Project Title – A CRM APPLICATION TO ENGINEERING WORKS

1. Project Overview

The Engineering Project Management System (EPMS) will streamline client and project management for engineering works, including fabrication, shed construction, and pipe lining. It will track company, owner, worker, and material details, automating material pricing based on specifications and measurements. The system will monitor work processes like drilling, welding, cutting, and folding, ensuring accurate progress tracking. Automated pricing and quotation generation will support project budgeting. The web-based application will provide real-time updates, enhance transparency, and improve cost control. It will be built using modern web technologies, with role-based access and secure data management.

2. Objectives

The objective of the Engineering Project Management System (EPMS) is to provide an efficient, centralized platform for managing engineering projects. It aims to streamline the tracking of client, company, worker, and material details, automate pricing calculations, and facilitate the management of engineering processes such as fabrication, shed construction, and pipe lining. By automating tasks like material pricing and quotation generation, the system will improve cost control, enhance project transparency, and ensure accurate progress tracking. The web-based application will support real-time updates, secure data management, and role-based access, ultimately optimizing project workflow and decision-making.

3. Sales force Key Features and Concepts Utilized

1. Custom Objects:

- **Project**, **Worker**, **Material Requirement**, **Fabrication Process**, **Shed Construction**, and **Pipe Lining** are custom objects to track specific project-related data like client info, workers, materials, and processes.

2. Record Types:

- Different engineering works (e.g., **Fabrication**, **Shed Construction**, **Pipe Lining**) will have **Record Types** to customize fields and page layouts for each type of work, ensuring relevant data is displayed for each project type.

3. Formula Fields & Apex Triggers:

- **Formula Fields** are used to automatically calculate material costs based on quantities and unit prices.
- **Apex Triggers** can handle complex calculations or business rules, such as adjusting total project costs based on material quantities or applying discounts.

4. Reports & Dashboards:

- **Reports** track key project metrics like material usage, worker assignments, and project costs.
- **Dashboards** provide visual summaries, such as project status, material cost distribution, and worker progress.

5. Process Automation (Workflow, Process Builder, Flows):

- **Workflow Rules** automate simple tasks (e.g., sending emails on project status updates).
- **Process Builder** handles more complex workflows (e.g., automatically updating project costs when materials are added).
- **Flows** guide users through multi-step processes, ensuring consistent data entry.

6. Security & Access Control:

- **Profiles**, **Permission Sets**, and **Role Hierarchy** ensure that only authorized users can access specific project data.
- **Sharing Rules** allow for flexible sharing of project data among teams.

7. Mobile Access:

- The **Salesforce mobile app** provides real-time access to project data, allowing field workers and managers to update and monitor projects on the go.

8. Chatter for Collaboration:

- **Chatter** facilitates communication among team members by allowing them to post updates, share files, and collaborate on project-related tasks.

4. Detailed Steps to Solution Design

1. Requirement Gathering & Analysis

- **Understand Key Business Requirements**:
  - Manage client information (company details, owner, and contact).
  - Track worker details, material requirements (including measurements), and their costs.
  - Handle multiple types of engineering work (Fabrication, Shed Construction, and Pipe Lining).
  - Automatically calculate prices for materials based on quantities and measurements.
  - Ensure tracking of processes within Fabrication (e.g., Drilling, Welding, Cutting, and Folding).
- **Identify Stakeholders**: Project managers, engineers, field workers, accounting teams, and clients.
- **Key Functions to Address**:
  - Project creation and management.
  - Worker assignment and tracking.
  - Material management, including cost and measurement tracking.
  - Process tracking for different types of work (Fabrication, Shed Construction, Pipe Lining).
  - Automation of pricing and cost calculations based on materials and work processes.

2. Define Data Model

Key Entities and Relationships:

- **Client (Account)**: Stores company information.
  - Fields: Name, Address, Owner Name (Contact), Industry, Contact Info, etc.
- **Contact**: Represents people associated with the client, such as the project owner and other contacts.
  - Fields: Name, Role, Email, Phone, Associated Account (lookup to Account).
- **Project (Custom Object)**: Represents each engineering project.
  - Fields: Project ID, Name, Client (lookup to Account), Status (Picklist: New, In Progress, Completed), Engineering Work Type (Picklist: Fabrication, Shed Construction, Pipe Lining), Budget, Start/End Dates, etc.
- **Worker (Custom Object)**: Represents the workers assigned to projects.
  - Fields: Name, Role (Picklist: Engineer, Welder, Laborer), Contact Info, Assigned Projects (lookup to Project), Skills, Availability, etc.
- **Material Requirement (Custom Object)**: Tracks the materials needed for a project.
  - Fields: Material Name, Quantity, Measurement, Price per Unit, Total Cost (calculated), Associated Project (lookup to Project).
- **Fabrication Process (Custom Object)**: Tracks the specific fabrication processes (Drilling, Welding, Cutting, Folding) involved in the project.
  - Fields: Process Type (Picklist), Description, Start/End Dates, Status (Picklist: Not Started, In Progress, Completed), Associated Project (lookup to Project).
- **Shed Construction (Custom Object)**: For shed construction work.
  - Fields: Shed Type (Picklist), Dimensions (Length, Width, Height), Construction Dates, Associated Project (lookup to Project).
- **Pipe Lining (Custom Object)**: For pipe-related work.
  - Fields: Pipe Size, Material Type (Picklist), Start/End Dates, Associated Project (lookup to Project).

3. Define Process Flow and Record Types

- **Record Types**:
    - For the **Project** object, create Record Types for the different types of engineering works (Fabrication, Shed Construction, Pipe Lining). Each will have different page layouts, required fields, and processes.
    - For **Fabrication Process**, define Record Types for each type of process (Drilling, Welding, Cutting, Folding).
    - For **Material Requirement**, include fields for quantity, price, and total cost calculation based on measurements.
- **Process Flow Design**:
    - When a new project is created, the application should guide users through selecting the appropriate work type (Fabrication, Shed Construction, Pipe Lining) and entering all associated details (materials, workers, timelines).
    - Track the **progress** of each work process (e.g., Drilling in Fabrication) and update status based on task completion.

4. Automate Price Calculation

Formula Fields & Apex Triggers:

- **Formula Fields**:
    - In the **Material Requirement** object, create a formula field to calculate **Total Cost** based on `Quantity * Price Per Unit`.
    - In the **Project** object, use a formula field to calculate the total cost of the project by summing the `Total Cost` of all related Material Requirement records.
- **Apex Triggers**:
    - If pricing involves more complex business rules (e.g., applying discounts based on quantities or specific material types), an **Apex Trigger** can be created. For instance, when a new **Material Requirement** is added, the trigger will automatically update the total project cost.

5. Automation of Processes

Workflow Rules, Process Builder, and Flows:

- **Workflow Rules**:
    - Set up simple workflows to send email notifications or update field values automatically. For example, send a notification when a Fabrication Process is marked as "Completed."
- **Process Builder**:
    - Create processes that automate workflows across objects. For example, when a **Material Requirement** record is updated, the Process Builder can trigger an update to the **Project** object, recalculating the total cost.
- **Flows**:
    - **Guided Flows** for users to easily add materials, workers, or processes. A Flow can be used to guide the user through the steps of entering materials and calculating prices or assigning workers to projects.

6. Reporting & Dashboards

- **Custom Reports**:
  - Create reports to track project progress, material usage, and costs. Examples include:
    - **Project Status Report**: Displays all projects with their current status (In Progress, Completed, etc.), deadlines, and costs.
    - **Material Usage Report**: Displays material types, quantities, unit price, and total cost.
    - **Worker Assignment Report**: Shows workers assigned to projects, their roles, and status.
    - **Fabrication Process Progress Report**: Tracks the completion status of fabrication processes (e.g., Welding, Cutting).
- **Dashboards**:
  - Create a **Project Management Dashboard** that gives a high-level overview of:
    - Project status (In Progress, Completed).
    - Total material costs across all projects.
    - Worker assignments and availability.
  - Dashboards will allow real-time monitoring of key metrics for managers and team leads.

