In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
df=pd.read_csv("C:\TASK 1\iris flower dataset.csv")
df.head()
```

Out[2]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

In [3]:
```
df['Species'],categories =pd.factorize(df['Species'])
df.head()
```

Out[3]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	0
1	2	4.9	3.0	1.4	0.2	0
2	3	4.7	3.2	1.3	0.2	0
3	4	4.6	3.1	1.5	0.2	0
4	5	5.0	3.6	1.4	0.2	0

In [4]:
```
df=df.drop(columns =['Id'])
df.head()
```

Out[4]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	5.1	3.5	1.4	0.2	0
1	4.9	3.0	1.4	0.2	0
2	4.7	3.2	1.3	0.2	0
3	4.6	3.1	1.5	0.2	0
4	5.0	3.6	1.4	0.2	0

In [5]:
```
df.describe
```

Out[5]:
```
<bound method NDFrame.describe of      SepalLengthCm  SepalWidthCm  PetalLengthCm  Petal
WidthCm  Species
0              5.1           3.5            1.4           0.2        0
1              4.9           3.0            1.4           0.2        0
2              4.7           3.2            1.3           0.2        0
3              4.6           3.1            1.5           0.2        0
4              5.0           3.6            1.4           0.2        0
..             ...           ...            ...           ...      ...
145            6.7           3.0            5.2           2.3        2
146            6.3           2.5            5.0           1.9        2
147            6.5           3.0            5.2           2.0        2
148            6.2           3.4            5.4           2.3        2
149            5.9           3.0            5.1           1.8        2

[150 rows x 5 columns]>
```

In [6]:
```
df.isna().sum()
```

Out[6]:
```
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

In [7]:
```
df.describe()
```

Out[7]:

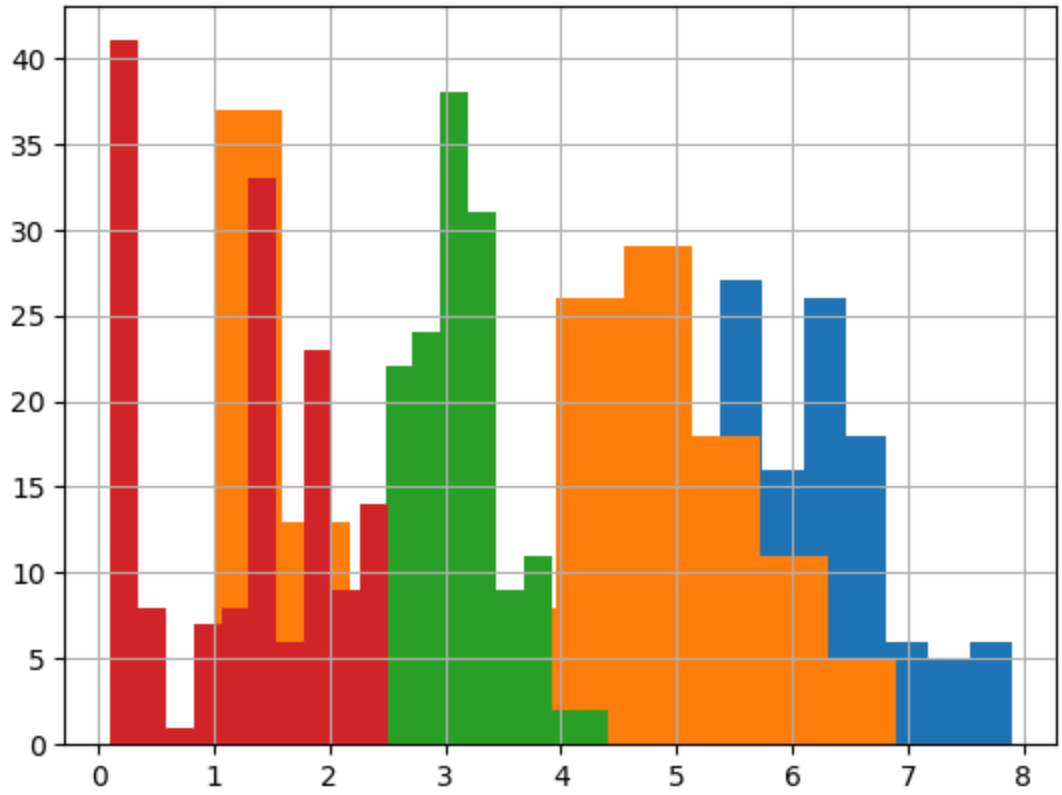
	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
count	150.000000	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667	1.000000
std	0.828066	0.433594	1.764420	0.763161	0.819232
min	4.300000	2.000000	1.000000	0.100000	0.000000
25%	5.100000	2.800000	1.600000	0.300000	0.000000
50%	5.800000	3.000000	4.350000	1.300000	1.000000
75%	6.400000	3.300000	5.100000	1.800000	2.000000
max	7.900000	4.400000	6.900000	2.500000	2.000000

In [31]:
```
df.info()
```

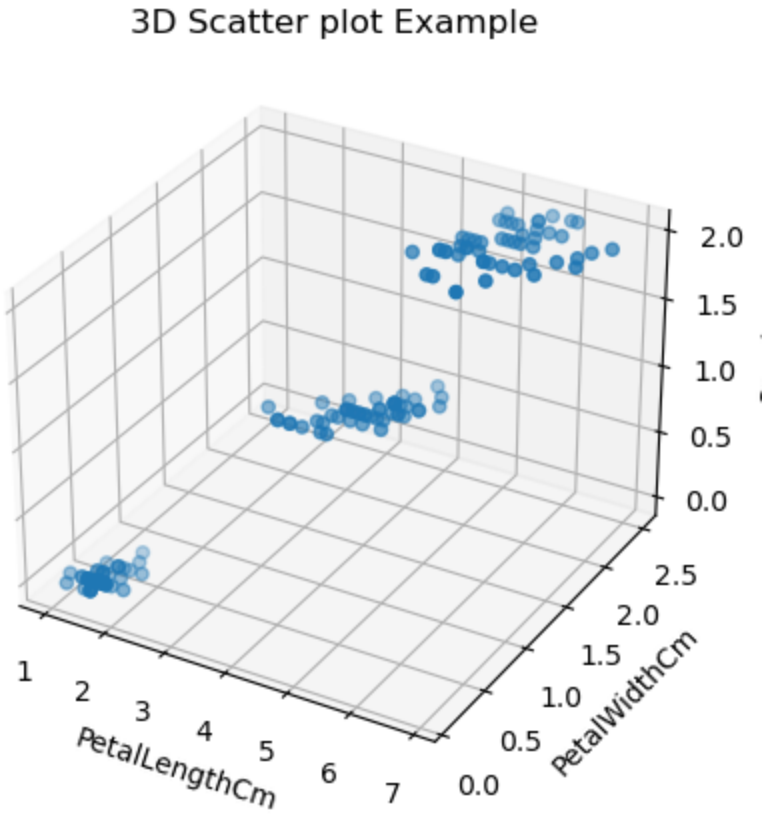
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   SepalLengthCm  150 non-null    float64
 1   SepalWidthCm   150 non-null    float64
 2   PetalLengthCm  150 non-null    float64
 3   PetalWidthCm   150 non-null    float64
 4   Species        150 non-null    int64
