ME 209
NUMERICAL METHODS

PROBLEM HOUR I

1. (35p) Determine the positive real root of the following equation:

$$\ln\left(x^4\right) = 0.7$$

Use **<u>Bisection method</u>** to determine the value of x with initial guesses of $x_l = 0.5$; $x_u = 2$ with an absolute approximate relative percentage error $\varepsilon_a <$ ¿ 10%.

2. (30p) The critical speeds of oscillation (λ) of a loaded beam are given by the following equation:

$$\lambda^3 - 3.250\lambda^2 + \lambda - 0.063 = 0$$

Use **Newton-Raphson method** to determine the value of λ using initial guess $\lambda_0 = ¿$ 3.0 with an absolute approximate relative percentage error $\varepsilon_a < ¿$ **0.5%**.

5.11 Determine the real root of $x^{3.5} = 80$: **(a)** analytically and **(b)** with the false-position method to within $\varepsilon_s = 2.5\%$. Use initial guesses of 2.0 and 5.0.