Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech**
PCBT4303

5th Semester Back Examination 2017-18
Upstream Process Engineering
BRANCH: BIOTECH
Time: 3 Hours
Max Marks: 70
Q.CODE: B208

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Explain the equation of continuity.

b) What is kinematic viscosity? Give its units.

c) 5.6 m^3 of oil weighs 46,800 N. Find its mass density and relative density?

d) What is expression of the theoretical velocity of jet at *vena-contracta*, where the H = Head of water at vena-contracta?

e) Define and give expression of thermal boundary layer.s

f) State Newton's law of cooling.

g) Define the terms heat flux and temperature gradient.

h) Define Rauolt's law. What is its significance?

i) Types of Mass transfer coefficients?

j) Mention few properties of adsorbent.

Q2 State and derive the Fourier's law of heat conduction with *assumptions* made before deriving and also explain the thermal diffusivity with mathematical expression. **(10)**

Q3 **a)** By applying momentum balance to the steady flow of a fluid inside a pipeline, obtain the Bernoulli's equation. Indicate the corrections necessary to the equation for application to real situations. **(5)**

b) A pipe having diameters 20 cm and 10cm at two sections A and B, carries water that flows at a rate 40 Lts/s. Section A is 5m above datum and section 'B' is 2m above datum. If the pressure at section A is 4 bar, find the pressure at section 2. **(5)**

Q4 **a)** What do mean by heat transfer? What are the different modes of heat transfer? **(5)**

b) A steel pipe with 50 mm outer diameter is covered with a 6.4 mm asbestos insulation [k= 0.166 W/mK] followed by a 25 mm layer of fiber-glass insulation [k= 0.0485 W/mK]. The pipe wall temperature is 120 ^{0}C and the outside insulation temperature is 38 ^{0}C. Calculate the interface temperature between the asbestos and fiber- glass? **(5)**

Q5 **a)** Discuss the steady state diffusion of A through a non-diffusing B and show how the diffusion rate will be modified when component B is counter diffusing. **(5)**

b) With neat sketches, define co-current and counter-current flow in heat exchangers. A steady state, do the energy balance for a heat exchanger? **(5)**

Q6 **a)** Briefly explain flash distillation and steam distillation? **(5)**

b) A mixture of noble gases [helium, argon, krypton, and xenon] is at a total pressure of 100 kPa and a temperature of 200 K. If the mixture has equal kmole fractions of each of the gases, determine: [Molecular weight of helium, argon, krypton (3), and xenon (4) are 4, 40, 83.8 and 131.3 kg/mol respectively] **(5)**

i) The composition of the mixture in terms of mass fractions.

ii) Total molar concentration

iii) The mass density.

Q7 Using Hagen-poiseulle equation, derive an expression for the head loss in a pipe of diameter D and length L in terms of Reynolds number and velocity head. **(10)**

Q8 **Write short notes on *any* TWO:** **(5 x 2)**

a) Venturi meter

b) Azeotropic distillation.

c) liquid-liquid extractions.

d) Friction Factor.