 5   cluster        150 non-null    int32
dtypes: float64(4), int32(1), int64(1)
memory usage: 6.6 KB
```

In [11]:
```
df['SepalLengthCm'].hist()
df['PetalLengthCm'].hist()
df['SepalWidthCm'].hist()
df['PetalWidthCm'].hist()
```

Out[11]:
```
<Axes: >
```

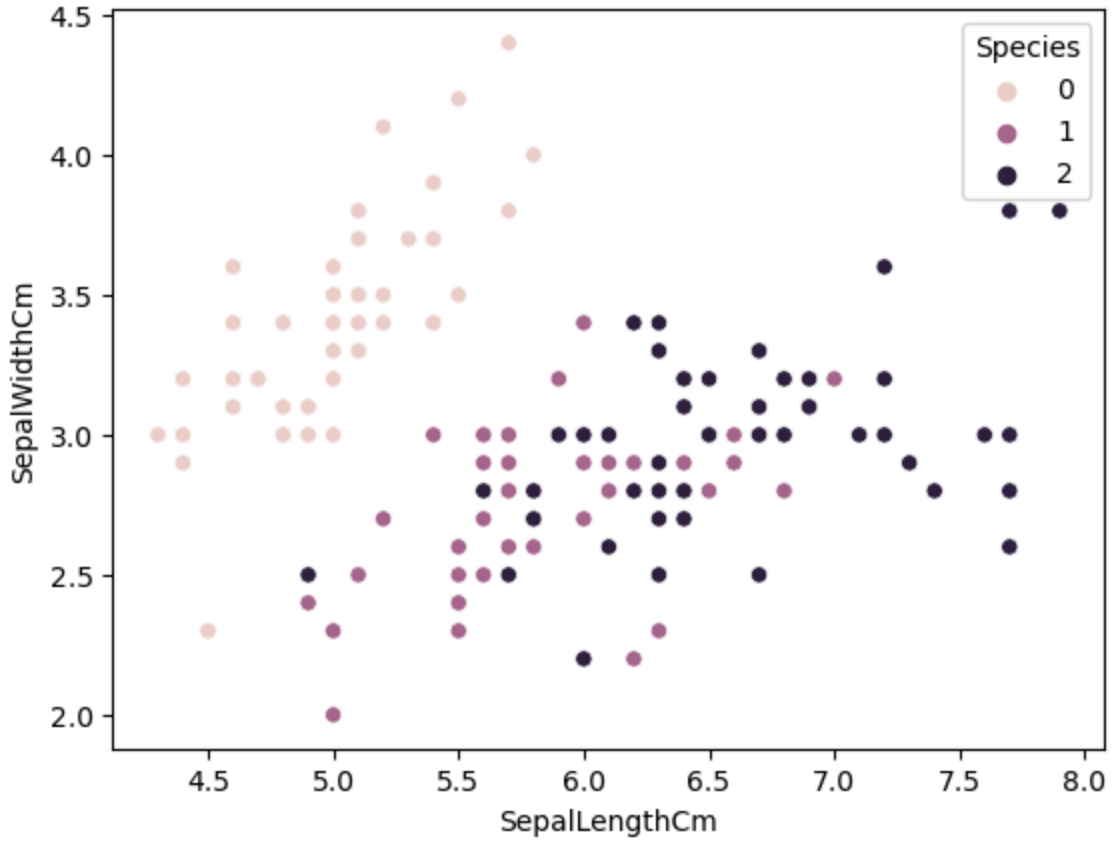


In [14]:
```
