Importing libraries

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
```

In [2]:

```
df = pd.read_csv("C:\\Users\\Lenovo\\Downloads\\NSE-TATAGLOBAL.csv")
df
```

Out[2]:

	Date	Open	High	Low	Last	Close	Total Trade Quantity	Turnover (Lacs)
0	2018-09-28	234.05	235.95	230.20	233.50	233.75	3069914	7162.35
1	2018-09-27	234.55	236.80	231.10	233.80	233.25	5082859	11859.95
2	2018-09-26	240.00	240.00	232.50	235.00	234.25	2240909	5248.60
3	2018-09-25	233.30	236.75	232.00	236.25	236.10	2349368	5503.90
4	2018-09-24	233.55	239.20	230.75	234.00	233.30	3423509	7999.55
...	...	...	...	...	...	...	...	...
2030	2010-07-27	117.60	119.50	112.00	118.80	118.65	586100	694.98
2031	2010-07-26	120.10	121.00	117.10	117.10	117.60	658440	780.01
2032	2010-07-23	121.80	121.95	120.25	120.35	120.65	281312	340.31
2033	2010-07-22	120.30	122.00	120.25	120.75	120.90	293312	355.17
2034	2010-07-21	122.10	123.00	121.05	121.10	121.55	658666	803.56

2035 rows × 8 columns

In [3]:

```
df.head()
```

Out[3]:

	Date	Open	High	Low	Last	Close	Total Trade Quantity	Turnover (Lacs)
0	2018-09-28	234.05	235.95	230.20	233.50	233.75	3069914	7162.35
1	2018-09-27	234.55	236.80	231.10	233.80	233.25	5082859	11859.95
2	2018-09-26	240.00	240.00	232.50	235.00	234.25	2240909	5248.60
3	2018-09-25	233.30	236.75	232.00	236.25	236.10	2349368	5503.90
4	2018-09-24	233.55	239.20	230.75	234.00	233.30	3423509	7999.55

In [4]:

```
df.describe()
```

Out[4]:

	Open	High	Low	Last	Close	Total Trade Quantity	Tu
count	2035.000000	2035.000000	2035.000000	2035.000000	2035.00000	2.035000e+03	2035.
mean	149.713735	151.992826	147.293931	149.474251	149.45027	2.335681e+06	3899.
std	48.664509	49.413109	47.931958	48.732570	48.71204	2.091778e+06	4570.
min	81.100000	82.800000	80.000000	81.000000	80.95000	3.961000e+04	37.
25%	120.025000	122.100000	118.300000	120.075000	120.05000	1.146444e+06	1427.
50%	141.500000	143.400000	139.600000	141.100000	141.25000	1.783456e+06	2512.
75%	157.175000	159.400000	155.150000	156.925000	156.90000	2.813594e+06	4539.
max	327.700000	328.750000	321.650000	325.950000	325.75000	2.919102e+07	55755.

In [5]:

```
df.shape
```

Out[5]:

```
(2035, 8)
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2035 entries, 0 to 2034
Data columns (total 8 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   Date                  2035 non-null   object 
 1   Open                  2035 non-null   float64
 2   High                  2035 non-null   float64
 3   Low                   2035 non-null   float64
 4   Last                  2035 non-null   float64
 5   Close                 2035 non-null   float64
 6   Total Trade Quantity  2035 non-null   int64  
 7   Turnover (Lacs)       2035 non-null   float64
dtypes: float64(6), int64(1), object(1)
memory usage: 127.3+ KB
```

In [7]:

```
df.isnull().sum()
```

Out[7]:

```
Date                    0
Open                    0
High                    0
Low                     0
Last                    0
Close                   0
Total Trade Quantity    0
Turnover (Lacs)         0
dtype: int64
```

Sorting Data

In [8]:

```
df['Date'] = pd.to_datetime(df['Date'], errors='coerce')
print(type(df.Date[0]))
```

```
<class 'pandas._libs.tslibs.timestamps.Timestamp'>
```

In [9]:

