

Name: Harsh Jodhau

Roll No: 21

Class: DISB

MPL Assignment No.2

Q.1] Define progressive Web App (PWA) and explain the significance in modern web development. Discuss the key characteristics that differentiate PWAs from traditional mobile apps.

⇒ A progressive web app (PWA) is a type of web application that leverages modern web technologies to provide an app-like experience on the web. PWAs combine the best features of traditional web apps and native mobile applications, offering improved performance, offline capabilities, and enhanced user engagement.

Significance in Modern Web Development:-

- Cross-platform compatibility: PWAs work seamlessly across different devices and operating systems.
- Offline functionality: Service workers allow caching, enabling PWAs to function offline or in low network conditions.
- Improved Performance: PWAs utilize caching strategies to load faster than traditional web pages.
- App-like experience: They can be installed on the home screen without requiring app store downloads.
- SEO-friendly: Unlike native apps, PWAs are indexable by search engines.

- Key characteristic That differentiate PWAs from Traditional mobile applications.

Feature	PWA	Traditional Mobile App
① Installation	No app store required, add to home screen.	Installed via App store / play store.
② offline Support	yes using service workers	Yes, via local storage and background sync.
③ Performance	Fast due to caching	optimized but may require more resource.
④ Development cost	Lower, single codebase for web and mobile.	Higher, requires separate development for iOS & android.

Q.2] Define responsive web design and explain its importance in the context of progressive Web Apps. Compare and contrast responsive fluid and adaptive web design approaches.

⇒ Responsive Web Design (RWD) is a design approach that ensures a website's layout adjusts dynamically to different screen sizes and resolutions. It uses flexible grids, media queries, and CSS techniques to provide an optimal viewing experience.

* Importance of PWAs

- PWAs need to function seamlessly across multiple

devices (mobile, tablet, desktop).

- Ensure a consistent user experience regardless of screen size.
- Enhance accessibility and usability.
- Improves SEO rankings as mobile friendly websites are favoured by search engines.
- Reduces the need for separate designs for different device making development more efficient.

Comparison of Responsive, Fluid and Adaptive Design.

Feature.	Responsive Design	Fluid Design	Adaptive Design.
① approach	uses break-points and Media queries.	uses percentage based layout.	uses predefined layouts for specific screen sizes.
② flexibility	High, adjusts dynamically.	Very High, scales with screen.	Medium, fixed layout per device.
③ user Experience	Smooth across all devices.	Consistent but may stretch too much.	Optimized for predefined screens and sizes.

Q.3] Describe the lifecycle of service workers, including registration, installation and activation phases.

⇒ A service worker is a background script that helps Progressive Web Apps (PWAs) work offline, cache assets and handle push notifications.

The lifecycle of a service worker includes the following phases:

1. Registration phase:-

Before a service worker can start working, it must be registered in the browser. This is done using JavaScript in the main application file.

Steps in Registration:

- The browser checks if service workers are supported.
- The service worker script is registered.
- If successful, the installation phase begins.

2. Installation phase:-

During installation, the service worker prepares itself by caching essential assets like HTML, CSS, JavaScript and images. If the installation is successful, it moves to the activation phase.

Steps in Installation

- The install event is triggered.
- The service worker caches required files for offline access.

If caching fails, the service worker is not installed.

3. Activation phase:-

After installation, the service worker becomes active. In this phase, old caches are cleared and the new service worker takes control of open pages.

• Step in activation :

- The "activate" event is triggered.
- Old caches from previous versions are deleted.
- The new service worker takes control of all open pages.

Q.4] Explain the use of IndexedDB in the service worker for data storage.

→ IndexedDB is a client side NoSQL database that allows web applications to store large amounts of structured data.

It works asynchronously and is used in progressive web apps (PWAs) to enable offline data storage and synchronization when the user is online.

• Use of IndexedDB in the service worker:

1. Offline Data Storage: Allows data to be stored locally when the user is offline.
2. Background Syncing: Sync data in the background when the user goes online.
3. Fast Data Retrieval: IndexedDB supports indexed searches for efficient data queries.
4. Storage of large data: Unlike local storage, IndexedDB can store large JSON objects.

5. Asynchronous operations: - work asynchronously to prevent UI blocking.

A server writer cannot access Indexed DB directly because it runs in a separate thread.

However it communicates with the main thread using the PostMessage() API or Background Sync API to store and retrieve data.