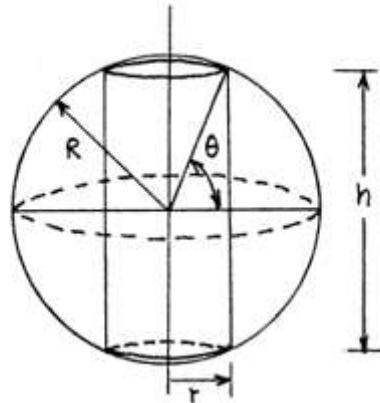


BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, PILANI CAMPUS
DEPARTMENT OF CHEMICAL ENGINEERING
First Semester 2022-23
Mid-Semester Examination (Open Notes)
CHE G558: Chemical Process Optimization
Marks: 30 **Date: 01.11.2022** **Time: 90 minutes**

Note: Make suitable assumptions wherever necessary and write all the steps clearly.

1. (6 Marks) Find the volume of the largest right circular cylinder that can be inscribed inside a sphere of radius R as shown in the following figure.



2. (a) (3 Marks) Sketch the feasible region for the given constraints.

$$g_1(x) = x_1 - x_2^2 - 25 \geq 0$$

$$g_2(x) = x_1 - x_2 + 20 \geq 0$$

- (b) (3 Marks) Is the following function convex? Strictly convex? Why?

$$f = 2x_1^2 + 2x_1x_2 + 3x_2^2 + 7x_1 + 8x_2 + 25$$

3. (6 Marks) Write a MATLAB code to solve the following ODE using Euler method.

$$\frac{dx}{dt} = -2x \quad ; \quad x(0) = 3.$$

4. (a) (4 Marks) Find the maximum of $f(x) = 2x - 1.75x^2 + 1.1x^3 - 0.25x^4$ using golden section search method in the interval $[-2, 4]$. Perform 4 iterations and report the result in the following tabular form:

Iteration	a	b	x_1	x_2	$f(x_1)$	$f(x_2)$
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- (b) (2 Marks) Write a MATLAB code to solve the problem in Part (a)

5. (a) (3 Marks) Find the minimum of the following function in the interval $[-4, -1]$ using Fibonacci Search method to reduce the original interval of uncertainty to 20%.

$$f(x) = x^2 + 4x + 7$$

- (b) (3 Marks) Carry out the initial and two additional iterations of the dichotomous search for the minimum of the following function in the interval $[0,1]$ with $\epsilon = 0.2$.

$$f(x) = x^2 - 1.2x - 6.64$$

(All the best)

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