Analyze data of gas consumption in the first column of matrix Gas stored in the file GAS_5yearsPT. Data were observed during the period of 5 years with the sampling period of one day. Solve the problem in the following steps:

- Plot gas consumption in the first column of matrix Gas and corresponding temperature values in the second column of the same matrix Gas

- Evaluate and plot the given sequence spectrum and find the main periodic signal components

- For a selected period of gas consumption values $Gas(I1 : I2)$ defining sequence $\{x(n)\}_{n=1}^{N}$ use the autoregressive model for one-step ahead signal prediction by relation

$$\hat{x}(n) = -\sum_{k=1}^{M} a(k)\, x(n-k) \tag{1}$$

where $[a(1), ..., a(M)]$ are model parameters, values $\{\hat{x}(n)\}_{n=M+1}^{N}$ represent estimated output values and $\{e(n)\}_{n=M+1}^{N}$ represent the noise component. Model coefficients can be evaluated from the system of equations

$$\mathbf{A}_{N-M,M}\, \mathbf{a}_{M,1} = \mathbf{b}_{N-M,1} \tag{2}$$

where

$$\mathbf{A}_{N-M,M} = -\begin{bmatrix} x(M) & x(M-1) & ... & x(1) \\ x(M+1) & x(M) & ... & x(2) \\ .... & ... & ... & ... \\ x(N-1) & x(N-2) & ... & x(N-M) \end{bmatrix}$$

$$\mathbf{a}_{M,1} = [a(1), a(2), ..., a(M)]'$$

$$\mathbf{b}_{N-M,1} = [x(M+1), x(M+2), ..., x(N)]'$$

assuming that M is the order of the AR model and N is the length of the given signal.

- Plot observed and predicted values and evaluate the mean square error

- Study the effect of the model order selection to the mean square error values

Use the following MATLAB functions: LOAD, FFT, ABS, BACKSLASH, STEM, PLOT, LEGEND, MEAN.

CS2.1   PERIOD: I1=250, I2=450, MODEL ORDER: 30

CS2.2   PERIOD: I1=250, I2=450, MODEL ORDER: 26

CS2.3   PERIOD: I1=250, I2=450, MODEL ORDER: 23

CS2.4   PERIOD: I1=250, I2=450, MODEL ORDER: 20

CS2.5   PERIOD: I1=250, I2=450, MODEL ORDER: 18

CS2.6   PERIOD: I1=250, I2=450, MODEL ORDER: 15

CS2.7   PERIOD: I1=250, I2=350, MODEL ORDER: 30

CS2.8   PERIOD: I1=250, I2=350, MODEL ORDER: 25

CS2.9   PERIOD: I1=250, I2=350, MODEL ORDER: 20

CS2.10   PERIOD: I1=350, I2=450, MODEL ORDER: 30

CS2.11   PERIOD: I1=350, I2=450, MODEL ORDER: 25

CS2.12   PERIOD: I1=350, I2=450, MODEL ORDER: 20