Experiment Name: <u>**Simulation of Basic Test Signals**</u>

<u>Aim:</u>

To generate continuous and discrete waveforms for the following:

1. Unit Impulse Signal
2. Bipolar Pulse Signal
3. Unipolar Pulse Signal
4. Ramp Signal
5. Triangular Signal
6. Sine Signal
7. Cosine Signal
8. Exponential Signal
9. Unit Step Signal

<u>Theory:</u>

<u>1. Unit Impulse Signal:</u>

- A signal that is zero everywhere except at one point, typically at t=0 where its value is 1.

- **Mathematically** $\delta(t) = \begin{cases} \infty; t = 0 \\ 0; t \neq 0 \end{cases}$

<u>2. Bipolar Pulse Signal:</u>

- A pulse signal that alternates between positive and negative values, usually rectangular in shape. It switches between two constant levels (e.g., -1 and 1) for a defined duration.

- **Mathematically p(t) = A for |t| ≤ τ/2, p(t) = 0 otherwise**

<u>3. Unipolar Pulse Signal:</u>

- A pulse signal that alternates between zero and a positive value. It remains at zero for a specified duration and then jumps to a positive constant level (e.g., 0 and 1).

- **Mathematically p(t) = A for |t| ≤ τ/2, p(t) = 0 otherwise (assuming A is positive)**

4. Ramp Signal:

- A signal that increases linearly with time.
- **Mathematically** $r(t) = \begin{cases} t; t \geq 0 \\ 0; t < 0 \end{cases}$

5. Triangular Signal:

- A periodic signal that forms a triangle shape, linearly increasing and decreasing with time, typically between a positive and negative peak.
- **Mathematically: $\Lambda(t) = 1 - |t|$ for $|t| \leq 1$, $\Lambda(t) = 0$ otherwise**

6. Sine Signal:

- A continuous periodic signal. It oscillates smoothly between -1 and 1.
- **Mathematically: y(t)=Asin(2πft)**

7. Cosine Signal:

- A continuous periodic signal like the sine wave but phase-shifted by π\2.
- **Mathematically: y(t)=Acos(2πft)**

8. Exponential Signal:

- A signal that increases or decreases exponentially with time. The rate of growth or decay is determined by the constant a.
- **Mathematically: e^(at)**

9. Unit Step Signal:

- A signal that is zero for all negative time values and one for positive time values.
- **Mathematically** $u(t) = \begin{cases} 1; t \geq 0 \\ 0; t < 0 \end{cases}$

Program:

```
clc;

clear all;

close all;
```

```matlab
subplot(3,3,1);
t = -5:1:5;
y = [zeros(1,5),ones(1,1),zeros(1,5)];
stem(t,y);
xlabel("Time(s)");
ylabel("Amplitude");
title("Unit Impulse Signal");


subplot(3,3,2);
t2 = 0:0.01:1;
f = 5;
y2 = square(2*pi*f*t2);
stem(t2,y2);
hold on;
plot(t2,y2);
xlabel("Time(s)");
ylabel("Amplitude");
title("Bipolar Pulse Signal");
legend("Discrete","Continuous");


subplot(3,3,3);
t3 = 0:0.1:1;
f = 5;
y3 = abs(square(2*pi*f*t3));
stem(t3,y3);
hold on;
plot(t3,y3);
xlabel("Time(s)");
ylabel("Amplitude");
title("Unipolar Pulse Signal");
legend("Discrete","Continuous");
```

```matlab
subplot(3,3,4);
t4 = -5:1:5;
y4 = t4 .*(t4>=0);
stem(t4,y4);

hold on;

plot(t4,y4);

xlabel("Time(s)");

ylabel("Amplitude");

title("Unit Ramp Signal");

legend("Discrete","Continuous");


subplot(3,3,5);
t5 = 0:0.025:1;
f = 10;
y5 = sawtooth(2*pi*f*t5,0.5);

stem(t5,y5);

hold on;

plot(t5,y5);

xlabel("Time(s)");

ylabel("Amplitude");

title("Triangular Signal");

legend("Discrete","Continuous");


subplot(3,3,6);
t6 = 0:0.001:1;
f = 10;
y6 = sin(2*pi*f*t6);

stem(t6,y6);

hold on;

plot(t6,y6);

xlabel("Time(s)");
```

```matlab
ylabel("Amplitude");

title("Sine Wave");

legend("Discrete","Continuous");


subplot(3,3,7);

t7 = 0:0.001:1;

f = 10;

y7 = cos(2*pi*f*t7);

stem(t7,y7);

hold on;

plot(t7,y7);

xlabel("Time(s)");

ylabel("Amplitude");

title("Cosine Wave");

legend("Discrete","Continuous");


subplot(3,3,8);

t8 = -5:1:5;

y8 = exp(t8);

stem(t8,y8);

hold on;

plot(t8,y8);

xlabel("Time(s)");

ylabel("Amplitude");

title("Exponential Signal");

legend("Discrete","Continuous");


subplot(3,3,9);

t9 = -5:1:5;

y9 = [zeros(1,5),ones(1,6)];

 stem(t9,y9);
```

```
xlabel("Time(s)");

ylabel("Amplitude");

title("Unit Step Signal");
```

Result

Generated and Verified various Continuous and Discrete waveforms for basic test signals.