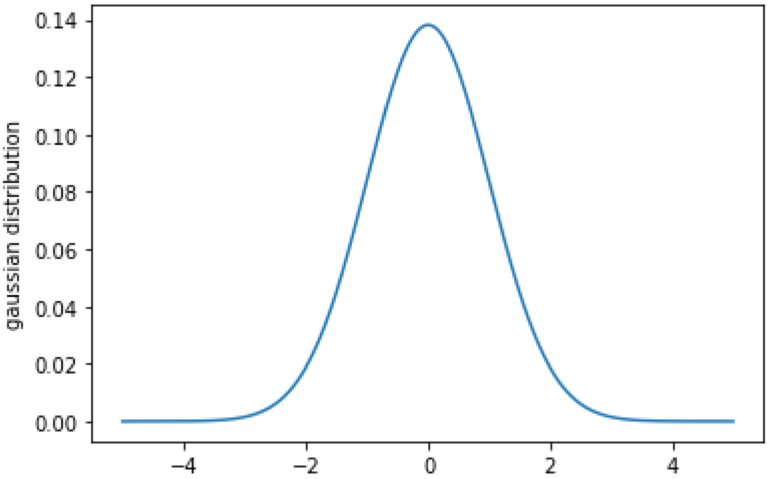
Assignment No :- 02

Title :- Plot the Normal Distribution for class test result of a particular subject. Identify the Skewness and Kurtosis

Plotting Normal Distribution

In [8]:

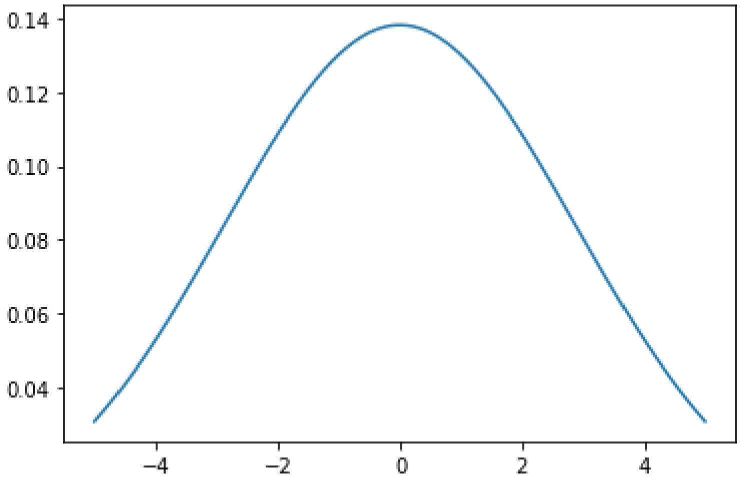
```
import numpy as np
import matplotlib.pyplot as plt
import statistics

x = np.arange(-5,5,.01)

# Calculating mean and standard deviation
mean = statistics.mean(x)
sd = statistics.stdev(x)
variance = np.square(sd)

f = np.exp(-0.5*np.square(x-mean/sd))/(sd*np.sqrt(2*np.pi))

plt.plot(x,f)
plt.ylabel('gaussian distribution')
plt.show()
```



Using Scipy module

In [3]:

```
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import norm
import statistics

# Plot between -10 and 10 with .001 steps.
x_axis = np.arange(-5,5,.01)

# Calculating mean and standard deviation
mean = statistics.mean(x_axis)
sd = statistics.stdev(x_axis)

plt.plot(x_axis, norm.pdf(x_axis, mean, sd))
plt.show()
```



Lab 2

Plotting Normal distribution of Test Results for Science subject

In [9]:

```
# Importing the necessary libraries
import numpy as np
import pandas as pd
from scipy.stats import kurtosis, skew, norm

# loading the dataset
df= pd.read_csv('results.csv',index_col=0,dtype=float) # index_col=0 takes 1s
df.describe()
```

Out[9]:

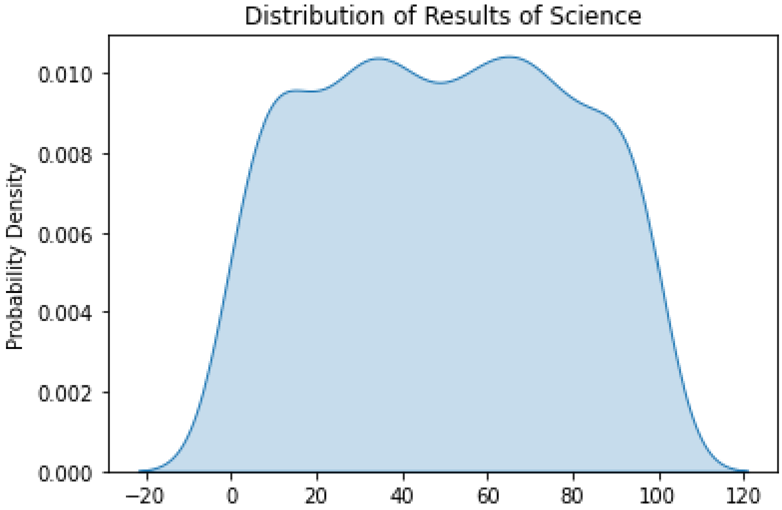
	Hindi	English	Science	Maths	History	Geograpgy	Total
count	1000.000000	1000.000000	1000.000000	1000.000000	1000.00000	1000.000000	1000.00000C
mean	51.645000	50.110000	49.440000	49.553000	49.03400	50.028000	299.81000C
std	29.471912	28.048505	28.921114	28.632447	28.76975	28.710268	71.865239
min	0.000000	0.000000	0.000000	0.000000	0.00000	0.000000	103.00000C
25%	26.000000	26.000000	25.000000	25.750000	24.00000	26.000000	254.00000C
50%	53.000000	50.500000	50.000000	49.000000	49.00000	49.000000	296.00000C
75%	77.000000	75.000000	73.250000	74.000000	73.25000	75.000000	349.25000C
max	99.000000	99.000000	99.000000	99.000000	99.00000	99.000000	505.00000C

In [10]:

```
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import statistics

sub = np.array(df['Science'])   # loading entries of Science subject into sub

#print(x)
# Calculating mean and standard deviation
mn = statistics.mean(sub)
std = statistics.stdev(sub)
variance = np.square(std)

print("Mean:", mn)
print("Std Dev:", std)
```

```
print("Variance:", variance)

#f = np.exp(-0.5*np.square(x-mn/std))/(std*np.sqrt(2*np.pi))

#plt.plot(x,f)
'''
plt.plot(sub,norm.pdf(sub,mn,std))   # from scipy.stats we use norm.pdf
plt.xlim([-50, 150])
plt.ylim([0, 0.02])
plt.title('Normal distribution')
'''
plt.title('Distribution of Results of Science')
sns.kdeplot(sub,shade=True)     # kernel density estimation
#sns.kdeplot(df['Maths'])
#plt.xlabel('Science Marks')
plt.ylabel('Probability Density')
plt.show()
```

```
Mean: 49.44
Std Dev: 28.921113927904486
Variance: 836.4308308308308
```



Skewness and Kurtosis with pandas

In [11]:

```
#calculation skewness and kurtosis for Maths subject
ku = df['Science'].kurt()
print("Kurtosis for Science: ",ku)
sk = df['Science'].skew()
print("Skewness for Science: ",sk)
```

```
Kurtosis for Science:  -1.178566396468201
Skewness for Science:  0.008994125306680551
```

Skewness and Kurtosis with scipy.stats

In [12]:

```
print("Kurtosis for Science: ",kurtosis(df['Science'],bias=False))   # False
print("Skewness for Science: ",skew(df['Science'],bias=False))
```

```
Kurtosis for Science:  -1.178566396468201
Skewness for Science:  0.008994125306680551
```

IMPLEMENTING THE FORMULA

In [13]:

```
from math import sqrt
n= len(sub)   # count of students
```

```
def moment(data, k):       # calculates kth moment for data
  data_mean = sum(data)/len(data)
  return sum((d-data_mean)**k for d in data)/len(data)

def skw(data):             # uses moment fn to find population skewness
  return moment(data, 3)/(moment(data, 2)**1.5)

def kurto(data):
  return moment(data,4)/(moment(data, 2)**2)

print("Popluation Skewness of Science:",skw(sub))
print("Population Kurtosis of Science:",kurto(sub))
print("\n")

g2 = kurto(sub)-3       # excess kurtosis
print("Sample Skewness of Science:",skw(sub)*(sqrt(n*(n-1))/(n-2))) #Sample S
print("Population Excess Kurtosis of Science:",g2) # From library fn Kurtosis
print("Sample Excess Kurtosis of Science:",(6+g2*(n+1))*((n-1)/((n-2)*(n-3)))
```

```
Popluation Skewness of Science: 0.008980628493454167
Population Kurtosis of Science: 1.8213241854399451


Sample Skewness of Science: 0.0089941253066806
Population Excess Kurtosis of Science: -1.1786758145600549
Sample Excess Kurtosis of Science: -1.1785663964682025
```

Conclusion

Since both Population and Sample Skewness is very low, data is almost Symmetrical (Very Slightly Right Skewed).

Since both Population and Sample Excess Kurtosis is -ve, data distribution is short-tailed (Platykurtic)

In [ ]: