

## **About Us**

Hello readers, we have created some projects for the course Digital Logic Design (EC261) and Waves and Electromagnetics (PH170). The collaborators for this projects are Aniruddha Kajave, Ankita Ranjan, Annaya Sharma, Anubhav Dubey and me Apurva Bajaj. We hope this will help you lot throughout your learnings.

The objective and step-by-step guide to access those is given below.

### **Section-1: Digital Logic Design**

**Objective:** To make a graphical user interface for the truth table of two or three input for all types of logic gate.

Step-1: Select the type of logic gate.

Step-2: Select the number of bits.

Step-3: Choose the value of input bits (from 0 and 1).

Step-4: Click the 'click' button to generate the output.

It will perform the required logical operation and the user can obtain the desired result just within a glimpse.

**Objective:** To make a graphical user interface that takes the input waveform through the selection panel and pass this input waveform through (i) NOT gate (ii) NOR gate (iii) XOR gate

It's often difficult for many to plot the waveform when it is passed through different logic gates. Here is a one-step solution for it.

- The user needs to enter the input waveform (in the form of 0 and 1).
- After inserting the input waveform, the user needs to select the gate from which he/she wishes to pass the waveform.
- After selection, user can find the desired output waveform in fraction of seconds.

## **Section-2: Waves and Electromagnetics**

### **▪ Space-time signal**

**Objective:** To make an interface that shows the space - time signal based on the input parameter variation.

Description: Waves propagate through space and time by transfer of energy between the particles in the medium. The wave function for a cosine wave with an initial phase shift  $\Phi$ , is  $y(x, t) = A \cos(kx + \omega t + \Phi)$ .

This GUI will plot the space-time signal when amplitude, wavelength and instantaneous phase and frequency are assigned by the user. It will also generate the wave equation for the given input parameters.

User guidelines:

- Enter the amplitude (in metres), phase count (in degrees), wavelength (lambda) in metres and frequency (in Hertz).
- Click on 'solve' button to generate the plot for space time signal.
- Click on 'calculate' to generate the wave equation.

## ▪ Friis Transmission Equation

**Objective:** To make a simulator that finds the received power in free space.  
To plot the transmitting and receiving signal based on the input parameter.

Description: The Friis Transmission Equation is used to calculate the power received from one antenna (with gain  $G_1$ ), when transmitted from another antenna (with gain  $G_2$ ), separated by a distance  $R$ , and operating at frequency  $f$  or wavelength  $\lambda$ .

This GUI will calculate the received power in free space using Friis transmission equation when parameters such as carrier frequency, distance between transmitter and receiver, transmitted power and receive/transmit gain are assigned. It will also plot transmitting signal and receiving signal.

Step-1: Enter the value of  $G_T$ ,  $G_R$  where both  $G_T$  and  $G_R$  are in decibels.

Step-2: Enter Transmitted power (in watts) and distance between transmitter and receiver (in km), wavelength ( $\lambda$ ) in metres and carrier frequency (in Hertz).

Step-3: Click on 'solve' button to plot the transmitting and receiving signal.

Step-4: Click on 'calculate' button, the received power for antenna will be calculated.