

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: FLUID FLOW OPERATIONS IN BIOPROCESSING [BIO

2106]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.

Fresh water and sea water flowing in parallel horizontal pipelines are connected to each other by a double U-tube manometer as shown. Determine the pressure difference between the two pipelines. Take the density of sea water at that location to be 1035kg/m³. Can the air column be ignored in the analysis?

1A.	Fresh- water 60 cm 10 cm + 10 cm - Mercury	3
1B.	Explain the variation of shear stress with respect to shear rate in Newtonian and non Newtonian fluids.	4
1C.	Blood pressure is usually measured by wrapping a closed air-filled jacket equipped with a pressure guage around the upper arm of a person at the level of the heart. Using a mercury manometer and a stethoscope, the systolic pressure (the maximum pressure when the heart is pumping) and the diastolic pressure (the minimum pressure when the heart is resting) are measured in mmHg. The systolic and diastolic pressure of a healthy person are about 120mm Hg and 80mmHg respectively, and are indicated as 120/80. Express both of these gage pressures in kPa, psi, and meter water column.	3
2A.	If the velocity distribution over a plate is given by $u=[(2/3y)-(y^2)]$ in which 'u' is the velocity in m/s at a distance 'y' meter above the plate determine the shear stress at y=0 and y=0.15m. Take dynamic viscosity of the fluid as 8.63 poises.	3
2B.	A horizontal venturimeter with inlet and throat diameters 300mm and 100mm respectively is used to measure the flow of water. The pressure intensity at the inlet is 130 kN/m ² while the vaccum pressure head at the throat is 350mm mercury. Assuming that 3percent of the head is lost in between the inlet and the throat find: (i) The value of coefficient of discharge for veturimeter and rate of flow.	3
2C.	A total of 12 liters per second of oil is pumped through two pipes in parallel, one 12cm in diameter and the other 10cm in diameter, both pipes being 1000 meters long. The specific gravity of the oil is 0.97 and the kinematic viscosity 9cm ² per second. Calculate	4

Reg.	No.