from mpl_toolkits.mplot3d import Axes3D
fig=plt.figure()
ax=fig.add_subplot(111,projection='3d')
ax.scatter(df.PetalLengthCm,df.PetalWidthCm,df.Species)
ax.set_xlabel('PetalLengthCm')
ax.set_ylabel('PetalWidthCm')
ax.set_zlabel('Species')
plt.title('3D Scatter plot Example')
plt.show()
```



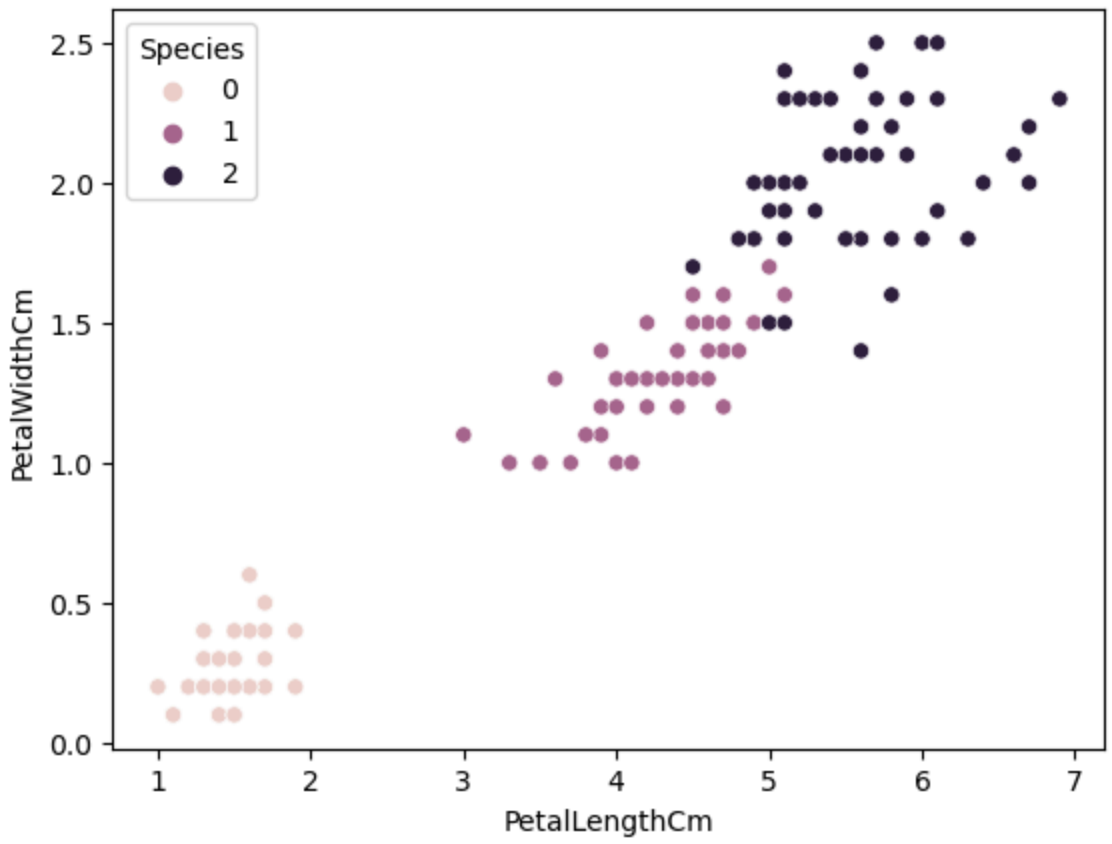

