GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2714007Date:03/01/2017Subject Name: Modelling & Simulation of Rubber Processing (MSRP)Time: 2:30 pm to 5:00 pmTotal Marks: 70Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Discuss degree of freedom analysis for modelling. Discuss partitioning of 07 equation for deciding the sequence of solution for a set of simultaneous nonlinear equations.
 - (b) Give Step by step procedure with all stages in the development of a complete 07 mathematic model of a process.
- Q.2 (a) Explain the concept of ANN and working of it with example. List out 06 applications of ANN in Rubber technology.
 - (b) Differentiate distributed parameter and lumped parameter models, 08 deterministic and stochastic models.

OR

- (b) Differentiate steady state and dynamic processes giving examples. Also 08 highlight the difference in their model equations with example.
- **Q.3** A wire coating die essentially consists of a cylindrical wire of radius κR moving 14 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.



- 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.

OR

Q.3 A vertical tube is filled with Bingham fluid and a plate is held over the lower end. When 14 the plate is removed, the fluid may or may not flow out of the tube by gravity. Develop the model and estimate criteria for flow in such an experiment.

Q.4 (a) The continuously stirred mixing tank with 10 liter of volumetric capacity is 07 initially filled with 4 kg solution containing 2% salt. Pure water at a rate of 1.1 kg/min is continuously charged to it. Solution at 1.0 kg/min is going out of the tank, hence volume is increasing continuously. The tank will overflow once the volume reaches its maximum capacity. Calculate the concentration in the tank after 30 minutes from initial state. Assume no reaction takes place in the tank.

(b) Discuss application of ANN for modeling Mooney viscosity of rubber. 07

OR

- Q.4 (a) A fluid of constant density is pumped into a spherical tank of one meter diameter. 07 The flow out of the bottom of the tank is proportional to the square root of the height of the liquid in the tank. The discharge pine is raised inside the tank by 10 cm. Develop a dynamic model representing the system.
 - (b) List out different neural networks and discuss back propagation algorithm. 07
- Q.5 (a) Discuss role for FEA for design and analysis using example of any rubber 07 product.
 - (b) Discuss importance of Pre-process, Analysis and Post processing in FEA with 07 simple example.

OR

- Q.5 (a) Derive a formula for the thickness of a film of a Bingham fluid falling a 09 vertical flat surface.
 - (b) Discuss meshing for FEA highlighting does and don'ts of meshing. 05