In [ ]:

```
import numpy as np # Data Handling
import matplotlib.pyplot as plt # Data Visualization
import pandas as pd # # Data Handling
import os # Working Directory
from sklearn.preprocessing import LabelEncoder, OneHotEncoder # Transformation of Categor
from sklearn.compose import ColumnTransformer # Transformation same as level encoding and
from sklearn.model_selection import train_test_split # Splitting Data into Train & Test
from sklearn.preprocessing import StandardScaler # Neural Networks --> generally standari
from sklearn.metrics import confusion_matrix # Model Evaluation
from sklearn.metrics import classification_report # Model Evaluation
import keras # Deep Learning Framework
from keras.models import Sequential # Adding layers in the Neural Network
from keras.layers import Dense # Adding layers in the Neural Network
```

In [ ]:

```
df = pd.read_csv('TCS.csv')
```

In [4]:

```
df = pd.read_csv('TCS.csv')
df.head()
```

Out[4]:

	Date	Symbol	Series	Prev Close	Open	High	Low	Last	Close	VWAP	Volume	
0	25-08-2004	TCS	EQ	850.00	1198.7	1198.7	979.00	985.00	987.95	1008.32	17116372	1
1	26-08-2004	TCS	EQ	987.95	992.0	997.0	975.30	976.85	979.00	985.65	5055400	4
2	27-08-2004	TCS	EQ	979.00	982.4	982.4	958.55	961.20	962.65	969.94	3830750	3
3	30-08-2004	TCS	EQ	962.65	969.9	990.0	965.00	986.40	986.75	982.65	3058151	3
4	31-08-2004	TCS	EQ	986.75	986.5	990.0	976.00	987.80	988.10	982.18	2649332	2

In [5]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4139 entries, 0 to 4138
Data columns (total 15 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   Date                4139 non-null   object 
 1   Symbol              4139 non-null   object 
 2   Series              4139 non-null   object 
 3   Prev Close          4139 non-null   float64
 4   Open                4139 non-null   float64
 5   High                4139 non-null   float64
 6   Low                 4139 non-null   float64
 7   Last                4139 non-null   float64
 8   Close               4139 non-null   float64
 9   VWAP                4139 non-null   float64
 10  Volume              4139 non-null   int64  
 11  Turnover            4139 non-null   float64
 12  Trades              2456 non-null   float64
 13  Deliverable Volume  4139 non-null   int64  
 14  %Deliverble         4139 non-null   float64
dtypes: float64(10), int64(2), object(3)
memory usage: 485.2+ KB
```

In [6]:

```
df.head()
```

Out[6]:

	Date	Symbol	Series	Prev Close	Open	High	Low	Last	Close	VWAP	Volume	
0	25-08-2004	TCS	EQ	850.00	1198.7	1198.7	979.00	985.00	987.95	1008.32	17116372	1
1	26-08-2004	TCS	EQ	987.95	992.0	997.0	975.30	976.85	979.00	985.65	5055400	4
2	27-08-2004	TCS	EQ	979.00	982.4	982.4	958.55	961.20	962.65	969.94	3830750	3
3	30-08-2004	TCS	EQ	962.65	969.9	990.0	965.00	986.40	986.75	982.65	3058151	3
4	31-08-2004	TCS	EQ	986.75	986.5	990.0	976.00	987.80	988.10	982.18	2649332	2

In [7]:

```
df.shape
```

Out[7]:

```
(4139, 15)
```

In [8]:

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

Out[8]:

```
Date                    0
Symbol                  0
Series                  0
Prev Close              0
Open                    0
High                    0
Low                     0
Last                    0
Close                   0
VWAP                    0
Volume                  0
Turnover                0
Trades               1683
Deliverable Volume      0
%Deliverble             0
dtype: int64
```

In [9]:

```
df1 = df.reset_index()['Close']
```

In [10]:

```
df1
```

Out[10]:

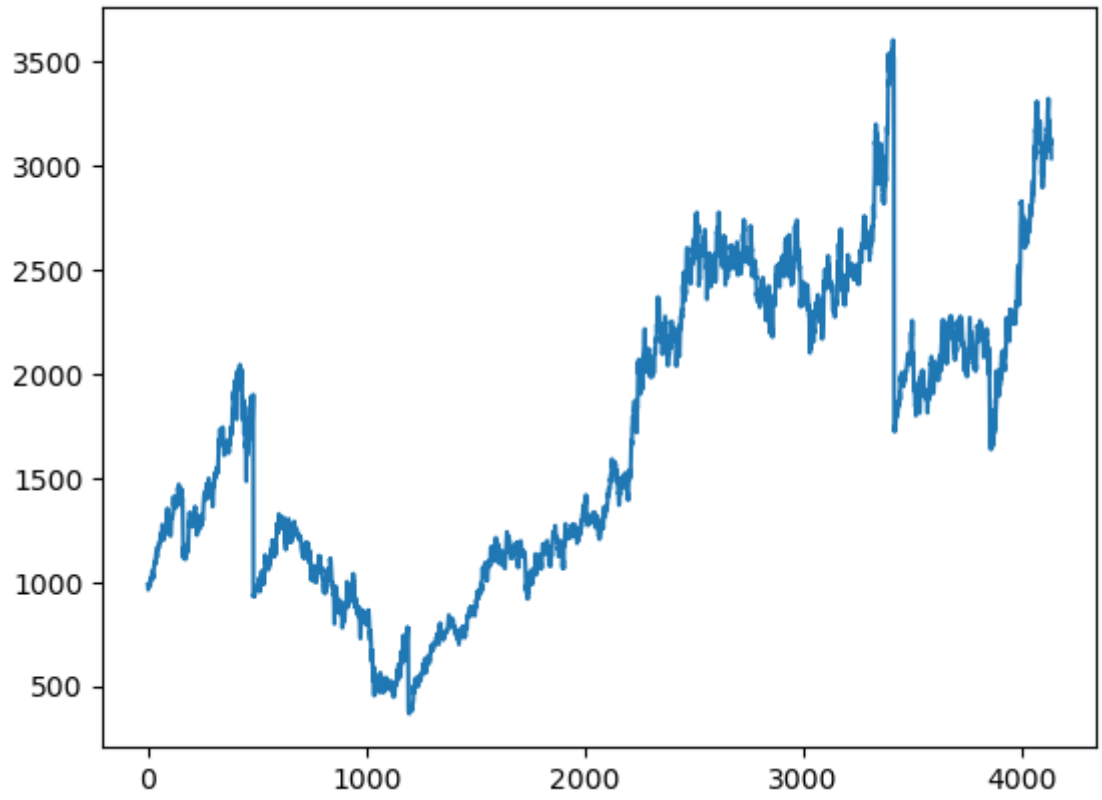
```
0        987.95
1        979.00
2        962.65
3        986.75
4        988.10
         ...
4134    3100.80
4135    3132.00
4136    3124.10
4137    3115.25
4138    3035.65
Name: Close, Length: 4139, dtype: float64
```

In [11]:

```
plt.plot(df1)
```

Out[11]:

```
[<matplotlib.lines.Line2D at 0x1d8f1a13b80>]
```



In [12]:

```
df1
```

Out[12]:

```
0        987.95
1        979.00
2        962.65
3        986.75
4        988.10
         ...
4134    3100.80
4135    3132.00
4136    3124.10
4137    3115.25
4138    3035.65
Name: Close, Length: 4139, dtype: float64
```

In [13]:

```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler(feature_range=(0,1))
df1=scaler.fit_transform(np.array(df1).reshape(-1,1))
```

In [14]:

```
print(df1)
```

```
[[0.19193401]
 [0.18916915]
 [0.18411826]
 ...
 [0.85184041]
 [0.84910644]
 [0.82451615]]
```

In [15]:

```
training_size=int(len(df1)*0.65)
test_size=len(df1)-training_size
train_data,test_data=df1[0:training_size,:],df1[training_size:len(df1),:1]
```

In [16]:

```
training_size,test_size
```

Out[16]:

```
(2690, 1449)
```

In [17]:

```
train_data
```

Out[17]:

```
array([[0.19193401],
       [0.18916915],
       [0.18411826],
       ...,
       [0.66832455],
       [0.67434856],
       [0.68730789]])
```

In [18]:

```
import numpy
# convert an array of values into a dataset matrix
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]   ###i=0, 0,1,2,3-----99   100
        dataX.append(a)
        dataY.append(dataset[i + time_step, 0])
    return numpy.array(dataX), numpy.array(dataY)
```

In [19]:

```
# reshape into X=t,t+1,t+2,t+3 and Y=t+4
time_step = 100
X_train, y_train = create_dataset(train_data, time_step)
X_test, ytest = create_dataset(test_data, time_step)
```

In [20]:

```
print(X_train.shape), print(y_train.shape)
```

```
(2589, 100)
(2589,)
```

Out[20]:

```
(None, None)
```

In [21]:

```
print(X_test.shape), print(ytest.shape)
```

```
(1348, 100)
(1348,)
```

Out[21]:

```
(None, None)
```

In [39]:

```
# reshape input to be [samples, time steps, features] which is required for LSTM
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)
```

In [40]:

```
pip install tensorflow
```

```
Requirement already satisfied: tensorflow in e:\anaconda\lib\site-packages
(2.13.0)
Requirement already satisfied: tensorflow-intel==2.13.0 in e:\anaconda\lib
\site-packages (from tensorflow) (2.13.0)
Requirement already satisfied: packaging in e:\anaconda\lib\site-packages
(from tensorflow-intel==2.13.0->tensorflow) (22.0)
Requirement already satisfied: h5py>=2.9.0 in e:\anaconda\lib\site-package
s (from tensorflow-intel==2.13.0->tensorflow) (3.7.0)
Requirement already satisfied: numpy<=1.24.3,>=1.22 in e:\anaconda\lib\sit
e-packages (from tensorflow-intel==2.13.0->tensorflow) (1.23.5)
Requirement already satisfied: wrapt>=1.11.0 in e:\anaconda\lib\site-packa
ges (from tensorflow-intel==2.13.0->tensorflow) (1.14.1)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.
3,!=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 in e:\anaconda\lib\site-packages (f
rom tensorflow-intel==2.13.0->tensorflow) (4.24.0)
Requirement already satisfied: flatbuffers>=23.1.21 in e:\anaconda\lib\sit
e-packages (from tensorflow-intel==2.13.0->tensorflow) (23.5.26)
Requirement already satisfied: libclang>=13.0.0 in e:\anaconda\lib\site-pa
ckages (from tensorflow-intel==2.13.0->tensorflow) (16.0.6)
Requirement already satisfied: tensorflow-estimator<2.14,>=2.13.0 in e:\an
aconda\lib\site-packages (from tensorflow-intel==2.13.0->tensorflow) (2.1
3.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in e:\anaconda\lib\site
-packages (from tensorflow-intel==2.13.0->tensorflow) (1.57.0)
Requirement already satisfied: astunparse>=1.6.0 in e:\anaconda\lib\site-p
ackages (from tensorflow-intel==2.13.0->tensorflow) (1.6.3)
Requirement already satisfied: google-pasta>=0.1.1 in e:\anaconda\lib\site
-packages (from tensorflow-intel==2.13.0->tensorflow) (0.2.0)
Requirement already satisfied: opt-einsum>=2.3.2 in e:\anaconda\lib\site-p
ackages (from tensorflow-intel==2.13.0->tensorflow) (3.3.0)
Requirement already satisfied: absl-py>=1.0.0 in e:\anaconda\lib\site-pack
ages (from tensorflow-intel==2.13.0->tensorflow) (1.4.0)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in
e:\anaconda\lib\site-packages (from tensorflow-intel==2.13.0->tensorflow)
(0.31.0)
Requirement already satisfied: typing-extensions<4.6.0,>=3.6.6 in e:\anaco
nda\lib\site-packages (from tensorflow-intel==2.13.0->tensorflow) (4.4.0)
Requirement already satisfied: six>=1.12.0 in e:\anaconda\lib\site-package
s (from tensorflow-intel==2.13.0->tensorflow) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in e:\anaconda\lib\site-pa
ckages (from tensorflow-intel==2.13.0->tensorflow) (2.3.0)
Requirement already satisfied: keras<2.14,>=2.13.1 in e:\anaconda\lib\site
-packages (from tensorflow-intel==2.13.0->tensorflow) (2.13.1)
Requirement already satisfied: gast<=0.4.0,>=0.2.1 in e:\anaconda\lib\site
-packages (from tensorflow-intel==2.13.0->tensorflow) (0.4.0)
Requirement already satisfied: setuptools in e:\anaconda\lib\site-packages
(from tensorflow-intel==2.13.0->tensorflow) (65.6.3)
Requirement already satisfied: tensorboard<2.14,>=2.13 in e:\anaconda\lib
\site-packages (from tensorflow-intel==2.13.0->tensorflow) (2.13.0)
Requirement already satisfied: wheel<1.0,>=0.23.0 in e:\anaconda\lib\site-
packages (from astunparse>=1.6.0->tensorflow-intel==2.13.0->tensorflow)
(0.38.4)
Requirement already satisfied: google-auth-oauthlib<1.1,>=0.5 in e:\anacon
da\lib\site-packages (from tensorboard<2.14,>=2.13->tensorflow-intel==2.1
3.0->tensorflow) (1.0.0)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in
e:\anaconda\lib\site-packages (from tensorboard<2.14,>=2.13->tensorflow-in
tel==2.13.0->tensorflow) (0.7.1)
Requirement already satisfied: google-auth<3,>=1.6.3 in e:\anaconda\lib\si
te-packages (from tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tenso
rflow) (2.22.0)
```

```
Requirement already satisfied: werkzeug>=1.0.1 in e:\anaconda\lib\site-pac
kages (from tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow)
(2.2.2)
Requirement already satisfied: requests<3,>=2.21.0 in e:\anaconda\lib\site
-packages (from tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorf
low) (2.28.1)
Requirement already satisfied: markdown>=2.6.8 in e:\anaconda\lib\site-pac
kages (from tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow)
(3.4.1)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in e:\anaconda\lib\s
ite-packages (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.13->tensorf
low-intel==2.13.0->tensorflow) (5.3.1)
Requirement already satisfied: urllib3<2.0 in e:\anaconda\lib\site-package
s (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.13->tensorflow-intel==
2.13.0->tensorflow) (1.26.14)
Requirement already satisfied: rsa<5,>=3.1.4 in e:\anaconda\lib\site-packa
ges (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.13->tensorflow-intel
==2.13.0->tensorflow) (4.9)
Requirement already satisfied: pyasn1-modules>=0.2.1 in e:\anaconda\lib\si
te-packages (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.13->tensorfl
ow-intel==2.13.0->tensorflow) (0.2.8)
Requirement already satisfied: requests-oauthlib>=0.7.0 in e:\anaconda\lib
\site-packages (from google-auth-oauthlib<1.1,>=0.5->tensorboard<2.14,>=2.
13->tensorflow-intel==2.13.0->tensorflow) (1.3.1)
Requirement already satisfied: certifi>=2017.4.17 in e:\anaconda\lib\site-
packages (from requests<3,>=2.21.0->tensorboard<2.14,>=2.13->tensorflow-in
tel==2.13.0->tensorflow) (2022.12.7)
Requirement already satisfied: charset-normalizer<3,>=2 in e:\anaconda\lib
\site-packages (from requests<3,>=2.21.0->tensorboard<2.14,>=2.13->tensorf
low-intel==2.13.0->tensorflow) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in e:\anaconda\lib\site-packag
es (from requests<3,>=2.21.0->tensorboard<2.14,>=2.13->tensorflow-intel==
2.13.0->tensorflow) (3.4)
Requirement already satisfied: MarkupSafe>=2.1.1 in e:\anaconda\lib\site-p
ackages (from werkzeug>=1.0.1->tensorboard<2.14,>=2.13->tensorflow-intel==
2.13.0->tensorflow) (2.1.1)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in e:\anaconda\lib\sit
e-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard
<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow) (0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in e:\anaconda\lib\site-pac
kages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<1.1,>=0.5->tens
orboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow) (3.2.2)
Note: you may need to restart the kernel to use updated packages.
```

In [41]:

```
### Create the Stacked LSTM model
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM
```

In [64]:

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

In [65]:

```
model.summary()
```

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

 lstm_1 (LSTM)               (None, 100, 50)           20200

 lstm_2 (LSTM)               (None, 50)                20200

 dense (Dense)               (None, 1)                 51

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

In [66]:

```
model.summary()
```

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

 lstm_1 (LSTM)               (None, 100, 50)           20200

 lstm_2 (LSTM)               (None, 50)                20200

 dense (Dense)               (None, 1)                 51

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

In [ ]:

```
model.fit(X_train,y_train,validation_data=(X_test,ytest),epochs=20,batch_size=64,verbose=
```

```
Epoch 1/20
41/41 [==============================] - 20s 262ms/step - loss: 0.0156 - v
al_loss: 0.0044
Epoch 2/20
41/41 [==============================] - 9s 217ms/step - loss: 8.7404e-04
- val_loss: 0.0029
Epoch 3/20
41/41 [==============================] - 9s 217ms/step - loss: 7.6280e-04
- val_loss: 0.0028
Epoch 4/20
41/41 [==============================] - 9s 208ms/step - loss: 7.3615e-04
- val_loss: 0.0028
Epoch 5/20
41/41 [==============================] - 8s 205ms/step - loss: 6.9306e-04
- val_loss: 0.0026
Epoch 6/20
41/41 [==============================] - 10s 241ms/step - loss: 6.8190e-04
- val_loss: 0.0025
Epoch 7/20
41/41 [==============================] - 11s 278ms/step - loss: 6.5872e-04
- val_loss: 0.0025
Epoch 8/20
41/41 [==============================] - 11s 256ms/step - loss: 7.0343e-04
- val_loss: 0.0023
Epoch 9/20
41/41 [==============================] - 10s 243ms/step - loss: 6.1916e-04
- val_loss: 0.0022
Epoch 10/20
41/41 [==============================] - 9s 231ms/step - loss: 6.0347e-04
- val_loss: 0.0022
Epoch 11/20
41/41 [==============================] - 10s 237ms/step - loss: 5.5252e-04
- val_loss: 0.0022
Epoch 12/20
41/41 [==============================] - 9s 217ms/step - loss: 5.3033e-04
- val_loss: 0.0019
Epoch 13/20
 6/41 [===>..........................] - ETA: 6s - loss: 5.5260e-04
```

In [ ]:

```
### Lets Do the prediction and check performance metrics
train_predict=model.predict(X_train)
test_predict=model.predict(X_test)
```

In [ ]:

```
##Transformback to original form
train_predict=scaler.inverse_transform(train_predict)
test_predict=scaler.inverse_transform(test_predict)
```

In [ ]:

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

In [ ]:

```
math.sqrt(mean_squared_error(ytest,test_predict))
```

In [ ]:

```
### Plotting
# shift train predictions for plotting
look_back=100
trainPredictPlot = numpy.empty_like(df1)
trainPredictPlot[:, :] = np.nan
trainPredictPlot[look_back:len(train_predict)+look_back, :] = train_predict
# shift test predictions for plotting
testPredictPlot = numpy.empty_like(df1)
testPredictPlot[:, :] = numpy.nan
testPredictPlot[len(train_predict)+(look_back*2)+1:len(df1)-1, :] = test_predict
# plot baseline and predictions
plt.plot(scaler.inverse_transform(df1))
plt.plot(trainPredictPlot)
plt.plot(testPredictPlot)
plt.show()
```

In [63]:

```
len(test_data)
```

Out[63]:

```
1449
```

In [44]:

```
x_input=test_data[341:].reshape(1,-1)
x_input.shape
```

Out[44]:

```
(1, 1108)
```

In [45]:

```
temp_input=list(x_input)
temp_input=temp_input[0].tolist()
```

In [46]:

```
temp_input
```

Out[46]:

```
[0.5570504008279142,
 0.5526019060564402,
 0.5358273736890071,
 0.5420521771365905,
 0.5631516349762902,
 0.5469640567800931,
 0.5432260854790627,
 0.5456356868136112,
 0.5462844256344512,
 0.5528799369796573,
 0.5627963732410683,
 0.5973648846943977,
 0.5918814970420598,
 0.584853493149627,
 0.5898580497675354,
 0.5859656168424954,
 0.5731144097249039,
 0.5620395112834218,
```

In [47]:

```
day_new=np.arange(1,101)
day_pred=np.arange(101,131)
```

In [48]:

```
import matplotlib.pyplot as plt
```

In [49]:

```
len(df1)
```

Out[49]:

```
4139
```

In [ ]:

```
df3=df1.tolist()
df3.extend(lst_output)
plt.plot(df3[1200:])
```

In [51]:

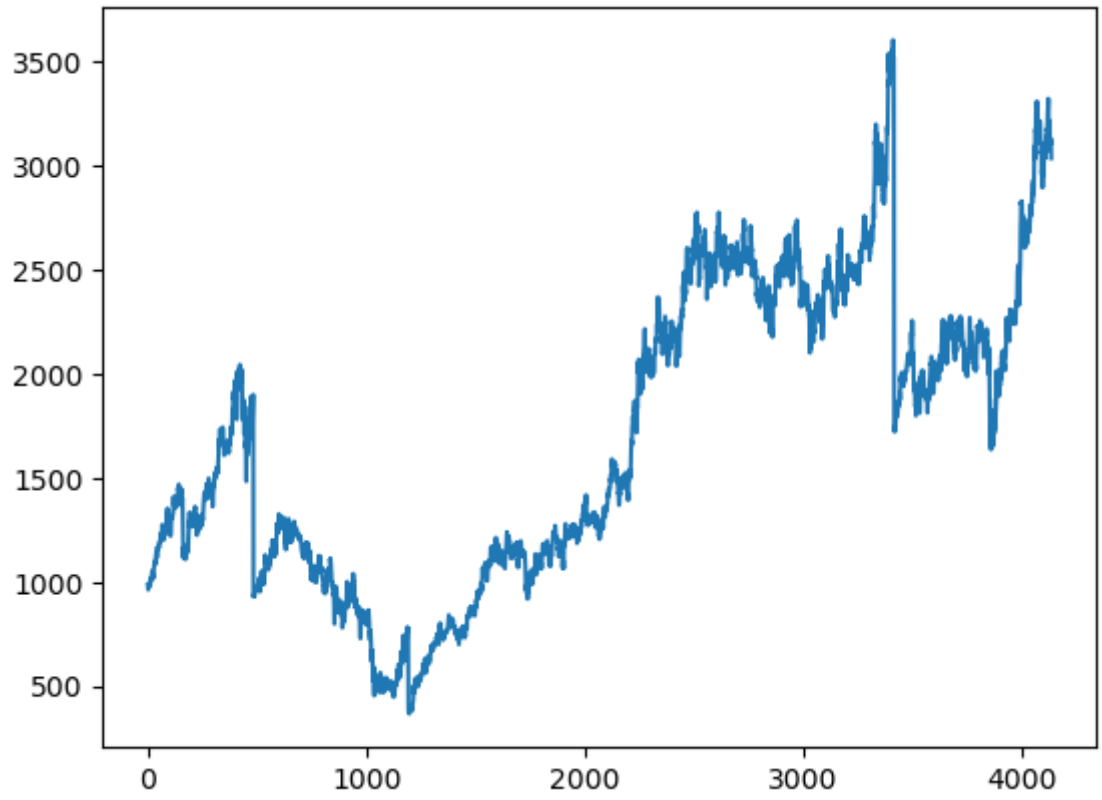
```
df3=scaler.inverse_transform(df3).tolist()
```

In [52]:

```
plt.plot(df3)
```

Out[52]:

```
[<matplotlib.lines.Line2D at 0x1d8fbefe110>]
```



In [ ]: