. Discuss the differences between Android styles and themes.
4. How can developers handle user interactions with notifications, such as responding to button clicks or opening specific app activities?
5. How can developers implement custom notification actions.
6. Explain the difference between explicit and implicit navigation in Android.

Activities

1. Create sample application with login module.(Check username and password),validate it for login screen and open new Activity on login success and display Toast message on login fail.
2. Create an application to accept two integer numbers via EditText and display larger number on another activity.

Learning Outcomes

- To understand activities and activity life cycle will be acquired.
- To understand layouts, Navigation & Fragments will be gained.
- To understand types of theming and how to apply will be acquired.

Working with Views

Practical List

1. Create a registration page to demonstrate basic widgets available.
2. Create sample application with login module. (check username and password). On successful login, change Text View "Login Successful" and on failing login, alert user using Toast "Login failed".
3. Create login application where you will have to validate username and password. Till the username and password is not validated, login button should remain disabled.
4. Create a login application as above. Validate login data and display error to user using setError() method.
5. Create an application that will pass two numbers using Text View to the next screen, and on the next screen display sum of those numbers.
6. Create an application that will Demonstrate Dialog Box Control.

Short Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What is the purpose of TextView? Explain the following attributes of TextView control (i) Id (ii) textColor (iii) text (iv) textStyle.	Understand
2.	How is the CheckBox different from Radiobutton? With XML code.	Apply
3.	What is the purpose of the RecyclerView widget. and how is it different from the ListView?	Evaluating
4.	Explain EditText with details.	Understand
5.	What is an Android layout?	Understand
6.	What is the use of the android:id attribute in XML layout files?	Understand
7.	What is the difference between match_parent and wrap_content in layout XML attributes?	Evaluating
8.	What is the purpose of the OnClickListener interface in Android?	Understand

Long Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	Explain Frame Layout and Table Layout.	Understand
2.	What is Layouts and explain all layouts with details.	Understand
3.	Explain imageView and imageButton.	Understand
4.	What are the key differences between View and ViewGroup classes in Android.	Evaluating
5.	Explain the role of ViewBinding and how it differs from the traditional use of findViewById() for accessing views in your layouts.	Evaluating

Essential Assignments

1. Explain all Views in detail.
2. Explain all View groups in detail.
3. Discus the various layout managers in Android, such as LinearLayout, RelativeLayout, ConstraintLayout, and FrameLayout.
4. How does the XML layout file play a role in defining the user interface of an Android app? Provide an example layout XML file.
5. Explain the Android View Hierarchy. What is it, and why is it important in Android app development?
6. Describe the differences between the dp, sp, px, and match_parent units in Android.

Desirable Assignments

1. How do you create a custom layout in Android?
2. Discuss the significance of the View.GONE, View.VISIBLE, and View.INVISIBLE visibility settings in Android views. Provide examples of when you would use each.
3. Explain the concept of "View Binding" and "Data Binding" in Android.
4. Explain screen orientation with Example.
5. What is the purpose of android:layoutDirection and android:textDirection attributes in Android views, and how do they affect layout and text directionality?

Activities

1. Create a registration page to demonstrate basic widgets available.
2. Create an application to accept two integer numbers via EditText and display larger number and smaller number on another activity.

Learning Outcomes

- To understand how to use View Groups will be acquired.
- To implement screen orientation will be gained.

4 Working with Graphics & Animation

Practical List

1. Create spinner with strings taken from resource folder (res >> value folder). On changing spinner value, change background of screen.
2. Create an application to demonstrate different Animations.
3. Create an application to demonstrate use of Media Player.

Short Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What is a Drawable in Android?	Understand
2.	What is the purpose of the "res/drawable" folder in an Android project?	Understand
3.	Which class is used to draw 2D graphics on an Android canvas?	Understand
4.	What is the purpose of the "ImageView" widget in Android?	Understand
5.	How can you set a custom font for a TextView in Android?	Apply
6.	Explain the difference between a Bitmap and a Drawable in Android.	Evaluating

Long Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	Explain the concept of a "Shape Drawable" in Android. Give an example.	Remember
2.	Explain how you can create animations using the "AnimationDrawable" class.	Creating
3.	Describe the role of the "res/values" folder in Android graphics, and why is it important?	Understand
4.	How can you apply a gradient background to a View in Android? Provide an example.	Apply
5.	Explain "VectorDrawable" format in Android with it's Advantages.	Understand

Essential Assignments

1. What is a Drawable in Android, and how is it used to display graphics?
2. Describe the purpose and usage of the "AnimationDrawable" class in Android.
3. What are the advantages of using a VectorDrawable over a traditional bitmap image for icons and graphics?
4. What is the Android Media Player, and what is its primary purpose?
5. What are the common audio and video formats supported by the Android Media Player?

Desirable Assignments

1. Create an application which has three different buttons, named as “RED”, “BLUE” & “GREEN”. The background color of the activity should be changed according to the button that is clicked.
2. What are the benefits of using the Android NDK (Native Development Kit) for graphics-intensive applications?
3. Describe the process of creating custom views with complex graphics by extending the View class.
4. Explain drawable resources?
5. Write an android code that displays “Android” in the middle of the screen in the 'Blue' color with 'black' background.

Activities

1. Create an application to navigate from one screen to another.
2. Create an application which will accept two different numbers from two different EditText. Display larger number via Toast.

Learning Outcomes

- Knowledge about Graphics and Animation in Android will be acquired.
- Compiling and running Android projects will be understood will be gained.

5 Events & Database Connectivity

Practical List

1. Create an UI such that, one screen has list of all the types of cars. On selecting of any car name, next screen should show car details like: name, launched date, company name.
2. Create an application to manage Student Data in the Device.
3. Create an application to manage Student Data using Web Services.
4. Create an application for calculator.
5. Create an application for distance and weight converters.

Short Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What does UI stand for in Android development?	Understand
2.	Explain the purpose of an "OnClickListener" in Android	Understand
3.	What is SQLite, and why is it commonly used in Android for local data storage?	Understand
4.	What is the purpose of the SQLiteOpenHelper class in Android database connectivity?	Understand
5.	What is the primary difference between internal and external storage for SQLite databases?	Evaluating
6.	How do you create a new SQLite database in an Android application?	Apply

Long Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	Explain the steps involved in opening and closing an SQLite database connection in Android.	Understand
2.	List and Explain advantages of Event Driven Programming.	Remember
3.	List and Explain advantages of SQLite database.	Understand

4.	Explain the Android event handling system. How does it differ from traditional desktop event handling systems?	Evaluating
5.	What are web services, and why are they essential in Android app development?	Understand
6.	What is JSON, and why is it a popular format for data interchange in Android applications?	Understand

Essential Assignments

1. Explain the role of "android.permission.READ_EXTERNAL_STORAGE" permission in accessing external databases?.
2. Explain basic operations of SQLite Database.
3. Explain Event Driven Programming in four points.
4. Explain create database operations with appropriate example.
5. How can you fetch JSON data from a web service and parse it into usable data structures in Android?

Desirable Assignments

1. Use content providers and permissions by implementing read phonebook contacts with content providers and display in the list.
2. Describe the purpose of the SQLiteOpenHelper class in Android database connectivity. How do you create and manage database versions using this class?
3. Explain the advantages and disadvantages of using Content Providers for data access and sharing between Android applications.
4. Discuss the concept of CRUD operations (Create, Read, Update, Delete) in Android database connectivity. Provide examples of how to perform each operation using SQLite.
5. Explain the concept of API endpoints in web services, and how do you construct and call them in Android?

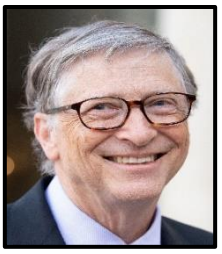
Activities

1. Create an application to insert, update and delete a record from the database.
2. Create an application that will create database to store username and password.
3. Create an application to call a phone number entered by the user the Edit Text.
4. Create an APK file and run on your mobile phone.

Learning Outcomes

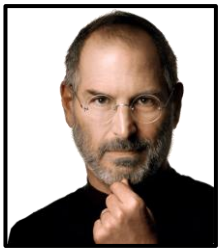
- Knowledge about to understand types of events will be acquired.
- To understand database connectivity will be gained.
- To understand connect with Web Services will be acquired.

Quotes from Pioneers



"The advance of technology is based on making it fit in so that you do not really even notice it, so it is part of everyday life."

- Bill Gates, Co-Founder, Microsoft.

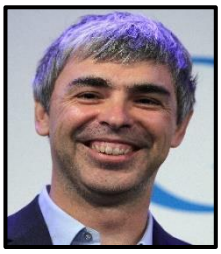


"Have the courage to follow your heart and intuition. They somehow already know what you truly want to become. Everything else is secondary."

- Steve Jobs, Co-Founder, Apple Inc.

"Success breeds complacency. Complacency breeds failure. Only the paranoid survives."

- Andy Grove, Former Chairman & CEO, Intel.

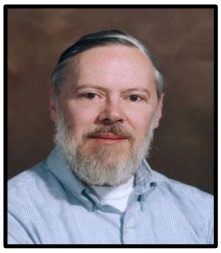


"If you are changing the world, you are working on important things. You're excited to get up in the morning."

- Larry Page, Co-Founder, Google & Alphabet Inc.

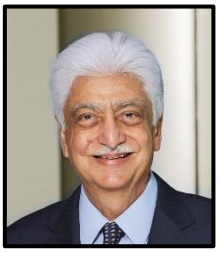
"Progress is often equal to the difference between mind and mindset."

- N. R. Narayana Murthy, Chairman Emeritus, Infosys.



"The only way to learn new programming language is by writing programs in it."

- Dennis Ritchie, Co-Creator of C Programming.



"Success is achieved twice. Once in the mind and the second time in the real world."

- Azim Premji, Founder Chairman, Wipro.

"The digital world has power because it has dynamic information, but it's important that we stay human instead of being another machine sitting in front of a machine."

- Pranav Mistry, President & CEO of STAR Labs.

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