```
lot(data=df,x="SepalLengthCm",y="SepalWidthCm",hue="Species")
```

Out[16]: <Axes: xlabel='SepalLengthCm', ylabel='SepalWidthCm'>



In [17]:
```
sns.scatterplot(data=df,x="PetalLengthCm",y="PetalWidthCm",hue="Species")
```

Out[17]: <Axes: xlabel='PetalLengthCm', ylabel='PetalWidthCm'>



In [21]:
```
from sklearn.cluster import KMeans
k_rng=range(1,10)
sse=[]
```

```
for k in k_rng:
        km=KMeans(n_clusters=k)
        km.fit(df[['PetalLengthCm','PetalWidthCm']])
        sse.append(km.inertia_)
```

```
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
```

Loading [MathJax]/extensions/Safe.js

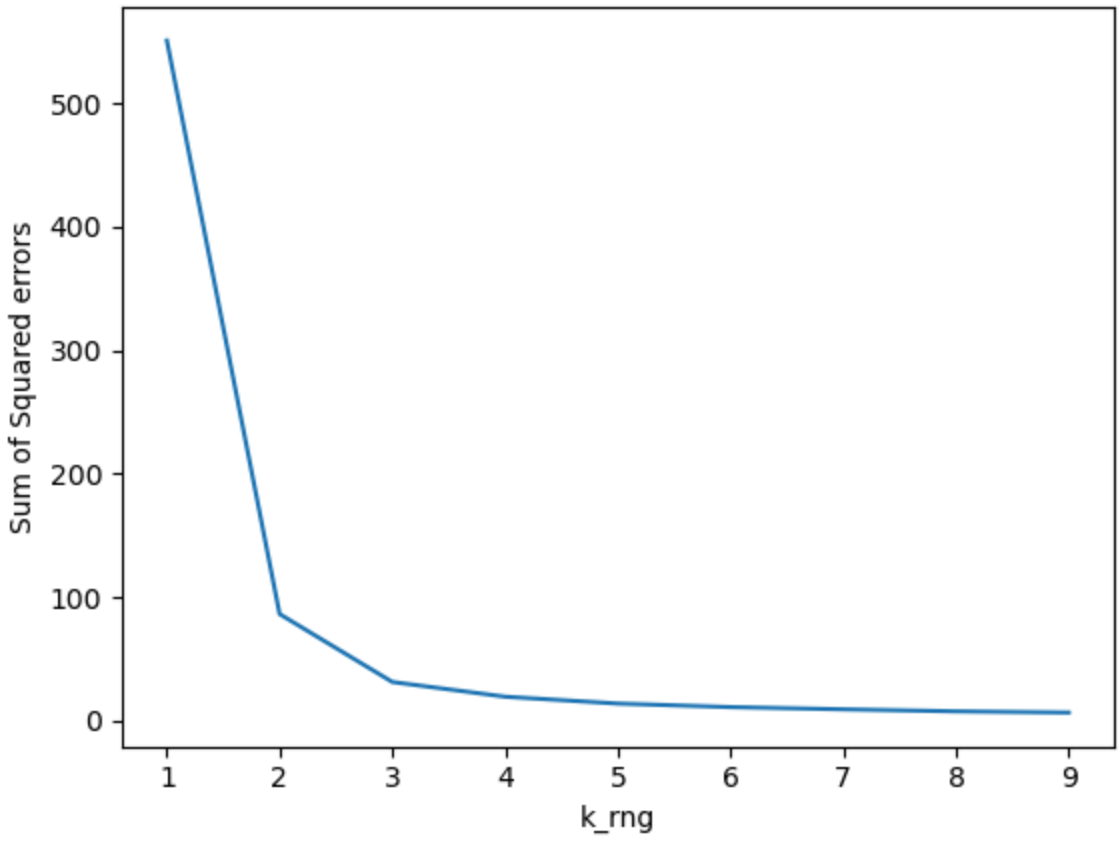
```
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
```

In [22]:
```
sse
```

Out[22]:
```
[550.6434666666668,
 86.40394533571002,
 31.387758974358984,
 19.48238901098901,
 13.93330875790876,
 11.067828739411807,
 9.266433398714177,
 7.631802244955955,
 6.649110835058662]
```

In [23]:
```
plt.xlabel('k_rng')
plt.ylabel("Sum of Squared errors")
plt.plot(k_rng,sse)
```

Out[23]:
```
[<matplotlib.lines.Line2D at 0x2415eec38d0>]
```



In [26]:
```
km=KMeans(n_clusters=3,random_state=0)
y_predicted=km.fit_predict(df[['PetalLengthCm','PetalWidthCm']])
y_predicted
```