```
df.sort_values(by=['Date'],inplace=True,ascending=True)
df.Date.head()
```

Out[9]:

```
2034   2010-07-21
2033   2010-07-22
2032   2010-07-23
2031   2010-07-26
2030   2010-07-27
Name: Date, dtype: datetime64[ns]
```

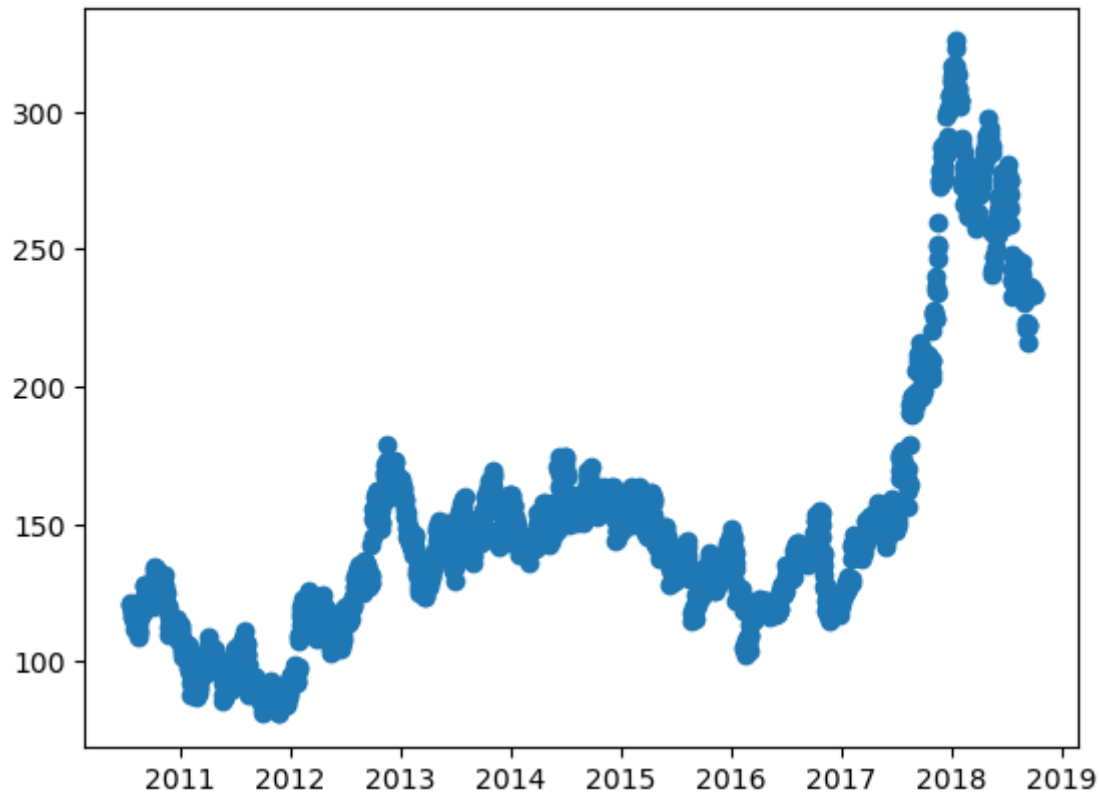
Data Visualization

In [10]:

```
fig,ax=plt.subplots()
ax.scatter(df.Date,df.Close)
```

Out[10]:

```
<matplotlib.collections.PathCollection at 0x1fa500411d0>
```



In [11]:

```
df.reset_index(inplace=True)
df
```

Out[11]:

	index	Date	Open	High	Low	Last	Close	Total Trade Quantity	Turnover (Lacs)
0	2034	2010-07-21	122.10	123.00	121.05	121.10	121.55	658666	803.56
1	2033	2010-07-22	120.30	122.00	120.25	120.75	120.90	293312	355.17
2	2032	2010-07-23	121.80	121.95	120.25	120.35	120.65	281312	340.31
3	2031	2010-07-26	120.10	121.00	117.10	117.10	117.60	658440	780.01
4	2030	2010-07-27	117.60	119.50	112.00	118.80	118.65	586100	694.98
...	...	...	...	...	...	...	...	...	...
2030	4	2018-09-24	233.55	239.20	230.75	234.00	233.30	3423509	7999.55
2031	3	2018-09-25	233.30	236.75	232.00	236.25	236.10	2349368	5503.90
2032	2	2018-09-26	240.00	240.00	232.50	235.00	234.25	2240909	5248.60
2033	1	2018-09-27	234.55	236.80	231.10	233.80	233.25	5082859	11859.95
2034	0	2018-09-28	234.05	235.95	230.20	233.50	233.75	3069914	7162.35

2035 rows × 9 columns

Univariate analysis of Closing Price

In [12]:

```
close_df=df['Close']
close_df
```

Out[12]:

```
0       121.55
1       120.90
2       120.65
3       117.60
4       118.65
         ...
2030    233.30
2031    236.10
2032    234.25
2033    233.25
2034    233.75
Name: Close, Length: 2035, dtype: float64
```

In [13]:

```
close_df.size
```

Out[13]:

```
2035
```

In [14]:

```
close_df.shape
```

Out[14]:

```
(2035,)
```

In [15]:

```
close_df.describe()
```

Out[15]:

```
count    2035.00000
mean      149.45027
std        48.71204
min        80.95000
25%       120.05000
50%       141.25000
75%       156.90000
max       325.75000
Name: Close, dtype: float64
```

Min Max Scaler

In [16]:

```
scaler=MinMaxScaler(feature_range=(0,1))
close_df=scaler.fit_transform(np.array(close_df).reshape(-1,1))
close_df
```

Out[16]:

```
array([[0.16584967],
       [0.16319444],
       [0.1621732 ],
       ...,
       [0.62622549],
       [0.62214052],
       [0.62418301]])
```

Train and Test Split

In [17]:

```
training_size=int(len(close_df)*0.7)
test_size=len(close_df)-training_size
train_data,test_data=close_df[0:training_size,:],close_df[training_size:len(close_df),:1]
```

In [18]:

```
train_data.shape,close_df.shape
```

Out[18]:

```
((1424, 1), (2035, 1))
```

In [19]:

```
test_data.shape
```

Out[19]:

```
(611, 1)
```

In [20]:

```
type(test_data)
```

Out[20]:

```
numpy.ndarray
```

Data Preprocessing

In [21]:

```
import numpy as np
def create_dataset(dataset, time_step=1):
    dataX=[]
    dataY=[]
    for i in range(len(dataset)-time_step-1):
        a = dataset[i:(i+time_step), 0]
        dataX.append(a)
        dataY.append(dataset[i + time_step, 0])
    return np.array(dataX), np.array(dataY)
time_step = 100
X_train, y_train = create_dataset(train_data, time_step)#reshaping into tuples
X_test, ytest = create_dataset(test_data, time_step)
```

In [22]:

```
X_test, ytest = create_dataset(test_data, time_step)
y_train.shape
```

Out[22]:

```
(1323,)
```

In [23]:

```
X_train.shape
```

Out[23]:

```
(1323, 100)
```

In [24]:

```
print(X_test.shape)
```

```
(510, 100)
```

In [25]:

```
 print(ytest.shape)
```

```
(510,)
```

In [26]:

```
X_train=X_train.reshape(X_train.shape[0],X_train.shape[1],1)
X_test=X_test.reshape(X_test.shape[0],X_test.shape[1],1)
```

Creating the stacked LSTM Model

In [27]:

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM

model=Sequential()
model.add(LSTM(50,return_sequences=True,input_shape=(time_step,1)))#input layer with 50 r
model.add(LSTM(50,return_sequences=True)) #hidden layers with 50 neurons
model.add(LSTM(50))
model.add(Dense(1))#output layer
model.compile(loss='mean_squared_error',optimizer='adam')
```

In [28]:

```
model = Sequential()
model.add(LSTM(50, return_sequences=True, input_shape=(100,1)))
model.add(LSTM(50, return_sequences=True, input_shape=(100,1)))
model.add(LSTM(50))
model.add(Dense(1))
model.compile(loss='mean_squared_error', optimizer='adam', metrics='acc')
```

In [29]:

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm_3 (LSTM)               (None, 100, 50)           10400

 lstm_4 (LSTM)               (None, 100, 50)           20200

 lstm_5 (LSTM)               (None, 50)                20200

 dense_1 (Dense)             (None, 1)                 51

=================================================================
Total params: 50851 (198.64 KB)
Trainable params: 50851 (198.64 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

In [30]:

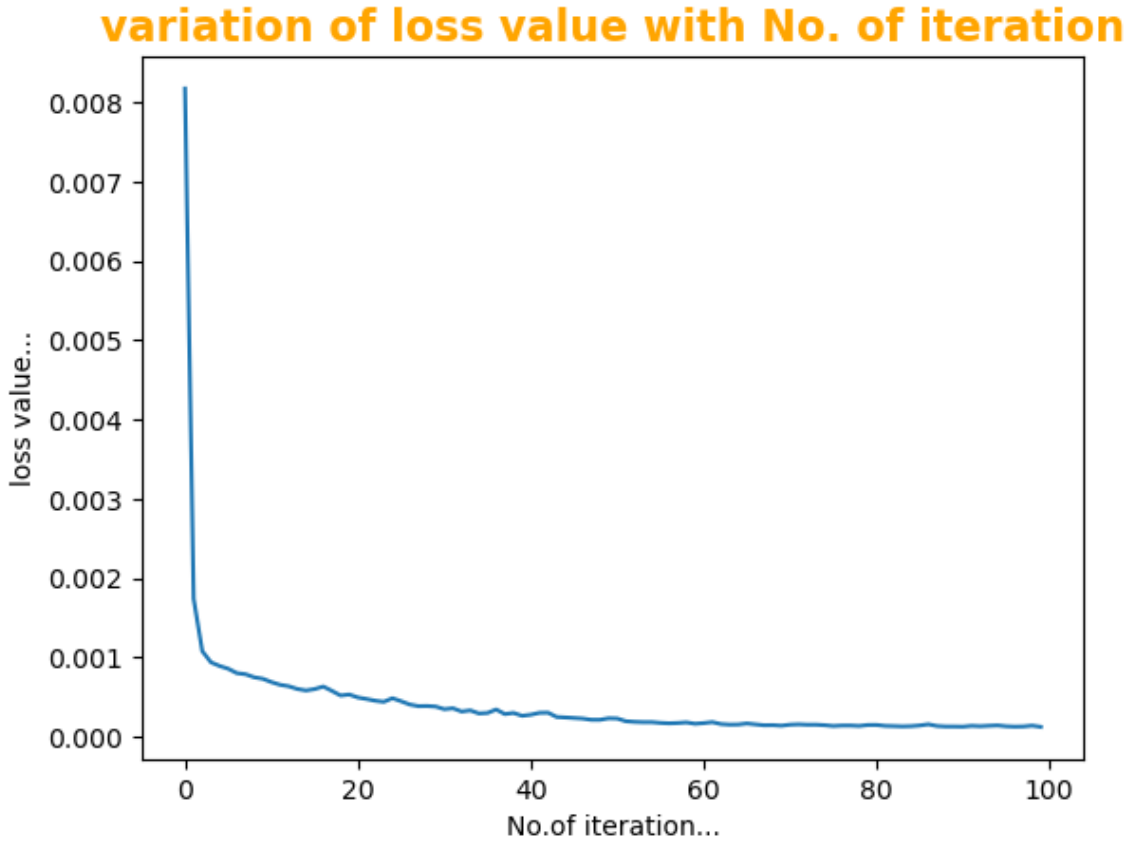
```
model.fit(X_train, y_train, validation_data = (X_test, ytest), epochs =100, batch_size =
```

```
Epoch 1/100
21/21 [==============================] - 12s 311ms/step - loss: 0.0082 -
acc: 7.5586e-04 - val_loss: 0.0108 - val_acc: 0.0020
Epoch 2/100
21/21 [==============================] - 5s 266ms/step - loss: 0.0017 -
acc: 7.5586e-04 - val_loss: 0.0069 - val_acc: 0.0020
Epoch 3/100
21/21 [==============================] - 6s 300ms/step - loss: 0.0011 -
acc: 7.5586e-04 - val_loss: 0.0031 - val_acc: 0.0020
Epoch 4/100
21/21 [==============================] - 7s 311ms/step - loss: 9.4067e-0
4 - acc: 7.5586e-04 - val_loss: 0.0053 - val_acc: 0.0020
Epoch 5/100
21/21 [==============================] - 6s 280ms/step - loss: 8.9481e-0
4 - acc: 7.5586e-04 - val_loss: 0.0043 - val_acc: 0.0020
Epoch 6/100
21/21 [==============================] - 6s 287ms/step - loss: 8.5967e-0
4 - acc: 7.5586e-04 - val_loss: 0.0038 - val_acc: 0.0020
Epoch 7/100
```

evaluation of constructed LSTM model

In [31]:

```
#ploting loss of our trained model
loss=model.history.history['loss']
plt.plot(loss)
plt.xlabel("No.of iteration...")
plt.ylabel("loss value...")
plt.title("variation of loss value with No. of iteration",color="orange",fontsize=16,font
```



Evaluation of our constructed model on train and test data

In [32]:

```
train_predict1=model.predict(X_train)
```

```
42/42 [==============================] - 3s 50ms/step
```

In [33]:

```
test_predict1=model.predict(X_test)
```

```
16/16 [==============================] - 1s 44ms/step
```

In [34]:

```
#Transformback to original form
train_predict1=scaler.inverse_transform(train_predict1)
test_predict1=scaler.inverse_transform(test_predict1)
```

In [35]:

```
import math
from sklearn.metrics import mean_squared_error
math.sqrt(mean_squared_error(y_train,train_predict1))
```

Out[35]:

```
133.82520994387295
```

In [36]:

```
close_df
```

Out[36]:

```
array([[0.16584967],
       [0.16319444],
       [0.1621732 ],
       ...,
       [0.62622549],
       [0.62214052],
       [0.62418301]])
```

In [37]:

```
train_predict1.shape
```

Out[37]:

```
(1323, 1)
```

Plotting

In [38]:

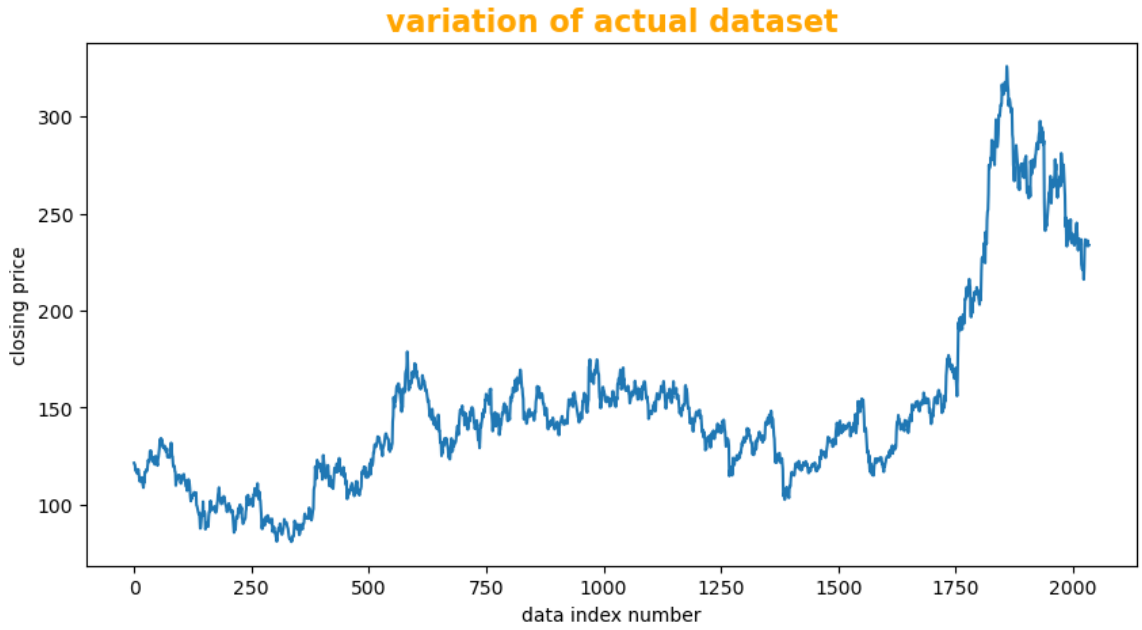
```
# shift train predictions for plotting
look_back=100
trainPredictPlot = np.empty_like(close_df)
trainPredictPlot[:, :] = np.nan
trainPredictPlot[look_back:len(train_predict1)+look_back, :] = train_predict1

# shift test predictions for plotting
testPredictPlot = np.empty_like(close_df)
testPredictPlot[:, :] = np.nan
testPredictPlot[len(train_predict1)+(look_back*2)+1:len(df)-1, :] = test_predict1
```

In [39]:

```
# plot baseline and predictions
plt.figure(figsize=(10,5))
plt.plot(scaler.inverse_transform(close_df))
plt.title("variation of actual dataset",color="orange",fontsize=16,fontweight="bold")
plt.xlabel("data index number")
plt.ylabel("closing price")
```

Out[39]:

```
Text(0, 0.5, 'closing price')
```



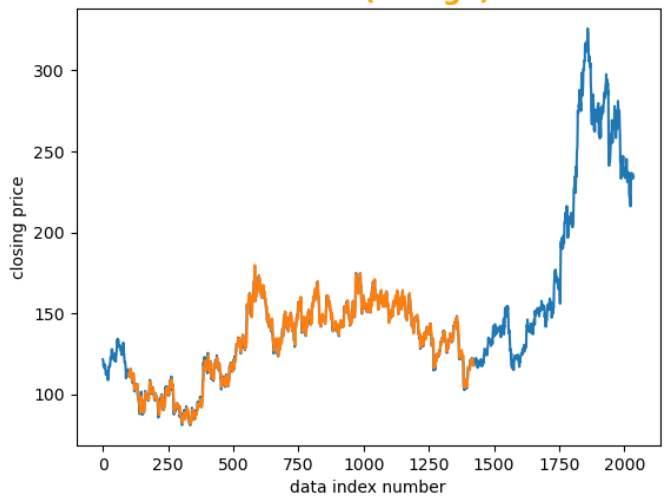
In [40]:

```
#plot of predictions on closing price made by our model on training dataset vs actual clo
plt.plot(scaler.inverse_transform(close_df))
plt.plot(trainPredictPlot)
plt.title("variation of predicted trained dataset(orange) and actual dataset(lightblue)",
plt.xlabel("data index number")
plt.ylabel("closing price")
```

Out[40]:

```
Text(0, 0.5, 'closing price')
```

variation of predicted trained dataset(orange) and actual dataset(lightblue)



In [41]:

```
#plot of prediction on closing price made by our model on training dataset vs actual clos
#vs prediction on closing price made by our model on test dataset
plt.plot(scaler.inverse_transform(close_df))
plt.plot(trainPredictPlot)
plt.title("variation of predicted tested dataset(green) and actual dataset(lightblue)",cc
plt.xlabel("data index number")
plt.ylabel("closing price")
plt.plot(testPredictPlot)
plt.show()
```

variation of predicted tested dataset(green) and actual dataset(lightblue)