

No. of Printed Pages : 05

Roll No. ....

**H81**

**B. Tech. EXAMINATION, 2020**

(Eighth Semester)

(B Scheme) (Re-appear Only)

(CHE)

CHE402B

PROCESS MODELLING AND SIMULATION

*Time : 2½ Hours]*

*[Maximum Marks : 75*

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Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

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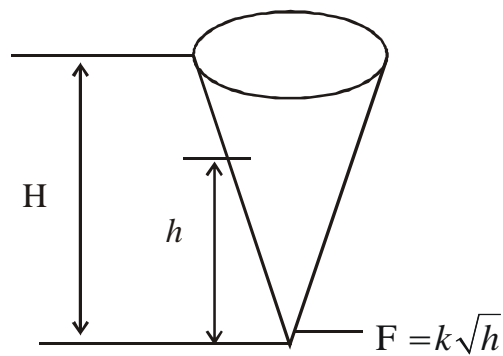
**Note :** Attempt *Four* questions in all. All questions carry equal marks.

**(5)M-H81**

**1**

1. (a) Define mathematical modelling and describe the principles of formulations of mathematical models. Describe the scope of coverage of mathematical models.  
(b) Explain in detail the different applications of the mathematical models.
2. (a) Derive the fundamental energy equation for a CSTR and its enthalpy and temperature dependent form.  
(b) What are the fundamental laws and equations required for developing chemical process models ? List all corresponding mathematical equations or formulas.
3. (a) Describe the mathematical model for two heated tanks.  
(b) Describe the mathematical model for a series of three isothermal CSTRs with  
(i) Constant hold up (ii) Variable hold up. List all assumptions and other parameters.

4. (a) A fluid of constant density  $\rho$  is pumped into a cone shaped tank of total volume  $\left(\frac{H\pi R^2}{3}\right)$ . The flow out of the bottom of the tank is proportional to the square root of the height  $h$  of the liquid in the tank. Derive the equation describing the system.



- (b) Draw the transfer function of single tank liquid level system. Draw a suitable sketch.

5. (a) Describe in detail the mathematical model for a heat exchanger.
- (b) Describe in detail the mathematical model for a liquid extraction unit. List the assumptions, forcing functions and degree of freedom analysis.
6. (a) Develop mathematical model for binary distillation column with neat sketch and all assumptions and other parameters.
- (b) Write a note on Numerical Simulation methods.
7. (a) Write a note on Z-transforms.
- (b) Explain the difference between feed-forward and ratio control.
- (c) Discuss Control system with multiple loops.

**8.** Write short notes on the following :

- (i) Dead time compensation
- (ii) Adaptive and Interfacial control
- (iii) Digital computer control loops
- (iv) Control of system with inverse response
- (v) Reactor with mass transfer.