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B.Tech. 3rd Year (Semester VI) Process Modeling and Simulation (CH 324) End Semester Examination

Max Marks: 50

Time:3 Hrs

Date: 09/05/2023

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Instructions:

- Make appropriate assumptions if needed.
- There are two pages in the question paper.
- Multiple attempts of same question will lead to zero marks in particular question.



all auxiliary equations.

1(b) A fed-batch culture has inlet feed rate F(t) and substrate concentration S_f . The reactor was initially inoculated with certain no of microrganism and cell mass concentration at any time is X(t). Substrate concentration at any time is S(t). Develop mathematical model of this system.



2 Starting from Navier-Stoke's equation derive Bernoulli's equation after stating all assumptions involved.

3(a) Transient equation for an isothermal CSTR is given as

$$\frac{dC_A}{dt} = \frac{F}{V} (C_{feed} - C_A) - r_A$$

Where, $r_A = 3C_A$



Develop a SIMULINK model to solve above differential equation for concentration in the reactor. Label symbols and connections. You can use following symbols having usual meaning:

- 3(b) Write a computer program (C/C++/Java) to solve a single non-linear algebraic 4 equation using Newton Raphson method.
- 4(a) Write mathematical model for a three stage multiple effect evaporators operating 7 in forward feed.
- 4(b) What is difference between deterministic and stochastic model? Name different 3 types of modeling equations and methods to solve them.
- 5(a) Develop expression for velocity profile for laminar flow of Newtonian fluid 5 through a pipe.
- 5(b) Develop mathematical model of an ordinary binary distillation column after 8 stating assumption involved in it.

----- End of Paper -----

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