Breast Cancer

In [1]:

```
import pandas as pd
from matplotlib import pyplot as plt
%matplotlib inline
```

In [2]:

```
df=pd.read_csv(r"C:\Users\Svijayalakshmi\Downloads\BreastCancerPrediction.csv")
df
```

Out[2]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothn
0	842302	M	17.99	10.38	122.80	1001.0	
1	842517	M	20.57	17.77	132.90	1326.0	
2	84300903	M	19.69	21.25	130.00	1203.0	
3	84348301	M	11.42	20.38	77.58	386.1	
4	84358402	M	20.29	14.34	135.10	1297.0	
...	...	...	...	...	...	...	
564	926424	M	21.56	22.39	142.00	1479.0	
565	926682	M	20.13	28.25	131.20	1261.0	
566	926954	M	16.60	28.08	108.30	858.1	
567	927241	M	20.60	29.33	140.10	1265.0	
568	92751	B	7.76	24.54	47.92	181.0	

569 rows × 33 columns

In [3]:

```
df.head()
```

Out[3]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothnes
0	842302	M	17.99	10.38	122.80	1001.0	
1	842517	M	20.57	17.77	132.90	1326.0	
2	84300903	M	19.69	21.25	130.00	1203.0	
3	84348301	M	11.42	20.38	77.58	386.1	
4	84358402	M	20.29	14.34	135.10	1297.0	

5 rows × 33 columns

In [4]:

```
df.tail()
```

Out[4]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothnes
564	926424	M	21.56	22.39	142.00	1479.0	
565	926682	M	20.13	28.25	131.20	1261.0	
566	926954	M	16.60	28.08	108.30	858.1	
567	927241	M	20.60	29.33	140.10	1265.0	
568	92751	B	7.76	24.54	47.92	181.0	

5 rows × 33 columns

In [5]:

```
df.drop(['Unnamed: 32'],axis=1)
```

Out[5]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothn
0	842302	M	17.99	10.38	122.80	1001.0	
1	842517	M	20.57	17.77	132.90	1326.0	
2	84300903	M	19.69	21.25	130.00	1203.0	
3	84348301	M	11.42	20.38	77.58	386.1	
4	84358402	M	20.29	14.34	135.10	1297.0	
...	...	...	...	...	...	...	
564	926424	M	21.56	22.39	142.00	1479.0	
565	926682	M	20.13	28.25	131.20	1261.0	
566	926954	M	16.60	28.08	108.30	858.1	
567	927241	M	20.60	29.33	140.10	1265.0	
568	92751	B	7.76	24.54	47.92	181.0	

