KONERU LAKSHMAIAH EDUCATION FOUNDATION
(DEEMED TO BE UNIVERSITY) (Deemed to be University, Estd. u/s. 3 of UGC Act 1956)

B.Tech - Odd Sem : End Semester Exam
Academic Year:2020-2021

18ES2102 - Transport processes in Biological systems

Set No: 4

Time: **Max.Marks: 100**

S.NO	Answer All Questions	Choice	Options	Marks	CO
1.	Summarize non-Newtonian fluids? Describe the rheological behavior of fermentation broth.A 25 cm long cylindrical metal rod slides inside a tube filled with oil. The inner diameter of the tube is 10cm and the clearance is 0.15mm.the mass of the bar is 1.5kg when immersed in the oil. What is the viscosity of the oil, if the steady state velocity of the rod is 1.1m/s?	choice Q-2		10Marks	CO1
2.	Describe the stress-strain relationship of non-Newtonian fluids.The fungus Aureobasidium pullulans is used to produce an extracellular polysaccharide by fermentation of sucrose. After 120 h fermentation, The following measurements of shear stress and shear rate were made with a rotating-cylinder viscometer..Plot the rheogram and estimate the viscosity index. Shear stress (dyn/cm^2) — Shear rate (S^{-1}) 45.1 — 11.2 245.3 — 180 367.1 — 350 467.1 — 520 646.8 — 1120			10Marks	CO1
3.	Derive the Bernoulli's equation for pumping water from underground storage to the tank on the top of a building. Explain the significance of each term.Water flows through a Venturi meter which has a diameter at the inlet of 1.2 m and a diameter of 0.6 m at the throat. The difference in pressure between the main and the throat is measured by a differential mercury gauge, which shows a deflection of 5.1 cm. Find the discharge through the meter and also calculate the velocity of water at the throat. Take the coefficient of discharge of the meter as 0.98.	choice Q-4		15Marks	CO1
4.	Water at 30oC (ρ=996 Kg/m3,μ=0.8Pa.s) flows through a horizontal pipe 25mm in diameter, in which the pressure drop per unit length is to be limited to 2.35 Pa/m. Estimate the volumetric flow rate			15Marks	CO1
5.	Discuss the basic mechanisms of heat transfer.The temperature at the inner and outer surfaces of a boiler wall made of 20 mm thick steel and covered with an insulating material of 5 mm thickness are 300C and 50C respectively. If the thermal conductivities of steel and insulating material are 58W/m0C and 0.116 W/m.C respectively, determine the rate of flow through the boiler wall.	choice Q-6		10Marks	CO2
6.	Derive an expression for heat conduction through resistances in parallel.Estimate the rate of radiation heat transfer for the following data. Where ε is the emissivity, σ is Stefan–Boltzmann constant, TS = system temperature, TSurr= surrounding temperature and As is the surface area available for exchange of radiation energy. S.No. — ε — σ($W/m^2 K^4$) — A_S (m^2) — T_S(K) — T_{Surr}(K) 1 — 0.1 — 5.670×10^{-8} — 0.008 — 250 — 155 2 — 0.3 — 5.670×10^{-8} — 0.009 — 350 — 169 3 — 0.5 — 5.670×10^{-8} — 0.1 — 450 — 198			10Marks	CO2
7.	A block baker's yeast at the room temperature of 30C is in the form of cuboids (20X10X10 cm). It is dried in an oven maintained at 100C. The emissivity of the yeast block may be taken as 0.55. In addition to radiation heat, the block receives convective heat also from the oven by natural circulation of air. Calculate the total heat transfer rate.	choice Q-8		15Marks	CO2
8.	Two infinite black plates at 800°C and 300°C exchange heat by radiation and convective heat transfer coefficient h=1.9 W/m2 K. Estimate the heat transfer per unit area.			15Marks	CO2
9.	Derive the expression for rate of drying in constant-rate period.	choice Q-10		10Marks	CO3
10.	Ammonia gas (A) diffuses through nitrogen gas (B) under steady state conditions with nitrogen non diffusing. The total pressure is 1.013×105 pa and the temperature is 298 K the diffusion path (z2-z1) is 0.15 m the partial pressure of NH3 at one point is 1.5×104 Pa the DAB of the mixture at 1.013×105 pa and 298 K is 2.3×10-5 m2/sec. Estimate (a) The flux of NH3 and (b) The equimolar counter diffusion flux, assuming that N2 also diffuses.			10Marks	CO3
11.	Describe drying rate curve and explain each stage in the FMC curve.	choice Q-12		15Marks	CO3

12.	Derive an expression for the maximum cell concentration.In a typical aerobic fermentation process, the diffusivity coefficient for oxygen into the fermentation broth is 9X10-10 m2/s. The stagnant liquid film thickness was calculated to be 6 microns. Find the mass transfer coefficient for oxygen based on the film theory.			15Marks	CO3
13.	Differentiate primary and secondary nucleation.. A multi stage soxlet extraction is performed in which 630 Kg of algal biomass contacted with 980 ml of pure hexane and the over a period of time 500 Kg of purified algal biomass collected from multi stage soxlet extraction apparatus. Determine the how much amount of oil present in the algal biomass.	choice Q-14		10Marks	CO4
14.	Differentiate evaporation and distillation and also draw the various feeding operations of evaporator.			10Marks	CO4
15.	Describe various commercial processes used in bioleaching processes.	choice Q-16		15Marks	CO4
16.	Describe the mechanism of bioleaching and summarize copper recovery process using bio-mining technology (copper leaching process)			15Marks	CO4

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