```
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarnin
g: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of
`n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436: UserWarning:
KMeans is known to have a memory leak on Windows with MKL, when there are less chunks th
an available threads. You can avoid it by setting the environment variable OMP_NUM_THREA
DS=1.
  warnings.warn(
```

Out[26]:
```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 2, 2, 2, 2, 0, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2, 2, 2, 2, 2, 2, 0, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 0, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2])
```

In [28]:
```
df['cluster']=y_predicted
df.head(100)
```

Out[28]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species	cluster
0	5.1	3.5	1.4	0.2	0	1
1	4.9	3.0	1.4	0.2	0	1
2	4.7	3.2	1.3	0.2	0	1
3	4.6	3.1	1.5	0.2	0	1
4	5.0	3.6	1.4	0.2	0	1
...	...	...	...	...	...	...
95	5.7	3.0	4.2	1.2	1	0
96	5.7	2.9	4.2	1.3	1	0
97	6.2	2.9	4.3	1.3	1	0
98	5.1	2.5	3.0	1.1	1	0
99	5.7	2.8	4.1	1.3	1	0

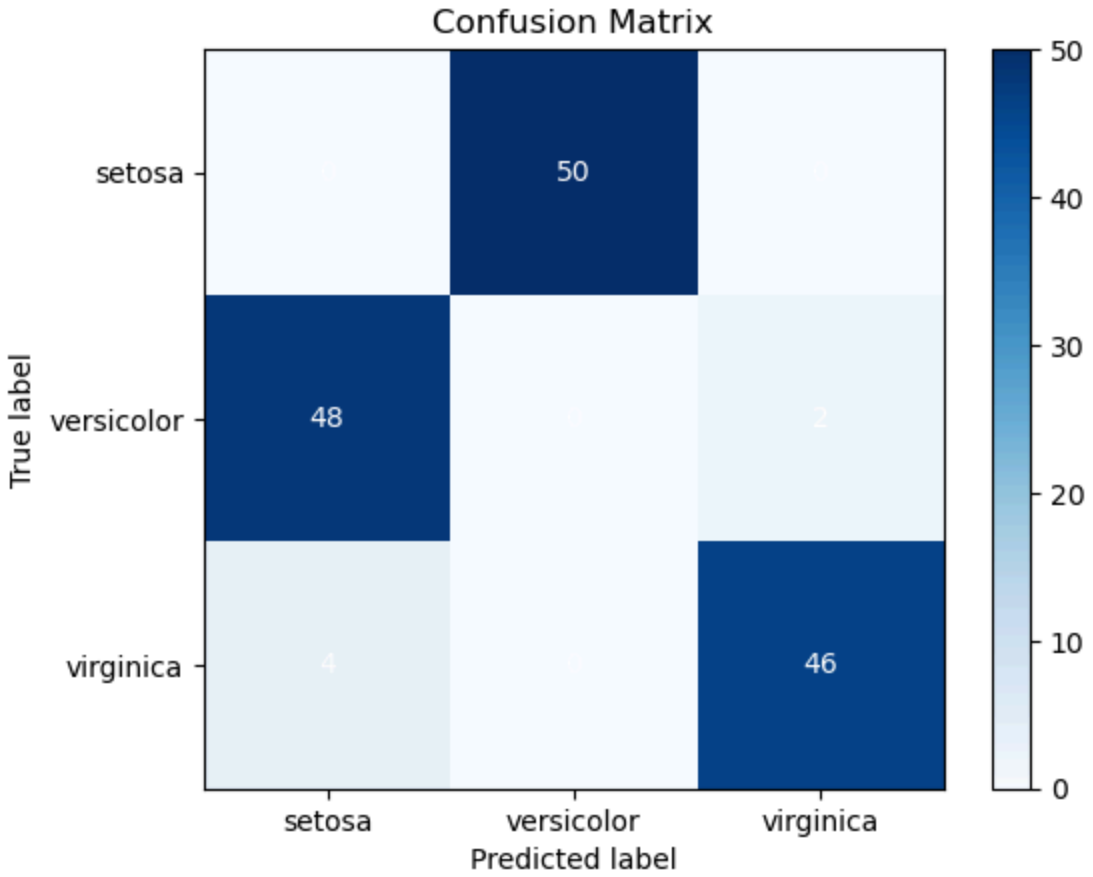
100 rows × 6 columns

In [30]:
```
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(df.Species,df.cluster)
cm
```

Out[30]:
```
array([[ 0, 50,  0],
       [48,  0,  2],
       [ 4,  0, 46]], dtype=int64)
```

In [34]:
```
true_labels=df.Species
predicted_labels=df.cluster

cm=confusion_matrix(true_labels,predicted_labels)
class_labels=['setosa','versicolor','virginica']

plt.imshow(cm,interpolation='nearest',cmap=plt.cm.Blues)
plt.title('Confusion Matrix')
plt.colorbar()
```

```
tick_marks=np.arange(len(class_labels))
plt.xticks(tick_marks,class_labels)
plt.yticks(tick_marks,class_labels)


for i in range(len(class_labels)):
    for j in range(len(class_labels)):
        plt.text(j,i,str(cm[i][j]),ha='center',va='center',color='White')

plt.xlabel('Predicted label')
plt.ylabel('True label')
plt.show()
```



In [ ]: