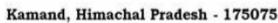
## Indian Institute of Technology Mandi





## भारतीय प्रौद्योगिकी संस्थान मण्डी कमांद, हिमाचल प्रदेश - 175075

MA-221(Numerical Analysis)
Course Instructor: Prof. Rajendra K. Ray
TA: Kajal Mittal
Lab Assignment-2
Date: 04/02/2025

## Provide the code for the following problems:

- 1. Convert the following numbers into the other number systems:
  - (a)  $(2655)_{10\to 16}$
  - (b)  $(0.0101)_{2\to10}$
  - (c)  $(.AAAA...)_{16\rightarrow 8}$
  - (d)  $(347.623)_{8\to 2}$
- 2. As part of a laboratory experiment, a group of students needs to calculate the modulus of elasticity E, of a steel beam. An object of mass m = 0.491kg is suspended from one end of a beam whose length is l = 0.451m, width is a = 0.021m and thickness is b = 0.003m. The resulting deflection of the tip of the beam is measured to be d = 0.142m. Substituting these values into the formula

$$E = \frac{4mgl^3}{dab^3},$$

where  $g = 9.81 m/s^2$  is the acceleration due to gravity, the students calculate

$$E = \frac{4(0.491)(9.81)(0.451)^3}{(0.142)(0.021)(0.003)^3} = 21.952 \times 10^9 N/m^2.$$

A standard table of properties of steel, however, indicates that the actual value should be  $E = 30 \times 10^9 N/m^2$ . Is the value calculated by the students within acceptable limits of the tabulated value?

- 3. A given calculation requires the value  $\sqrt{7.1} \approx 2.66458$ . The two most natural approaches to take would be chopping and rounding the number, producing  $\sqrt{7.1} \approx 2.6$  and  $\sqrt{7.1} \approx 2.7$ , respectively, if we drop all the digits after second one. Calculate the absolute and relative error in both the cases.
- 4. Let  $x_T = \pi$ ,  $x_A = 3.1416$ ,  $y_T = \frac{22}{7}$  and  $y_A = 3.1429$ . Calculate the relative error in  $x_A$  and  $y_A$ . Also calculate the relative error in-
  - (a)  $x_A + y_A$
  - (b)  $x_A y_A$
  - (c)  $x_A.y_A$
  - (d)  $x_A/y_A$
- 5. Find the condition number of the following functions:
  - (a)  $f(x) = \sqrt{x}$ , for all  $x \in [0, \infty)$
  - (b)  $f(x) = \frac{10}{1 x^2}$ , for all  $x \in \mathbb{R}$