MANIPAL INSTITUTE OF TECHNOLOGY

SEMESTER B.TECH./M.TECH END SEMESTER EXAMINATIONS

NOVEMBER/DECEMBER 2019

SUBJECT: TRANSPORT PHENOMENA IN BIOPROCESS ENGINEERING

[BIO5154]

Time of Exam: 3 Hours

(A constituent unit of MAHE, Manipal)

Max. Marks: 50

Instructions to Candidates:

✤ Answer ALL the questions & missing data may be suitable assumed



	Calculate the overall heat transfer coefficient and derive the expression	
	used for the calculation	
2B.	Explain the importance of Brinkman Number	2
3A.	Using Buckingham Pi theorem show that power required for an impeller of the reactor without baffles in dimensionless number and also show that it is a function of other dimensionless numbers.	8
3B.	Explain the significance of dimensionless numbers	2
4A.	Find the temperature profile of unsteady state heat conduction in semi-infinite slab	8
4B.	Write a basic mass transport equation for A passing through stagnant gas B with both molecular transport and convective transport terms.	2
5A.	Consider a catalytic heterogeneous chemical reaction in which a reaction $A \rightarrow 2B$ is carried out and assume reaction occurs instantaneously at the catalytic surface. Imagine that the catalytic particle is surrounded by a stagnant gas film through which A has to diffuse to reach the catalytic surface. Neglect the curvature of the particle. Obtain the expression for concentration profile of A in stagnant gas film in terms of mole fraction of A	4
5B.	Consider the absorption of gas A by a laminar falling film of liquid B. The material A is only slightly soluble in B, so that the viscosity of the liquid is unaffected. We shall make the further restriction that the diffusion takes place so slowly in the liquid film that A will not "penetrate" very far into the film-that is, that the penetration distance will be small in comparison with the film thickness. Derive an expression to represent concentration profile of gas A in a falling liquid film.	6