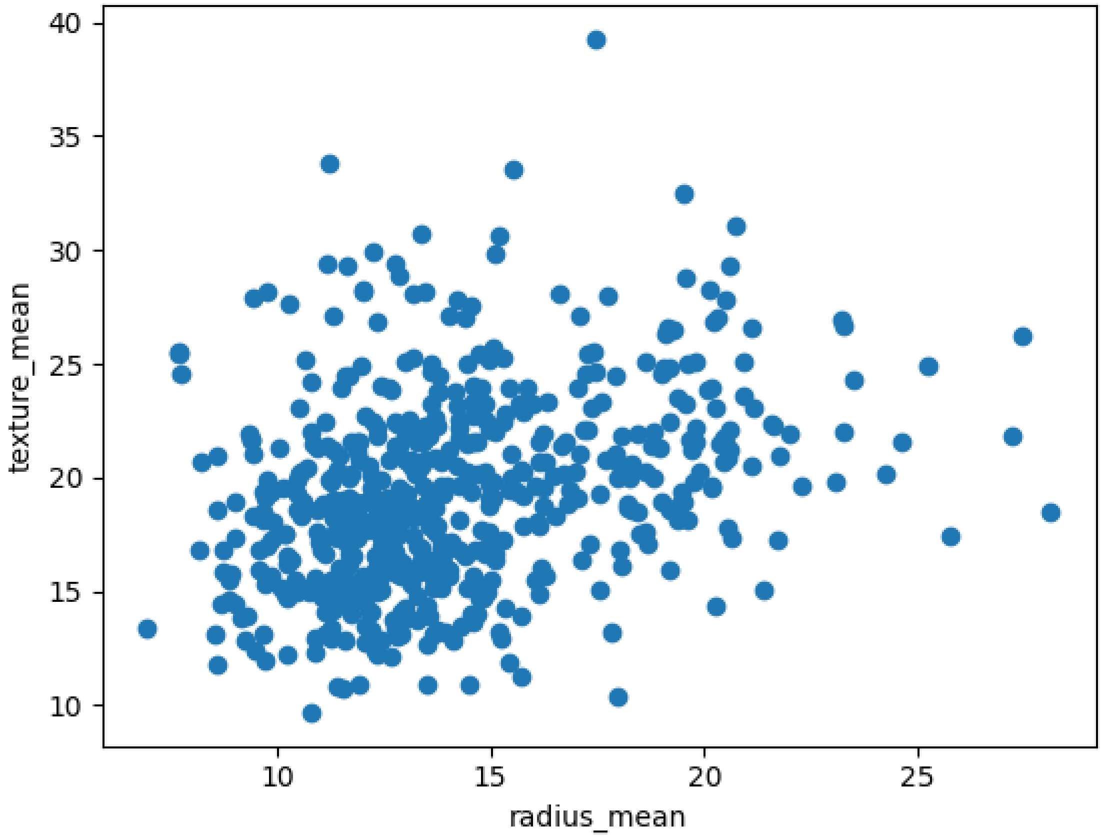
569 rows × 32 columns

In [6]:

```
plt.scatter(df["radius_mean"],df["texture_mean"])
plt.xlabel("radius_mean")
plt.ylabel("texture_mean")
```

Out[6]:

```
Text(0, 0.5, 'texture_mean')
```



In [7]:

```
from sklearn.cluster import KMeans
km=KMeans()
km
```

Out[7]:

```
KMeans()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.

On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [8]:

```
y_predicted=km.fit_predict(df[["radius_mean","texture_mean"]])
y_predicted
```

```
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
```

Out[8]:

```
array([1, 2, 2, 3, 2, 1, 2, 4, 0, 0, 4, 1, 7, 4, 0, 5, 4, 4, 2, 1, 1, 6,
       1, 7, 4, 1, 4, 2, 0, 1, 7, 3, 4, 7, 1, 4, 4, 3, 0, 4, 0, 0, 7, 4,
       0, 2, 3, 3, 6, 0, 0, 1, 3, 2, 4, 3, 2, 4, 3, 6, 6, 3, 4, 6, 0, 0,
       3, 3, 3, 1, 2, 6, 7, 1, 3, 4, 6, 1, 7, 3, 0, 1, 7, 7, 6, 2, 4, 7,
       0, 1, 0, 4, 1, 3, 4, 7, 3, 3, 6, 4, 0, 6, 3, 3, 3, 1, 3, 3, 2, 0,
       3, 0, 4, 3, 6, 0, 6, 1, 4, 2, 6, 2, 2, 6, 1, 1, 0, 2, 1, 7, 6, 4,
       4, 1, 2, 0, 3, 6, 1, 6, 6, 4, 3, 1, 6, 6, 3, 4, 1, 3, 0, 3, 6, 6,
       1, 3, 4, 4, 6, 6, 3, 2, 2, 0, 2, 4, 6, 4, 7, 1, 6, 3, 1, 6, 6, 6,
       3, 4, 0, 6, 2, 7, 4, 6, 4, 6, 2, 3, 3, 1, 0, 0, 3, 5, 4, 1, 0, 4,
       2, 4, 3, 4, 7, 0, 3, 1, 3, 4, 0, 1, 2, 3, 2, 7, 0, 1, 3, 3, 2, 7,
       1, 1, 3, 4, 1, 1, 6, 1, 0, 0, 4, 5, 5, 7, 6, 4, 7, 2, 5, 5, 1, 6,
       3, 0, 7, 3, 3, 6, 0, 6, 7, 3, 2, 1, 2, 1, 7, 1, 4, 5, 7, 4, 4, 4,
       4, 7, 3, 0, 1, 3, 1, 6, 2, 6, 7, 3, 6, 2, 3, 1, 7, 6, 2, 4, 1, 3,
       0, 6, 3, 3, 4, 4, 1, 3, 6, 1, 6, 3, 1, 0, 2, 3, 7, 3, 3, 0, 1, 6,
       6, 6, 3, 1, 6, 6, 3, 3, 6, 2, 3, 3, 6, 2, 6, 2, 6, 3, 1, 3, 4, 4,
       1, 3, 3, 6, 3, 4, 6, 2, 3, 7, 1, 3, 6, 2, 6, 6, 3, 1, 6, 6, 3, 4,
       2, 0, 6, 3, 3, 1, 6, 3, 3, 0, 3, 4, 1, 2, 7, 3, 2, 2, 4, 1, 2, 2,
       1, 1, 3, 5, 1, 3, 6, 6, 0, 3, 6, 0, 6, 1, 6, 7, 6, 3, 4, 2, 3, 1,
       3, 3, 6, 3, 4, 6, 3, 1, 6, 3, 1, 0, 2, 3, 3, 3, 0, 4, 5, 0, 0, 4,
       6, 0, 3, 1, 6, 3, 3, 0, 6, 0, 3, 3, 4, 3, 2, 2, 1, 4, 3, 1, 4, 1,
       3, 7, 1, 3, 2, 0, 7, 1, 4, 2, 0, 7, 5, 1, 3, 5, 5, 0, 0, 5, 7, 7,
       5, 3, 3, 4, 4, 3, 4, 3, 3, 5, 1, 5, 6, 1, 4, 1, 6, 4, 3, 4, 1, 1,
       1, 1, 1, 2, 3, 4, 0, 1, 2, 6, 4, 4, 3, 3, 2, 2, 1, 0, 1, 2, 6, 6,
       3, 3, 1, 4, 6, 1, 4, 1, 4, 3, 2, 2, 3, 1, 6, 2, 3, 3, 6, 6, 3, 6,
       1, 6, 3, 3, 1, 2, 3, 2, 0, 0, 0, 0, 6, 0, 0, 5, 4, 0, 3, 3, 3, 0,
       0, 0, 5, 0, 5, 5, 3, 5, 4, 0, 5, 5, 5, 7, 2, 7, 5, 7, 0])
```

In [9]:

```
df["cluster"]=y_predicted
df.head()
```

Out[9]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothnes
0	842302	M	17.99	10.38	122.80	1001.0	
1	842517	M	20.57	17.77	132.90	1326.0	
2	84300903	M	19.69	21.25	130.00	1203.0	
3	84348301	M	11.42	20.38	77.58	386.1	
4	84358402	M	20.29	14.34	135.10	1297.0	

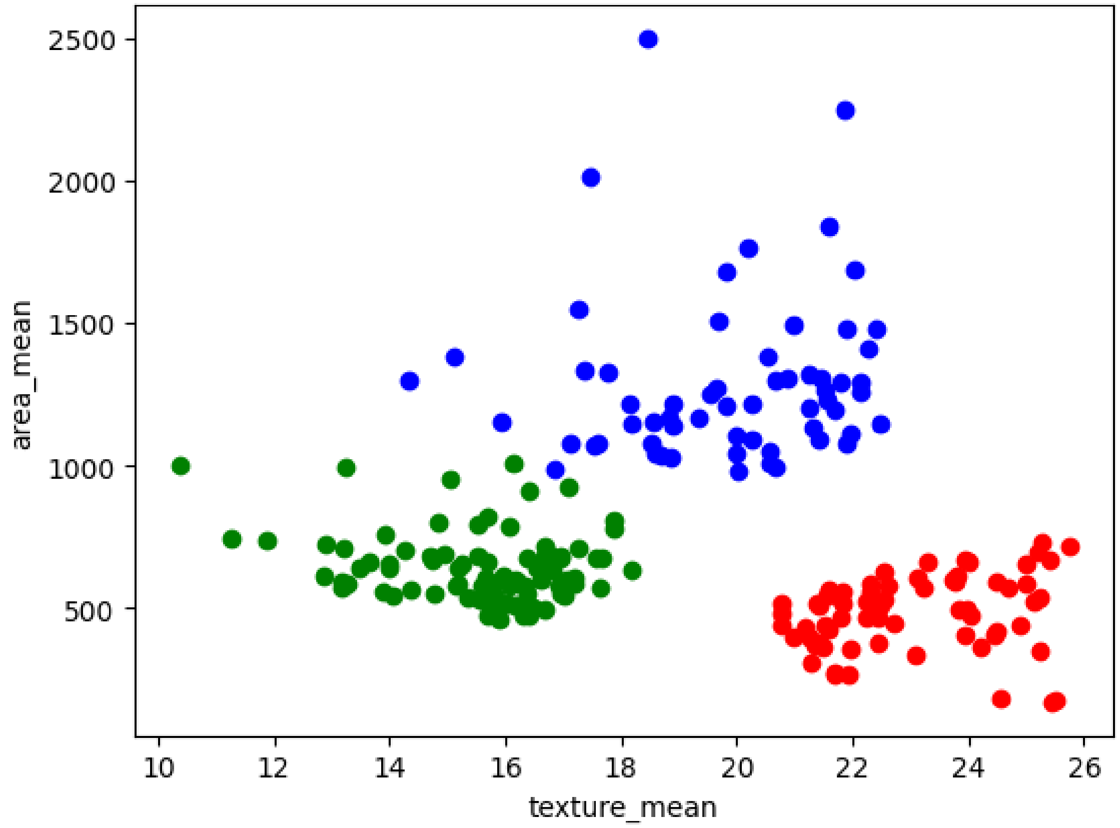
5 rows × 34 columns

In [10]:

```
df1=df[df.cluster==0]
df2=df[df.cluster==1]
df3=df[df.cluster==2]
plt.scatter(df1["texture_mean"],df1["area_mean"],color="red")
plt.scatter(df2["texture_mean"],df2["area_mean"],color="green")
plt.scatter(df3["texture_mean"],df3["area_mean"],color="blue")
plt.xlabel("texture_mean")
plt.ylabel("area_mean")
```

Out[10]:

```
Text(0, 0.5, 'area_mean')
```



In [11]:

```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler()
scaler.fit(df[["area_mean"]])
df["area_mean"]=scaler.transform(df[["area_mean"]])
df.head()
```

Out[11]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothnes
0	842302	M	17.99	10.38	122.80	0.363733	
1	842517	M	20.57	17.77	132.90	0.501591	
2	84300903	M	19.69	21.25	130.00	0.449417	
3	84348301	M	11.42	20.38	77.58	0.102906	
4	84358402	M	20.29	14.34	135.10	0.489290	

5 rows × 34 columns

In [12]:

```
scaler.fit(df[["texture_mean"]])
df["texture_mean"]=scaler.transform(df[["texture_mean"]])
df.head()
```

Out[12]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothnes
0	842302	M	17.99	0.022658	122.80	0.363733	
1	842517	M	20.57	0.272574	132.90	0.501591	
2	84300903	M	19.69	0.390260	130.00	0.449417	
3	84348301	M	11.42	0.360839	77.58	0.102906	
4	84358402	M	20.29	0.156578	135.10	0.489290	

5 rows × 34 columns

In [13]:

```
y_predicted=km.fit_predict(df[["texture_mean","area_mean"]])
y_predicted
```

```
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
```

Out[13]:

```
array([0, 4, 4, 6, 4, 0, 4, 7, 7, 7, 7, 2, 1, 7, 7, 5, 2, 2, 4, 0, 0, 0,
       0, 4, 2, 2, 7, 4, 7, 2, 1, 6, 1, 1, 2, 2, 7, 6, 7, 7, 7, 7, 1, 7,
       7, 4, 6, 6, 0, 7, 7, 0, 6, 4, 7, 6, 4, 7, 6, 0, 0, 6, 7, 0, 7, 7,
       6, 6, 6, 6, 4, 0, 1, 0, 6, 2, 0, 2, 1, 6, 7, 0, 3, 1, 0, 4, 7, 1,
       7, 0, 7, 7, 0, 6, 2, 4, 6, 6, 0, 2, 7, 0, 6, 6, 6, 0, 6, 6, 4, 7,
       6, 7, 2, 6, 0, 7, 0, 2, 7, 4, 0, 4, 3, 0, 0, 6, 7, 4, 2, 1, 0, 2,
       2, 0, 4, 7, 6, 0, 2, 0, 0, 2, 6, 0, 0, 0, 6, 2, 0, 6, 7, 6, 0, 0,
       0, 6, 4, 2, 0, 0, 6, 4, 4, 7, 3, 2, 0, 2, 1, 2, 0, 6, 0, 0, 0, 0,
       6, 2, 7, 0, 3, 1, 2, 0, 7, 0, 4, 6, 6, 0, 7, 7, 6, 5, 7, 0, 7, 4,
       4, 2, 6, 2, 3, 7, 6, 2, 6, 2, 7, 0, 4, 6, 3, 1, 7, 6, 6, 6, 4, 1,
       0, 0, 6, 2, 6, 0, 0, 0, 7, 7, 2, 5, 5, 1, 0, 7, 3, 4, 5, 5, 0, 0,
       6, 7, 1, 6, 6, 0, 7, 0, 1, 6, 4, 2, 4, 2, 1, 2, 7, 5, 1, 1, 4, 2,
       4, 1, 6, 7, 0, 6, 2, 0, 4, 0, 1, 6, 0, 4, 6, 0, 1, 0, 4, 2, 0, 6,
       7, 0, 6, 6, 2, 2, 0, 6, 0, 0, 0, 6, 2, 7, 4, 6, 1, 6, 6, 7, 0, 0,
       0, 0, 6, 0, 0, 0, 6, 6, 0, 4, 6, 6, 6, 4, 0, 4, 0, 6, 0, 6, 2, 2,
       2, 6, 6, 0, 6, 2, 0, 4, 6, 3, 2, 6, 0, 4, 0, 0, 6, 0, 0, 0, 6, 2,
       3, 7, 0, 6, 6, 0, 0, 6, 6, 7, 6, 2, 6, 4, 1, 6, 4, 4, 7, 0, 4, 4,
       0, 2, 6, 5, 0, 6, 0, 0, 7, 6, 0, 7, 0, 0, 0, 1, 0, 6, 2, 4, 6, 2,
       6, 6, 0, 6, 4, 0, 6, 0, 0, 6, 2, 7, 4, 6, 6, 6, 7, 7, 5, 7, 7, 2,
       0, 7, 6, 0, 0, 6, 6, 7, 0, 7, 6, 6, 7, 6, 4, 4, 2, 2, 6, 0, 2, 0,
       6, 1, 0, 6, 2, 7, 1, 2, 2, 4, 7, 1, 5, 0, 6, 5, 5, 7, 7, 5, 1, 3,
       5, 6, 6, 6, 7, 6, 1, 6, 6, 5, 0, 5, 0, 0, 7, 0, 0, 2, 6, 2, 0, 6,
       0, 6, 2, 4, 0, 2, 7, 2, 4, 0, 7, 2, 6, 6, 4, 4, 2, 7, 0, 3, 0, 0,
       6, 6, 2, 7, 0, 0, 7, 0, 2, 6, 4, 4, 6, 6, 0, 3, 6, 6, 0, 0, 6, 0,
       0, 0, 6, 6, 0, 4, 6, 4, 7, 7, 7, 7, 0, 7, 7, 5, 7, 7, 6, 6, 6, 7,
       7, 7, 5, 7, 5, 5, 6, 5, 7, 7, 5, 5, 5, 1, 4, 1, 1, 1, 7])
```

In [14]:

```
df["New Cluster"]=y_predicted
df.head()
```

Out[14]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothnes
0	842302	M	17.99	0.022658	122.80	0.363733	
1	842517	M	20.57	0.272574	132.90	0.501591	
2	84300903	M	19.69	0.390260	130.00	0.449417	
3	84348301	M	11.42	0.360839	77.58	0.102906	
4	84358402	M	20.29	0.156578	135.10	0.489290	

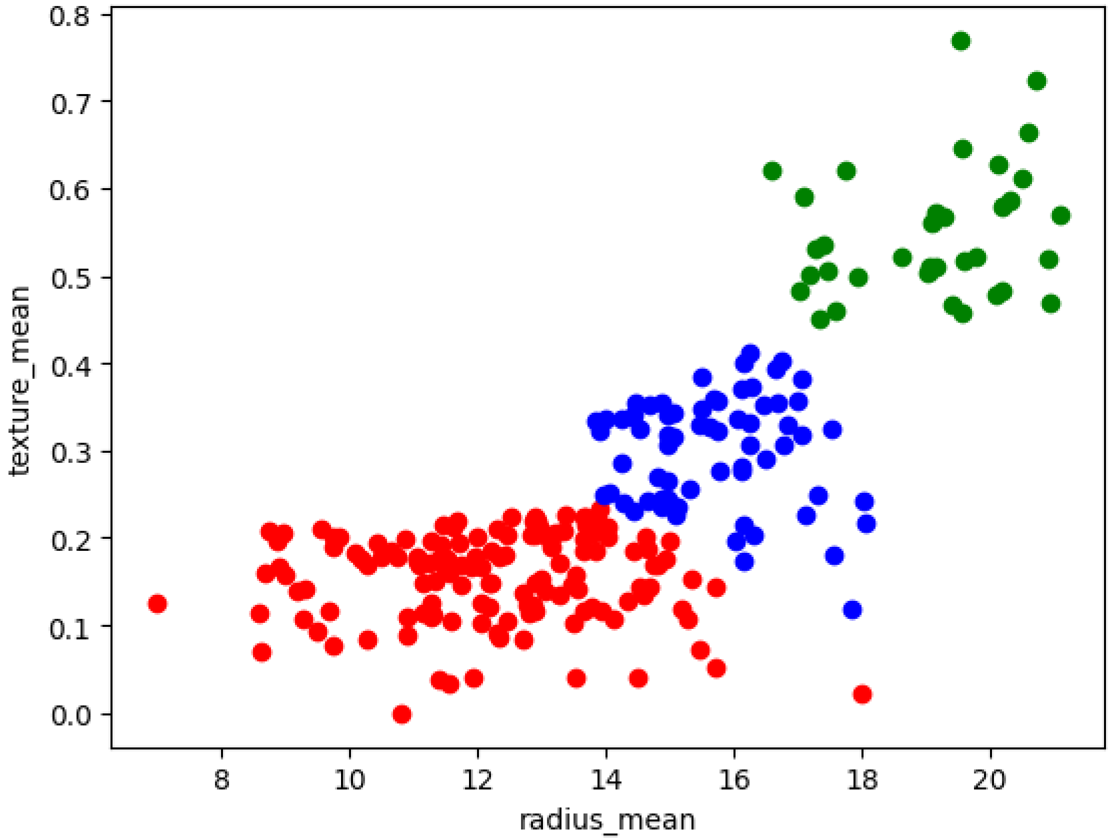
5 rows × 35 columns

In [15]:

```
df1=df[df["New Cluster"]==0]
df2=df[df["New Cluster"]==1]
df3=df[df["New Cluster"]==2]
plt.scatter(df1["radius_mean"],df1["texture_mean"],color="red")
plt.scatter(df2["radius_mean"],df2["texture_mean"],color="green")
plt.scatter(df3["radius_mean"],df3["texture_mean"],color="blue")
plt.xlabel("radius_mean")
plt.ylabel("texture_mean")
```

Out[15]:

```
Text(0, 0.5, 'texture_mean')
```



In [16]:

```
km.cluster_centers_
```

Out[16]:

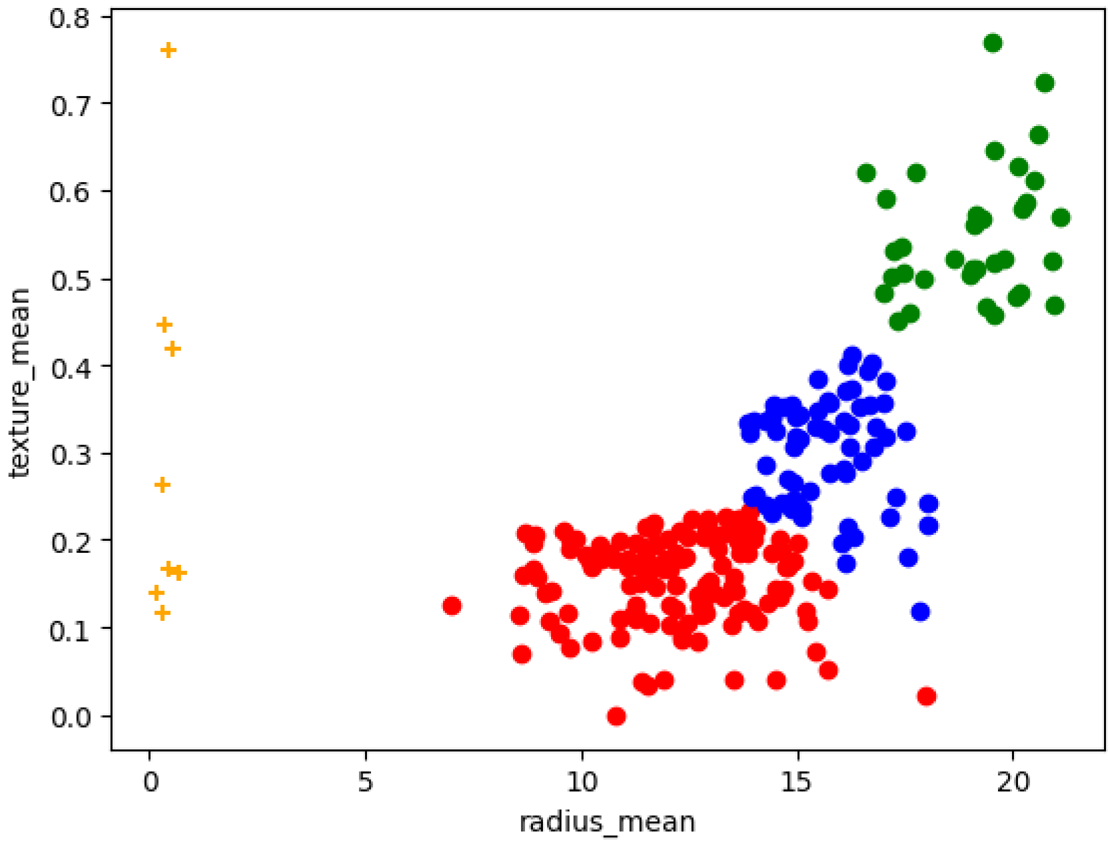
```
array([[0.15603556, 0.13917225],
       [0.54942751, 0.41952068],
       [0.29932961, 0.26343272],
       [0.43411115, 0.75956168],
       [0.35015782, 0.44572994],
       [0.66444031, 0.1620608 ],
       [0.29003781, 0.11701429],
       [0.43916131, 0.16610191]])
```

In [17]:

```
df1=df[df["New Cluster"]==0]
df2=df[df["New Cluster"]==1]
df3=df[df["New Cluster"]==2]
plt.scatter(df1["radius_mean"],df1["texture_mean"],color="red")
plt.scatter(df2["radius_mean"],df2["texture_mean"],color="green")
plt.scatter(df3["radius_mean"],df3["texture_mean"],color="blue")
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1],color="orange",marker="+")
plt.xlabel("radius_mean")
plt.ylabel("texture_mean")
```

Out[17]:

```
Text(0, 0.5, 'texture_mean')
```



In [18]:

```
k_rng=range(1,10)
sse=[]
```

In [19]:

```
for k in k_rng:
    km=KMeans(n_clusters=k)
    km.fit(df[["radius_mean","texture_mean"]])
    sse.append(km.inertia_)
#km.inertia_ will give you the value of sum of square error
print(sse)
plt.plot(k_rng,sse)
plt.xlabel("K")
plt.ylabel("Sum of Squared Error")
```

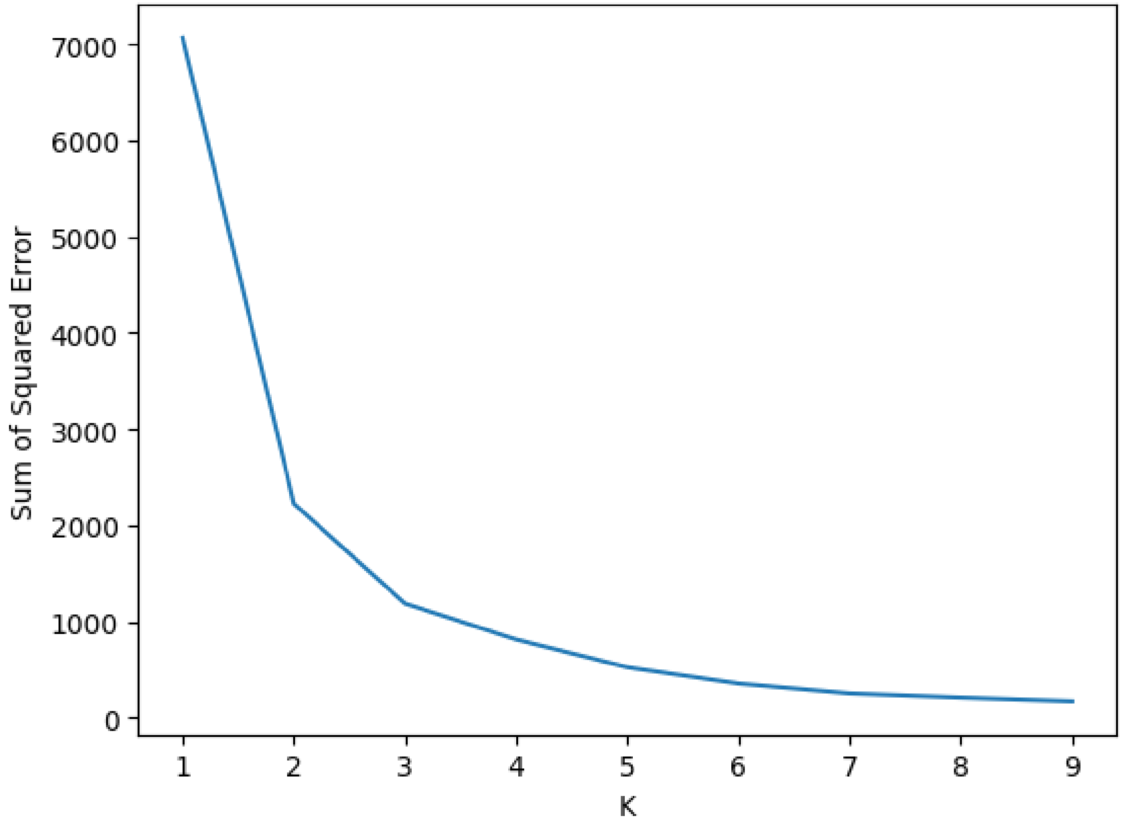
```
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(

[7065.963515529799, 2226.638890645259, 1187.9666138738194, 814.91876964654
52, 526.4261267325643, 358.2128380111053, 255.9722386393534, 213.107697178
18786, 175.0350771280773]
```

```
C:\Users\Svijayalakshmi\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value o
f `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
```

Out[19]:

```
Text(0, 0.5, 'Sum of Squared Error')
```


Sum of Squared Error
K