Open-Ended Lab (10 M)

Question # 01 **(05 M)**

Three engines (EFI, Diesel and Petrol) are tested on dynamometer. The results are shown in table given below.

EFI Engine		Diesel Engine		Petrol Engine	
Engine RPM	**BHP (HP)**	**Engine RPM**	**BHP (HP)**	**Engine RPM**	**BHP (HP)**
1522	4.029	1517	1.023	994	0.823
1691	4.916	1707	1.207	1097	0.785
1803	5.644	1922	1.437	1200	1.853
1898	5.800	2009	1.809	1309	1.911
2000	6.025	2224	1.744	1395	1.841

1. Estimate the constants of each engine based on quadratic relation.
2. Plot the equations with the actual data on a single graph.
3. Estimate the errors and form a table.
4. Evaluate the BHP for all three engines at 1500 rpm.
5. Why we use quadratic relation for rpm vs power, instead of linear relationship? (Use your Internal Combustion Engine knowledge to answer this question). To support your answer, draw lines of linear and quadratic equation on a single plot. (Students are encouraged to use subplot command to present your analysis)

Additional Information

Use different colour, marker and line type for each curve. Label axes, show title, open grid and show text next to each line defining type of engine.

Question # 02 **(05 M)**

The transmission of light through a transparent solid can be described by the equation:

$$I_T = I_0(1-R)^2 e^{-\beta L}$$

where I_T is the transmitted intensity, I_0 is the intensity of the incident beam, β is the absorption coefficient, L is the length of the transparent solid, and R is the fraction of light which is reflected at the interface. If the light is normal to the interface and the beams are transmitted through air, $R = \left(\frac{n-1}{n+1}\right)^2$ where n is the index of refraction for the transparent solid. Experiments measuring the intensity of light transmitted through specimens of a transparent solid of various lengths are given in the following table. The intensity of the incident beam is 5 W/m^2.

L (cm)	0.5	1.2	1.7	2.2	4.5	6.0
I_T (W/m^2)	4.2	4.0	3.8	3.6	2.9	2.5

Use this data and curve fitting to determine the absorption coefficient and index of refraction of the solid.