MPL LAB

ASSIGNMENT 2

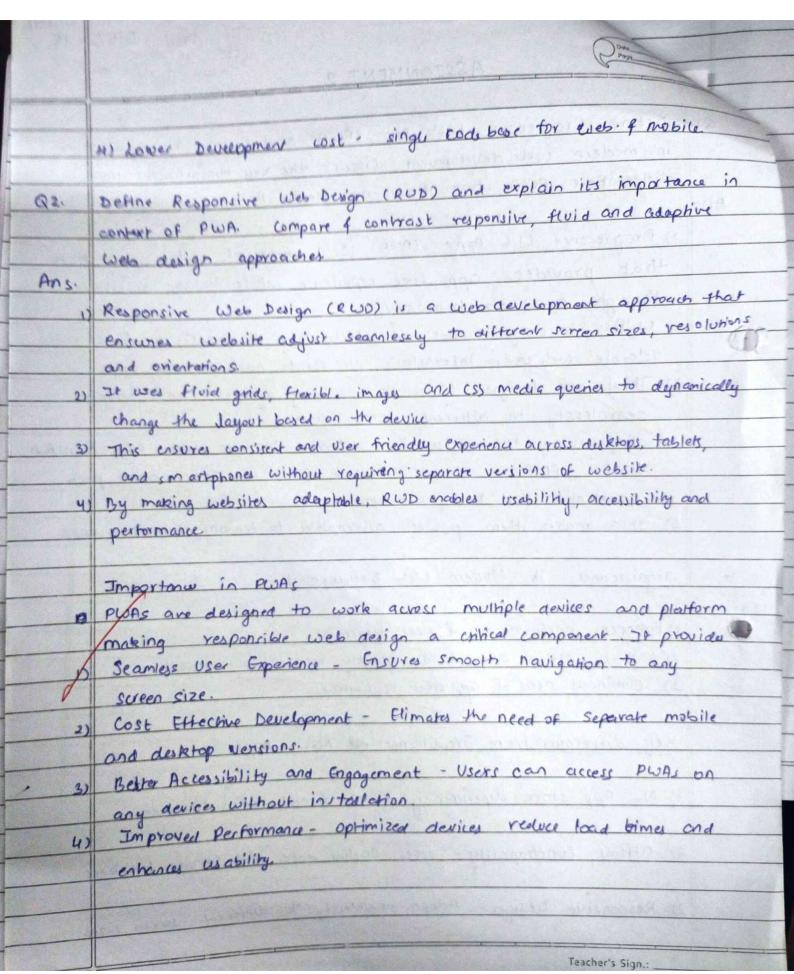**Q1.** Define Progressive Web App (PWA) and explain its significance in modern web development. Discuss the key characteristics that differentiate PWAs from traditional Mobile Apps

Ans.

1) Progressive Web Apps (PWA) is a type of web application that provides app like experience while being accessible through a web browser.

2) PWAs leverage modern web technologies to deliver fast reliable web user interactions similar to native mobile apps.

3) They are designed to work on any devices and adapt seamlessly to different screen sizes.

4) By using technologies like service workers, web app manifesh, HTTPs, PWAs enable feature such as offline access, push notification and background updates.

5) This makes them power alternative to traditional mobile apps.

Significance in Modern Web Development
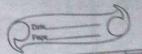
1) Enhances performance & user engagement

2) Works offline and loads quickly even in low network

3) Eliminares need of app store downloads.

Key differences from Traditional Mobile Apps

1) No App store dependency - Runs directly on a browser.

2) Offline functionality - uses cached data via service workers

3) Responsive Design - Adapts seamlessly to different screen sizes.

4) Lower Development cost - single code base for web & mobile.

Q2. Define Responsive Web Design (RWD) and explain its importance in context of PWA. Compare & contrast responsive, fluid and adaptive web design approaches.

Ans.

1) Responsive Web Design (RWD) is a web development approach that ensures website adjust seamlessly to different screen sizes, resolutions and orientations.

2) It uses fluid grids, flexible images and CSS media queries to dynamically change the layout based on the device.

3) This ensures consistent and user friendly experience across desktops, tablets, and smartphones without requiring separate versions of website.

4) By making websites adaptable, RWD enables usability, accessibility and performance.

Importance in PWAs

0) PWAs are designed to work across multiple devices and platform making responsible web design a critical component. It provides

1) Seamless User Experience - Ensures smooth navigation to any screen size.

2) Cost Effective Development - Elimates the need of Seperate mobile and desktop versions.

3) Better Accessibility and Engagement - Users can access PWAs on any devices without installation.

4) Improved Performance - optimized devices reduce load times and enhances usability.

Feature	Responsive Design	Fluid Design	Adaptive Design
Layout Type	Flexible and adjusts based on screen size	Uses percentage base widths for smooth resizing	Predefining layout for specific screen sizes.
Flexibility	Highly flexible, adjusts dynamically	Fully scalable without breakpoints	Fixed layouts change at specific breakpoints
Best for	Multi-device compatibility (PWAs, modern website)	smooth proportional scaling	Optimized experiences for specific devices.
Development complexity	Moderate	Simple	More complex due to multiple layouts.

Q3. Describe lifecycle of service Workers, including registration, installation and activation phases.

Ans.

A Service Workers is a script that runs in the background, enabling features like offline caching, push notifications and background sync. in PWAs.
Its lifecycle consist of 3 main phases:

(1) Registration :

i. Service worker is registered in the browser using Javascript (navigator. ServiceWorker. register() method)

ii. This ensures browser knows about Service Worker and can manage its lifecycle.

How IndexDB is used in Service Workers:

(1) Storing Offline Data:

i) Service worker fetch data from network and store it in Indexed DB.

(ii) This enables app to display content even when offline.

(2) Efficient Data Retrieval:

i) Unlike cache API, Indexed DB allows storing and querying structured data.

ii) It supports key-value pairs, indexes and transactions for efficient searching.

(3) Syncing Data with Server.

i) When user is offline, data (eg. form inputs, message) can be stored locally.

ii) Once connection restored, background sync updates server with stored data

(4) Improving Performance:

i) Indexed DB reduces unnecessary network requests by serving stored data

ii) This enhances the speed and responsiveness of PWAs

eg. 1) Service Worker intercepts a fetch request.

2) It checks Indexed DB for stored data

3) If available, it serves the data, else it fetchs from network and stores it.