Reg. No.



MANIPAL (A Constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. END SEMESTER EXAMINATION (OPE)

SUBJECT: NON-NEWTONIAN FLOW IN PROCESS INDUSTRIES (CHE 4067)

Date:22/12/2021, Time: -75 min (75+10 min) Max. Marks: 20

Instructions to Candidates: Answer ALL the questions & missing data may be suitably assumed

	Capillary viscometer is used to obtain the pressure drop and velocity data of a polymer solution	
	and reported in the table below, the solution follows the power law model. The capillary	1
	viscometer pipe internal diameter is 0.01 m. Obtain the flow behavior index and flow	I
1a	consistency coefficient of the solution	5
		1
	AP/I (P ₂ /m) 53 135 194 253 371 453	1
	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1
	Calculate the Reynolds number of the non-Newtonian fluid flows in circular pipe with an	
1h	internal diameter of 20 mm. The average velocity is 1 m/s and solution density is 1020 Kg/m^3 .	2
10	The consistency index and flow behavior index are 3 Pa s ⁿ and 0.76	1
_	Bingham plastic fluid is flowing in pipe whose ID is 25.4 mm and its viscosity and density are 2	2
1c	cP, density of 1200 kg/m ² . The Hedstrom number is 300000. Calculate the yield stress value of this fluid and also calculate Dermalds number where the valuation of this fluid is 2 m/s.	3
	this fluid and also calculate Reynolds humber where the velocity of this fluid is 2 m/s.	1
	Tabulate the velocity to average velocity ratios with r/R values =0, 0.1, 0.3, 0.5, 0.7, 0.9, 0.95	
	with axis symmetry for n=0.5. Draw the graph for above data. Where n is flow behavior index	5
2a	and r/R is radius ratio and corresponding velocity ratio is $V_z/V_{z,avg}$.	Э
	$\mathbf{v} = \frac{\mathbf{m}}{\mathbf{r}} \left[\left(-\frac{\mathbf{a} \cdot \mathbf{e}}{2} \right) \cdot \frac{\mathbf{R}}{\mathbf{r}} \right]^{\frac{1}{2}} \mathbf{x} \mathbf{R} \mathbf{x} \left[1 - \left(\frac{\mathbf{R}}{2} \right)^{\frac{1}{2}} \right]^{\frac{1}{2}}$	1
	Power law fluid is having the flow behavior index of 0.5, flowing in a pipe line (ID = 12 mm).	•
2b	The pressure drop offered by this fluid over a 100 m pipe is 20000 Pa. If the pipe diameter	4
	increased to 20%, what will be the pressure drop.	I
	The rheological properties of a china clay suspension can be approximated by Bingham plastic	
2c	model over a shear rate range of 10 to 100 s ⁻¹ and their corresponding shear stresses are 16.5 and	3
	30 Pa. Calculate the yield stress and viscosity of the suspension.	I