Time Series Analysis

The successful prediction of a stock's future price could yield significant profit. The efficient-market hypothesis suggests that stock prices reflect all currently available information and any price changes that are not based on newly revealed information thus are inherently unpredictable. Others disagree and those with this viewpoint possess myriad methods and technologies which purportedly allow them to gain future price information. Prediction methodologies fall into a number of broad categories which can (and often do) overlap. Time series analysis is one of the major predication methods used for such cases.

Problem Statement 1:
a) Plot the closing price of Tesla stocks.
b) Perform Rolling Mean smoothing for Tesla stock closing price with window size=4,7 and 14. Plot them individually with the actual closing price. What do you observe?

Problem Statement 2:
Decompose the closing price into trend, season and residual for frequency 16, 80, 200. Comment on seasonality based on the plots. Which frequency seem to represent right seasonality of the time series.

Problem Statement 4:
a) (i) Is the Closing price a stationary time series? Perform Augmented Dickey Fuller test to verify. If not, convert to stationary using ordered differences.
(ii) Remove Seasonality, and plot ACF and PACF plots and get the best parameter (using RMSE) for SARIMAX model for the AIC metric.
(iii) Compute Training RMSE for the best parameters. Plot the forecast with the test dataset.
b) Make comments on the predictions.
Did your model perform as per expectations, and why/why not?

Problem Statement 4:
a) What features do you think are useful in predicting closing price of the stock? Use information from the dataset given, as well as engineer new features.
b) Use the features you stated in (a) to a build a linear regression model to predict stock close price. Compute RMSE on the Train and Test datasets.