Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2152604 **Date:19/11/2016**

Subject Name:Rheology of Rubber

Time:10:30 AM to 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		Answer the following.	14
	1	Give the Reynolds number value for Transition Flow.	
	2	Define the term "Steady state".	
	3	Write the formula to calculate the film thickness (δ) for falling film.	
	4	List the one dimensional rheological models for rubber compounds.	
	5	Write the Energy equation.	
	6	Define the term Deformation Tensor.	
	7	Write the Cauchy laws of motion.	
	8	List the types of Elongational flow instruments.	
	9	Give the name of rheological model which are applicable for pseudoplastic and dilatant fluids.	
	10	Write the importance of Brinkman number.	
	11	What is Vorticity Tensor?	
	12	Name the scientist who derived a rheological model for a Non Newtonian fluid?	
	13	Draw the schematic representation of Velocity profile for Turbulent flow.	
	14	Write the equation of power law fluid model.	
Q.2	(a)	Discuss the important role of Rheology in rubber field.	03
	(b)	Give the difference between laminar and turbulent flow with example.	04
	(c)	Write down the assumptions for the development of the Hagen-Poiseuille Law.	07
		OR	
	(c)	List out the different variables influencing the Rheology of rubber. Explain any one in detail.	07
Q.3	(a)	Write the Ostwald-de waele model with its application.	03
	(b)	An fluid has a kinematic viscosity of $3X10^{-4}$ m^2 sec^{-1} and a density of $1X10^3$ kg m^{-3} .what should the mass rate of flow of this film down a vertical wall be in order to have a film thickness of 1 mm?	04
	(c)	Derive the equation of velocity distribution for flow through annulus tube.	07
		OR	
Q.3	(a)	Describe the boundary conditions for the velocity distribution in laminar flow.	03
	(b)	Write the Bukingham equation with their significance.	04
	(c)	Derive the equation of momentum flux distribution for flow through falling film.	07
Q.4	(a)	Write the importance of temperature on the Gums material for rheological behavior.	03

	(b)	A fluid of density 1000 kg/m^3 is flowing through horizontal circular pipe 100cm long and inside diameter 10 mm. For a pressure drop is 40 kg/cm^2, the flow rate is 2400 m^3/min. Find out the average velocity in circular tubes.	04
	(c)	Short note on "Shearing Disc Rheometer".	07
		OR	
Q.4	(a)	Write a short note on "Sandwich Rheometer"	03
	(b)	Describe the procedure to determine the viscosity of a Newtonian fluid by capillary method.	04
	(c)	Derive the Volumetric flow rate for a viscometer pipe whose length is larger than the diameter.	07
Q.5	(a)	Describe about the Yamamoto number	03
	(b)	Derive the angular velocity for Bingham Plastic fluid for Rotation viscometer.	04
	(c)	Explain in detail about one dimensional Plastic-Viscous models for rubber compounds.	07
		OR	
Q.5	(a)	Write about the Stress Tensor.	03
	(b)	Describe the one dimensional Plastic-Viscoelastic models for rubber compounds.	04
	(c)	Derive the Continuity equation for Elongation flow.	07