Selection Process 2024 - 2nd semester - PPGEM/EESC/USP

Answers for the Admission Exam

1) Linear Algebra

    a) $\lambda_2 = 3$ and $\lambda_3 = -1$

    b) $n = 1$ and $m = 2$

2) Differential and Integral Calculus

    a) $f(x) =$ **C**, $f'(x) = \frac{df}{dx} =$ **A** e $f''(x) = \frac{d^2 f}{dx^2} =$ **B**

    b) Area $= \frac{16}{3}\sqrt{2}$

3) Computation

    a) Sorted array is:

      1 2 3 4 5 8 10 14 42

    b) Replace the ">" operator with the "<" operator in the terms that compare

      v[ref] in lines 16 and 19.

4) Electronics

    a) Input impedance: infinity.

    b) Output voltage: Vo = (1 + 2R/Rp)(V1 - V2) = 21(V1 - V2)

5) Control Systems

    a) $T(s) = \frac{Y(s)}{R(s)} = \frac{G(s)K(s)}{1+H(s)G(s)K(s)} = \frac{K}{s^2+s+K}$

    b) K > 0

6) Materials

a) Engineering stress divides the load (force) on the specimen by the original area; while true stress divides the load by the instantaneous area which decreases as the sample stretches.

b) A three-point bending test is commonly used to test the strength of brittle materials. The test provides a measurement called transverse rupture strength for these materials.

7) General Mechanics

a) Coefficient of friction = 0,315

b) Force = 20,77 N

8) Solid Mechanics

a) Force discharged on spring A = 60 N

b) Total displacement of the piston = 30 mm

9) Thermodynamics

a) Power supplied by the thermal machine, $\dot{W} = 10,664 \text{ kW}$

b) Mass flow rate, $\dot{m} = 0,3985 \text{ kg/s}$

10) Fluid Mechanics

a) Boundary conditions: $v_z = 0$ in $r = r_1$ and $r = r_2$

b) $\dfrac{\partial p}{\partial z} = \mu \left[\dfrac{\partial}{\partial r} \left(r \dfrac{\partial v_z}{\partial r} \right) \right]$