

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 714004

Date: 06-01-2014

Subject Name: Modelling & Simulation of Rubber Processing

Time: 10.30 am – 01.00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

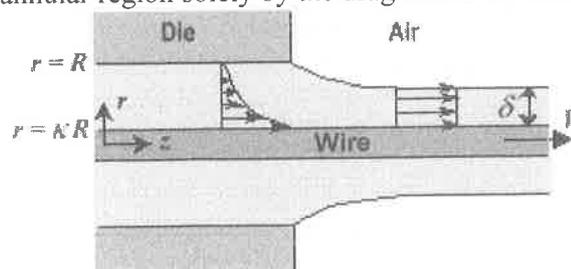
- Q.1 (a)** With example, explain step by step procedure with all stages in the development of a complete mathematic model of a process. 09
- (b)** List out attributes of a good mathematic model of a process. 05
- Q.2 (a)** Differentiate distributed parameter and lumped parameter models, deterministic and stochastic models. 07
- (b)** A fluid of constant density is pumped into a spherical tank. Outlet pipe at the bottom of the tank extended up to $1/8^{\text{th}}$ of diameter of the tank from bottom to avoid settled precipitates going out with liquid. The flow out from the tank is proportional to the square root of the height of the liquid head above the end of the pipe. There is a proportional controller installed to maintain constant outlet flow from the tank to desired set point value. Write the model describing the system. 07

OR

- (b)** Discuss importance of training/learning in ANN. Briefly explain different methods for training/learning. 07
- Q.3 (a)** What is simulation? How it is different from design? 07
 Discuss applications of simulation in Rubber technology.
- (b)** The continuously stirred mixing tank with 100 liter of volumetric capacity is initially filled with pure water. 0.1 kg/liter salt solution at 10 lit/min is continuously charged to it. Solution at the same rate is coming out of the tank, hence volume remains constant. Write a model stating the assumptions and using that model, calculate the time required to reach the concentration of the out coming stream to 0.01 kg/liter. No reaction takes place in the tank. 07

OR

- Q.3** A wire - coating die essentially consists of a cylindrical wire of radius κR moving horizontally at a constant velocity V along the axis of a cylindrical die of radius R . If the pressure in the die is uniform, then the polymer melt (which may be considered a non-Newtonian fluid described by the power law model and of constant density ρ) flows through the narrow annular region solely by the drag due to the axial motion of the wire. 14



- a) Obtain expression for the velocity profile in the annular region of the die.
- b) Obtain the expression for the mass flow rate through the annular die region.
- c) Estimate the coating thickness δ some distance downstream of the die exit.
- d) Find the force that must be applied per unit length of the wire.

Q.4 (a) Explain the concept of ANN and working of it with example. List out applications of ANN in Rubber technology. **07**

(b) List out different neural networks and discuss back propagation algorithm. **07**

OR

Q.4 (a) Discuss History of nonlinear FEA techniques/applications for Rubber. **07**

(b) Discuss degree of freedom analysis for modelling. Discuss partitioning of equation for deciding the sequence of solution for a set of simultaneous nonlinear equations. **07**

Q.5 (a) Explain the theory/working of FEA with simple example. **07**

(b) Discuss ten common mistakes engineers do in applying FEA. **07**

OR

Q.5 (a) Discuss meshing for FEA highlighting its importance. Discuss do's and don'ts of meshing. **07**

(b) Discuss role for FEA for design and analysis of car tyre. **07**
