In [2]:
```
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# CL IV (Business Intelligence)
#Practical No.5
```

In [3]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from sklearn.metrics import silhouette_score
import warnings
warnings.filterwarnings('ignore')
```

In [4]:
```
# Load the Iris dataset
iris = sns.load_dataset("iris")
print(iris.head())  # Display first 5 rows
```

```
   sepal_length  sepal_width  petal_length  petal_width species
0           5.1          3.5           1.4          0.2  setosa
1           4.9          3.0           1.4          0.2  setosa
2           4.7          3.2           1.3          0.2  setosa
3           4.6          3.1           1.5          0.2  setosa
4           5.0          3.6           1.4          0.2  setosa
```

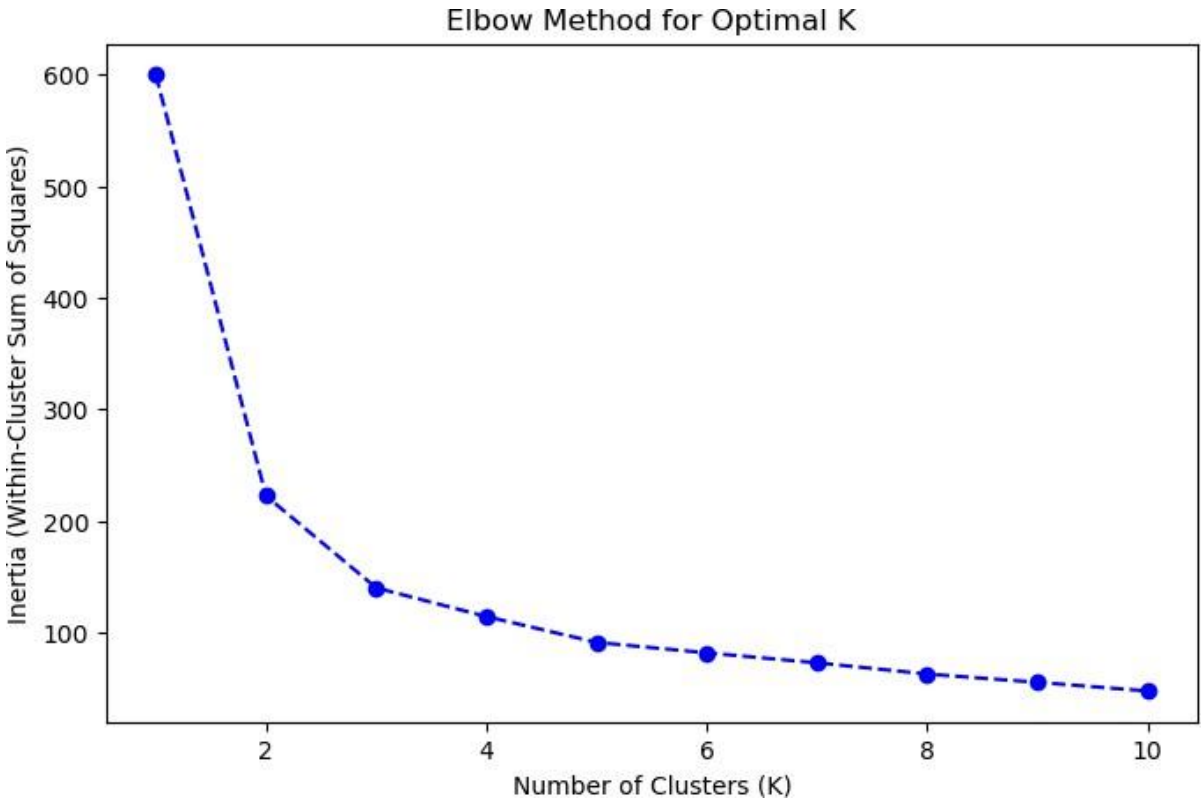
In [5]:
```
# Drop the categorical 'species' column
X = iris.drop(columns=['species'])

# Standardizing the features (scaling)
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

In [6]:
```
# Elbow Method to determine the best number of clusters
inertia = []
K_range = range(1, 11)  # Check for K=1 to K=10

for k in K_range:
    kmeans = KMeans(n_clusters=k, random_state=42, n_init=10)
    kmeans.fit(X_scaled)
    inertia.append(kmeans.inertia_)

# Plot Elbow Curve
plt.figure(figsize=(8, 5))
plt.plot(K_range, inertia, marker='o', linestyle='--', color='b')
plt.xlabel('Number of Clusters (K)')
plt.ylabel('Inertia (Within-Cluster Sum of Squares)')
plt.title('Elbow Method for Optimal K')
plt.show()
```



In [7]:
```
# Apply K-Means with 3 clusters
kmeans = KMeans(n_clusters=3, random_state=42, n_init=10)
clusters = kmeans.fit_predict(X_scaled)

# Assign clusters to a new column in the dataset
iris['Cluster'] = clusters

# Debug check
print(iris.head())  # Verify the 'Cluster' column is added
```

	sepal_length	sepal_width	petal_length	petal_width	species	Cluster
0	5.1	3.5	1.4	0.2	setosa	1
1	4.9	3.0	1.4	0.2	setosa	1
2	4.7	3.2	1.3	0.2	setosa	1
3	4.6	3.1	1.5	0.2	setosa	1
4	5.0	3.6	1.4	0.2	setosa	1

In [8]:
```
silhouette_avg = silhouette_score(X_scaled, clusters)
print(f'Silhouette Score: {silhouette_avg:.2f}')
```

```
Silhouette Score: 0.46
```

In [9]:
```
# Apply PCA to reduce dimensions from 4D to 2D
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X_scaled)

# Convert to DataFrame for visualization
pca_df = pd.DataFrame(X_pca, columns=['PC1', 'PC2'])
pca_df['Cluster'] = clusters  # Assign clusters
# Scatter plot of PCA components with clusters
plt.figure(figsize=(8, 6))
```

```
sns.scatterplot(x=pca_df['PC1'], y=pca_df['PC2'], hue=pca_df['Cluster'],
palette='viridis', s=100)
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.title('K-Means Clustering (PCA Reduced)')
plt.legend(title='Cluster')
plt.show()
```