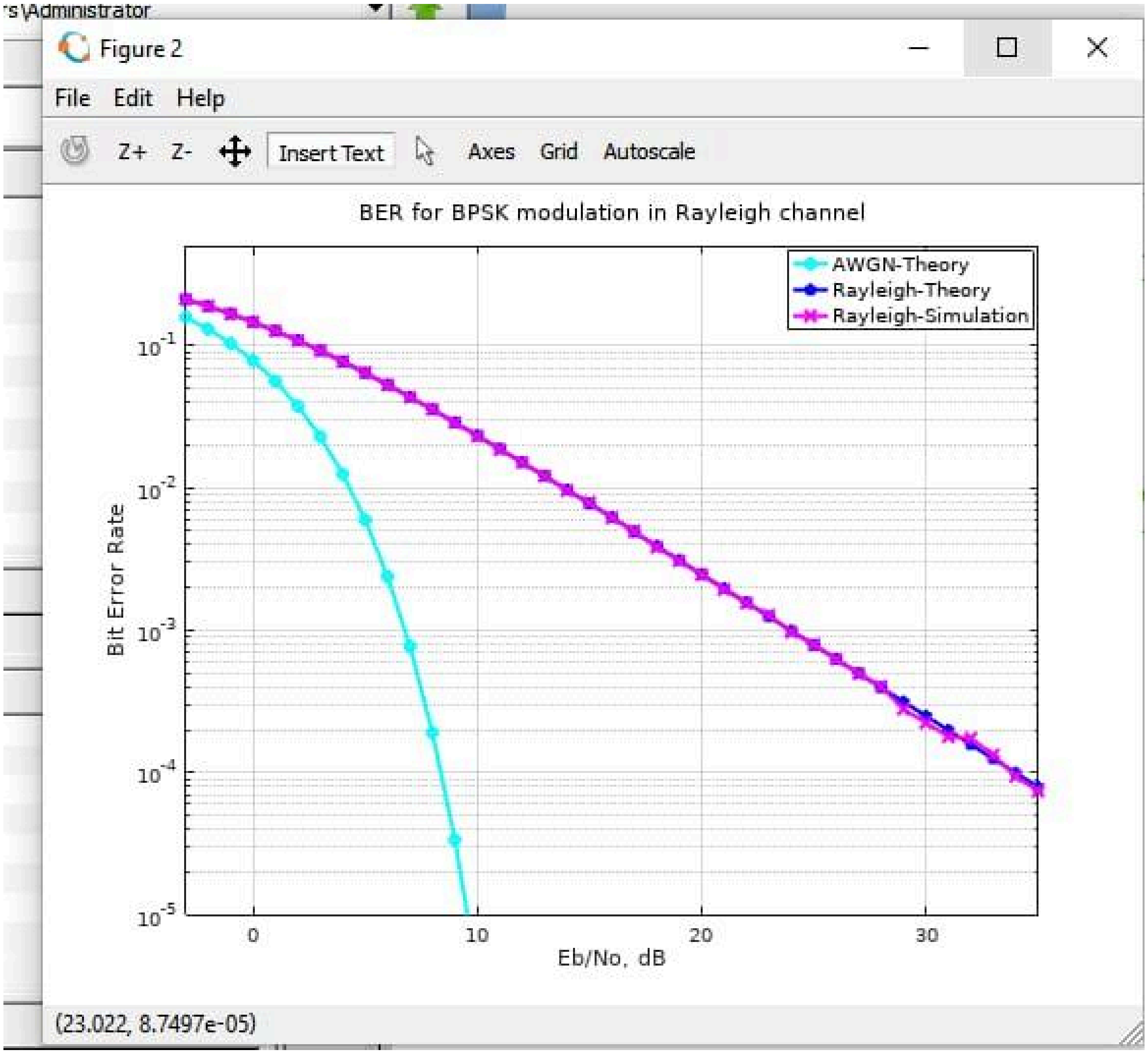
Code;-

```
% Script for computing the BER for BPSK modulation in a
% Rayleigh fading channel

clear
N = 10^6; % number of bits or symbols

% Transmitter
ip = rand(1,N) > 0.5; % generating 0,1 with equal probability
s = 2*ip - 1; % BPSK modulation: 0 -> -1, 1 -> 1

Eb_N0_dB = -3:35; % multiple Eb/N0 values
nErr = zeros(1, length(Eb_N0_dB)); % initialize error counter

for ii = 1:length(Eb_N0_dB)
   n = 1/sqrt(2) * (randn(1,N) + 1i*randn(1,N)); % white Gaussian noise
   h = 1/sqrt(2) * (randn(1,N) + 1i*randn(1,N)); % Rayleigh fading channel

   % Channel and noise addition
   y = h .* s + 10^(-Eb_N0_dB(ii)/20) * n;

   % Equalization
   yHat = y ./ h;

   % Receiver - hard decision decoding
   ipHat = real(yHat) > 0;

   % Count errors
   nErr(ii) = sum(ip ~= ipHat);
end

% Simulated BER
simBer = nErr / N;

% Theoretical BER
theoryBerAWGN = 0.5 * erfc(sqrt(10.^(Eb_N0_dB / 10)));
EbN0Lin = 10.^(Eb_N0_dB / 10);
theoryBer = 0.5 * (1 - sqrt(EbN0Lin ./ (EbN0Lin + 1)));

% Plotting
figure;
semilogy(Eb_N0_dB, theoryBerAWGN, 'cd-', 'LineWidth', 2); hold on;
semilogy(Eb_N0_dB, theoryBer, 'bp-', 'LineWidth', 2);
semilogy(Eb_N0_dB, simBer, 'mx-', 'LineWidth', 2);

axis([-3 35 10^-5 0.5]);
grid on;
legend('AWGN-Theory', 'Rayleigh-Theory', 'Rayleigh-Simulation');
xlabel('Eb/No, dB');
ylabel('Bit Error Rate');
title('BER for BPSK modulation in Rayleigh channel');
```

Output:-



's\Administrator
Figure 2
File
Edit
Help
Z+
Z-
Insert Text
Axes
Grid
Autoscale
BER for BPSK modulation in Rayleigh channel
AWGN-Theory
Rayleigh-Theory
Rayleigh-Simulation
Bit Error Rate
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
0
10
20
30
Eb/No, dB
(23.022, 8.7497e-05)