

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT  
TEST -2 EXAMINATION- Oct 2017  
M.Tech I Semester

COURSE CODE: 14M31CE112

MAX. MARKS: 25

COURSE NAME: SIMULATION AND MODELING

COURSE CREDITS: 03

MAX. TIME: 1 1/2 Hr

*Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

- Q1. a) Distinguish between an "Analytical Model" and a "Numerical Model".  
b) Discuss the applications of mathematical models in addressing the issues/concerns in Environmental Engineering. [2 + 3]
- Q2. a) What are the various hydrologic transport processes which are responsible for transport of contaminants in the environment? Discuss any one of them  
b) Write a basic equation which represents the fate of contaminants in environment due to transport and transformation processes and define the variables involved in the equation [2.5+2.5]
- Q3. a) State Fick's Laws of Diffusion  
b) A batch of liquid waste containing 1,70,000 kg of salt is to be pumped to the bottom of a lake 100 m deep. The lake has almost vertical sides and an average area normal to the vertical direction of  $1\text{km}^2$ . Estimate the concentration of salt at the surface of the lake 1 year later. Assume turbulent diffusion coefficient of  $10^0\text{cm}^2/\text{s}$ . What will be the concentration at the surface if the diffusion coefficient is reduced to  $10^{-1}\text{cm}^2/\text{s}$ . [2+3]
- Q4. a) A wastewater – treatment plant disposes of its effluent in a surface stream. Characteristics of the stream and effluent are shown below. [10 Marks]

	Wastewater	Stream
Flow	17280 m <sup>3</sup> /day	5.0 m <sup>3</sup> /s
Dissolved Oxygen, mg/L	1.0	8.0
Temperature, °C	15	25
BOD <sub>5</sub> @20°C, mg/L	200	2
K <sub>1</sub> at 20°C, day <sup>-1</sup>	0.2	
K <sub>2</sub> at 20°C, day <sup>-1</sup>		0.3

- i) What will be the dissolved oxygen concentration in the stream after 2.0 d?  
ii) What is the critical oxygen level in the stream and how far downstream will it occur?  
iii) Determine the maximum BOD<sub>5</sub> (20°C) that can be discharged if a minimum of 4mg/L of oxygen must be maintained in the stream  
iv) Sketch the Dissolved oxygen profile a 100-km reach of the stream below the discharge  
(Assume Velocity of mixture is 0.15m/s)