Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

(A Constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. MAKEUP EXAMINATION (OPE)

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

Date:22/02/2022, Time: -75 min (75+10 min) Max. Marks: 20

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

1a	Calculate the fluid consistency index coefficient with following data: Reynolds number is 1500, pipe diameter is 0.75 inch, density of fluid is 1015 kg/m ³ , flow behavior index is 0.7, velocity is 2.1 m/s (power law model). To get the same Reynolds number, what will be the change of velocity if the fluid behaves as Newtonian fluid (assume calculated flow consistency index as viscosity of fluid in Newtonian fluid)	4
1b	Briefly explain the Casson fluid model, Carreau viscosity model	2
1c	Derive the velocity profile equation of non-Newtonian fluid (Power law fluid model) which is flowing as shown in below diagram	4
2a	A non-Newtonian polymer solution (density 1020 kg/m ³) is in steady flow through 100 mm internal diameter and 200 m long pipe at the mass flow rate of 3000 kg/hr. The solution follows the power law mathematical model, its flow behavior index is 0.7 and flow consistency coefficient is 3 Pa .s ⁿ . Determine the power required for this pipe line.	5
2b	10% Iron oxide slurry (density 1250 kg/m ³) behaves as a Bingham plastic fluid with yield stress is 0.8 Pa and viscosity is $4x10^{-3}$ Pa.s. Estimate the friction factor for the velocity 0.08 m/s in a 75 mm diameter pipeline.	4
2c	Briefly explain the time dependent fluid behavior	1