7. Security & Access Control

- **Profiles & Permission Sets**:
  - Define **Profiles** for users, such as **Project Manager**, **Engineer**, and **Field Worker**. Each profile will have different access levels to project data.
  - Use **Permission Sets** to grant additional permissions for specific tasks or objects as needed.
- **Role Hierarchy**:
  - Set up role hierarchies to ensure that higher-level users (e.g., Project Managers) can access data owned by lower-level users (e.g., Engineers or Field Workers).
- **Sharing Rules**:
  - Define **sharing rules** to ensure that users can only access relevant project data. For instance, **Project Managers** may need access to all projects, while **Field Workers** only need access to projects they are assigned to.

8. Mobile Access and Collaboration

- **Mobile Access**:
  - Use the Salesforce mobile app to enable real-time updates, project tracking, and material management on the go. Field workers can update their progress, log time, or report material requirements directly from their mobile devices.
- **Chatter**:
  - Use **Chatter** for communication and collaboration among team members. Create Chatter groups for each project where team members can post updates, share files, and ask questions.

9. Testing and Validation

- **Unit Testing**:
  - Write unit tests for Apex triggers and any complex logic to ensure correctness.
- **User Acceptance Testing (UAT)**:
  - Engage users to test the system for usability and functionality. Collect feedback and refine the application.
- **Data Validation**:
  - Ensure that all data entered follows business rules and that price calculations are accurate.

10. Deployment and Rollout

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- **Deployment to Production**:
  - o After thorough testing, deploy the solution to production.
- **Training**:
  - o Provide training for end-users on how to use the application, enter data, and generate reports.
- **Post-Deployment Support**:
  - o Set up a support plan to address any issues or bugs that arise post-deployment.

5. Testing and Validation

1. Unit Testing

Unit testing focuses on testing individual components of the system (such as Apex triggers, formula fields, and process flows) in isolation to ensure each piece functions as expected.

Key Areas to Test:

- **Apex Triggers**:
  - o **Test Case 1**: Verify that the **Apex trigger** correctly updates the **Project Total Cost** when a **Material Requirement** is created or modified.
  - o **Test Case 2**: Ensure the trigger applies specific business logic, such as discounts or price adjustments based on material quantity or type.
- **Formula Fields**:
  - o **Test Case 3**: Validate that the **Total Material Cost** formula in the **Material Requirement** object correctly calculates the total cost based on quantity and unit price.
  - o **Test Case 4**: Verify the formula in the **Project** object sums the **Material Requirement** total costs correctly across related records.
- **Validation Rules**:
  - o **Test Case 5**: Check that validation rules enforce mandatory fields and correct data formats (e.g., ensuring material quantity is a positive number).
- **Flows**:
  - o **Test Case 6**: Test **Flows** to ensure they guide users through the process of entering materials or assigning workers correctly, including ensuring required fields are captured before the next step is allowed.

2. Integration Testing

Integration testing ensures that different parts of the system interact seamlessly, and that data flows correctly between objects and processes.

Key Areas to Test:

- **Data Integrity Between Objects**:
  - o **Test Case 1**: Verify that the **Material Requirement** data entered in a project correctly links to the **Project** object and that the project's cost field is automatically updated.
  - o **Test Case 2**: Check that worker assignments to projects via the **Worker** object appear correctly in the project's worker list.
- **Process Flow Integration**:

- o **Test Case 3**: Test that when a **Fabrication Process** (e.g., Drilling) is completed, the **Project** status is automatically updated (if applicable) and that associated costs are updated if process-related material costs change.
  - o **Test Case 4**: Verify that the **Process Builder** triggers an email notification when a **Project Status** is changed to "Completed."
- **Automated Price Calculation**:
  - o **Test Case 5**: Ensure that when materials are added or modified, the **Apex trigger** updates the **Total Project Cost** correctly and reflects changes in real-time across the project record.
  - o **Test Case 6**: Test complex pricing rules (e.g., apply discounts for bulk materials) to ensure that the price calculation is accurate.
- **Cross-Object Data Consistency**:
  - o **Test Case 7**: When a **Shed Construction** record is created, ensure that the correct **dimensions** and **materials** are automatically assigned and integrated into the project's total cost calculations.

3. User Acceptance Testing (UAT)

User Acceptance Testing (UAT) is conducted to ensure that the application meets the business needs and is ready for end-users. This stage tests the application in real-world scenarios, ensuring all processes are intuitive and functional.

Steps for UAT:

- **Involve Key Stakeholders**: Engage end users such as **Project Managers**, **Engineers**, **Field Workers**, and **Clients** in testing.

Key Test Cases:

- **Project Creation**:
  - o **Test Case 1**: As a **Project Manager**, create a new **Project** (Fabrication, Shed Construction, Pipe Lining) and ensure all necessary fields (e.g., client, project type, budget) are captured correctly.
  - o **Test Case 2**: Add **Material Requirements** to the project and verify that prices are automatically calculated and displayed.
  - o **Test Case 3**: Assign workers to a project and verify that they receive tasks related to fabrication, shed construction, or pipe lining.
- **Material and Cost Management**:
  - o **Test Case 4**: As a **Project Manager**, check that the total **Material Requirement** cost is automatically calculated based on quantity and unit price.
  - o **Test Case 5**: Test a scenario where material quantities are updated. Ensure that the **Project** total cost updates in real-time.
  - o **Test Case 6**: Test the application's ability to apply discounts based on quantity or material type (e.g., if the quantity exceeds a certain threshold).
- **Process Tracking and Status Updates**:
  - o **Test Case 7**: Test a **Fabrication Process** (e.g., Drilling) for a project. Mark the process as "In Progress" and then "Completed," ensuring the **Project Status** updates accordingly and that progress is visible in reports.
  - o **Test Case 8**: Verify that the system tracks the **time** and **cost** for each process (e.g., time spent on Welding or Cutting) and ensures that these figures contribute to the overall project cost.
- **Notifications and Alerts**:
  - o **Test Case 9**: Test email alerts and notifications, such as sending an email when a **Fabrication Process** is completed or when a **Project** is marked as "Completed."
  - o **Test Case 10**: Ensure **Chatter** functionality works, and team members are notified in real-time about project updates or task assignments.

4. Performance Testing

Performance testing checks how the system behaves under different load conditions, ensuring it can handle high volumes of data or multiple users without crashing or slowing down.

Key Areas to Test:

- **System Response Time**:
  - o **Test Case 1**: Measure the time taken to create a **new project** with several **Material Requirements**. Ensure that the system can handle creating and updating projects with multiple related records without significant delays.
- **Bulk Data Operations**:
  - o **Test Case 2**: Test the system's ability to handle bulk material uploads (e.g., importing large lists of materials for multiple projects) and verify that the **price calculations** are still accurate.
- **Simultaneous Users**:
  - o **Test Case 3**: Simulate multiple users (e.g., several project managers and workers) accessing the system simultaneously and ensure that it can handle concurrent users without performance degradation.

5. Security Testing

Security testing ensures that the application is secure and sensitive project data is protected. It involves verifying user access and ensuring data integrity.

Key Areas to Test:

- **User Permissions**:
  - o **Test Case 1**: Verify that **Project Managers** can view and modify all project data, while **Field Workers** can only view their assigned tasks and materials.
  - o **Test Case 2**: Ensure **Clients** can only view their own project data, and cannot access sensitive worker or material cost details.
- **Data Encryption**:
  - o **Test Case 3**: Test that sensitive data (e.g., material costs, worker salaries) is encrypted both at rest and in transit to prevent unauthorized access.
- **Role-Based Data Access**:
  - o **Test Case 4**: Ensure that **Role Hierarchy** settings prevent unauthorized users from accessing projects they are not associated with (e.g., ensuring that only **Managers** or **Administrators** can view all projects in the system).

6. Regression Testing

Regression testing ensures that new features or updates do not break existing functionality.

Key Areas to Test:

- **Old Features**: Ensure that the **Project Management** features (e.g., project creation, worker assignment, and material tracking) continue to work as expected after implementing new features.
- **Cross-Object Integration**: Test all cross-object relationships (e.g., **Material Requirements** linked to **Projects** and **Processes**) to ensure they still function properly.

7. Post-Deployment Validation

After deployment, perform additional checks to ensure the application works as expected in the production environment.

Key Post-Deployment Checks:

- **Data Migration**: If migrating from an existing system, ensure all data is correctly migrated to the new Salesforce environment, including client records, projects, and historical cost data.
- **System Monitoring**: Set up system monitoring to ensure that the application is running smoothly in the production environment and any issues can be detected early.

6. Key Scenarios Addressed by Salesforce in the Implementation Project

1. Client and Project Management

Scenario: Efficiently managing client information (company details, owner, contacts) and project t   racking (e.g., Fabrication, Shed Construction, and Pipe Lining).

- **Solution**: Salesforce's **Account** and **Contact** objects store client data, while **Custom Objects** like **Project** help track and manage projects. Record Types for different engineering work types (Fabrication, Shed Construction, Pipe Lining) ensure that project data is tailored and relevant. Projects can be associated with clients, and users can track their progress with real-time status updates.
    - **Example**: When a new engineering project is initiated, the **Project** object is populated with client details from the **Account** and **Contact** objects. This ensures all client information is automatically linked to the project.
    - **Key Features**:
        - Custom fields for project-specific data.
        - Record Types for managing different types of engineering work.
        - Automatic project status tracking.

2. Worker and Resource Management

Scenario: Managing workers (engineers, welders, laborers) and ensuring their availability and assignment to different engineering tasks (e.g., Drilling, Welding, Cutting, Folding, Shed Construction, Pipe Lining).

- **Solution**: Salesforce's **Worker** custom object tracks worker details, roles, and availability. **Project Workers** can be linked to specific tasks or processes within a project. Workflows and Process Builder can automate the assignment of workers to tasks based on their availability or skill set.
    - **Example**: When a **Fabrication Process** (e.g., Welding) starts, the system can automatically assign available **Welders** based on their skills and availability.
    - **Key Features**:
        - Availability tracking using custom fields.
        - Process automation for task assignment.
        - Worker scheduling and status updates.

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3. Material and Cost Management

Scenario: Managing material requirements for projects, including quantities, measurements, and cost calculations based on specified materials and measurements.

- **Solution**: **Material Requirements** are tracked using custom objects, and formula fields automatically calculate the cost based on quantity, unit price, and measurements. Salesforce's ability to handle complex **formulas** and **Apex triggers** allows the automatic calculation of costs when material quantities or prices change.
  - **Example**: When a **Material Requirement** (e.g., Steel Sheets) is created, the system calculates the **Total Cost** by multiplying quantity and price per unit, and the **Project** object is updated accordingly.
  - **Key Features**:
    - Formula fields for automatic cost calculations.
    - Integration of material data with project budgeting.
    - Apex triggers for handling complex pricing logic (e.g., volume discounts).

4. Engineering Work Process Tracking

Scenario: Tracking and managing specific processes within engineering works, including **Fabrication (Drilling, Welding, Cutting, Folding)**, **Shed Construction**, and **Pipe Lining** (repairing and replacing pipes).

- **Solution**: Salesforce's **Custom Objects** (e.g., **Fabrication Process**, **Pipe Lining**, **Shed Construction**) allow for detailed tracking of each step of the engineering process. Processes are tracked via status fields and can be associated with time and cost data. Salesforce automation tools (e.g., **Process Builder**, **Flows**) ensure that project stages progress smoothly.
  - **Example**: The **Fabrication Process** object could be used to track individual steps like **Drilling**. Once **Drilling** is marked as "Completed," the system can trigger the next step (e.g., **Welding**) or update the **Project Status**.
  - **Key Features**:
    - Process tracking via status fields (Not Started, In Progress, Completed).
    - Time and cost tracking for each process step.
    - Automation to move from one process to the next.

5. Price Calculation and Quotation Generation

Scenario: Automatically calculating the project price based on materials, labor, and processes, and generating accurate quotations for clients.

- **Solution**: Salesforce can automatically calculate the total project cost using **Formula Fields**, **Apex Triggers**, and custom logic. These calculations integrate materials, labor, and engineering processes to provide accurate price estimates. Additionally, Salesforce's **Quote** object and integration with **CPQ (Configure, Price, Quote)** can generate client-facing quotes.
  - **Example**: As materials and labor are tracked in the project, the system automatically updates the total cost. A **Quote** can be generated, including details like material costs, labor charges, and process costs, and sent directly to the client.
  - **Key Features**:
    - Formula fields for real-time price calculations.

- **CPQ (Configure, Price, Quote)** for generating accurate client quotes.
- Integration of material and process costs for accurate project estimates.

6. Automation of Workflow and Task Assignment

Scenario: Automating task assignments and notifications to ensure smooth project progress and efficient resource allocation.

- **Solution**: Salesforce's **Process Builder** and **Flows** are used to automate task assignments, update project statuses, and trigger notifications. This ensures that tasks are assigned to the appropriate workers at the right time, and that project managers are alerted when milestones or tasks are completed.
  - **Example**: When a **Fabrication Process** (e.g., **Welding**) is marked as "In Progress," the system can automatically notify the **Project Manager** and assign available **Welders**. If the **Fabrication Process** is delayed, notifications can be sent to the manager.
  - **Key Features**:
    - Process automation for task assignments and updates.
    - Automated notifications (e.g., emails, Chatter posts) for project updates.
    - Integration of worker assignments into the project workflow.

7. Real-time Collaboration and Communication

Scenario: Enabling seamless collaboration among project managers, engineers, and workers, ensuring timely communication of updates and issues.

- **Solution**: Salesforce's **Chatter** allows team members to communicate, share files, and post updates within projects. It serves as a central collaboration hub where engineers, managers, and workers can discuss project milestones, share issues, and update project statuses.
  - **Example**: A **Chatter group** is created for each project where team members post updates (e.g., when a specific process is completed), ask questions, or share files (e.g., engineering blueprints, work schedules).
  - **Key Features**:
    - **Chatter** for team collaboration and communication.
    - File sharing within the project environment.
    - Real-time discussions and updates on project progress.

8. Reporting and Dashboarding

Scenario: Generating reports and dashboards to track project progress, material usage, worker performance, and cost analysis.

- **Solution**: Salesforce's **Reports** and **Dashboards** allow users to track key metrics like project cost, material usage, worker performance, and overall project progress. Dashboards can be customized to show real-time data, providing managers with a snapshot of project health and resource utilization.
  - **Example**: A **Project Progress Dashboard** can display key metrics such as materials used, total cost incurred, number of tasks completed, and worker performance, giving project managers a high-level overview of the project's status.
  - **Key Features**:

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- Custom reports for project tracking, worker performance, and material usage.
- **Dashboards** for real-time monitoring of project status.
- Visualizations of project health (e.g., cost, timeline, resources).

9. Security and Access Control

Scenario: Ensuring that sensitive project data, such as material costs, worker pay, and client details, is securely stored and that only authorized personnel have access.

- **Solution**: Salesforce provides a robust **Security Model** using **Profiles**, **Permission Sets**, and **Role Hierarchy**. This ensures that only authorized users can access sensitive data. For example, **Field Workers** may only have access to the tasks they are assigned, while **Project Managers** have broader access to project financials and resource details.
  - **Example**: A **Project Manager** can view and modify all aspects of the project, including materials, workers, and financial data, while a **Field Worker** may only see their assigned tasks and work logs.
  - **Key Features**:
    - **Profiles** for defining user permissions.
    - **Role Hierarchy** to control data visibility.
    - **Sharing Rules** to manage access to specific records (e.g., projects, materials, and costs).

10. Mobile Access for On-the-Go Project Management

Scenario: Allowing field workers and project managers to update project statuses, track materials, and assign tasks via mobile devices, ensuring real-time project management.

- **Solution**: Salesforce's **Mobile App** provides full access to project data on the go. Field workers can log time, update task statuses, and report material needs directly from the mobile app, while managers can monitor progress in real-time.
  - **Example**: A **Field Worker** can use the mobile app to mark a **Fabrication Process** as "Completed" after finishing a task like **Cutting** or **Welding**, which updates the project status immediately.
  - **Key Features**:

7. Conclusion

- In conclusion, the Salesforce-based engineering project management application will streamline the management of client data, worker assignments, materials, and cost calculations. By automating tasks like price calculation and process tracking, it will ensure accurate, real-time project updates. The solution's custom objects, formula fields, and process automation will enhance operational efficiency, while mobile access and Chatter will improve team collaboration. With strong security controls and robust reporting capabilities, the application will enable better decision-making and resource management. Overall, this application will optimize project workflows and drive long-term success for the organization.