NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART 111 FIRST SEMESTER EXAM. APRIL/MAY. 2009
WASTEWATER ENGINEERING – TCW 3104

INSTRUCTIONS

Answer any four questions. Illustrate your answer where necessary with clearly labeled sketches.

Time : 3 hours
Total Marks: 100

QUESTION 1

(a) With the aid of a neat sketch; describe the symbiotic relationship between bacteria and algae. (10 marks)

(b) Laboratory tests on an industrial waste indicate that its ultimate BOD is 800mg/L and the K value at 20^0c is 0.25/day. Calculate the five day BOD. What would be the five day BOD if the K value dropped to 0.15/day? (15 marks)

QUESTION 2

(a) Distinguish between aerobic, anaerobic and facultative micro organism and their role in the decomposition of waste water. (11 marks)

(b) Assuming a mean velocity of 0.305 m/s, determine the size of spherical grit particle ($R_D = 2.65$) and spherical organic material ($R_D = 1.05$) which will remain in suspension in a grit channel for which K =0.05 and F = 0.03. (14 marks)

QUESTION 3

(a) Describe the phenomenon of ponding in trickling filters, stating its causes and how it can be controlled. (10 marks)

(b) The following information is given for the design of waste stabilization pond system:
(i) Retention time in anaerobic ponds   = 2.5 days.
(ii) Retention time in facultative ponds = 19 days
(iii) Temperature   = 14^0C

(iv) Concentration of faecal coliforms in the influent = 5×10^7/100ml

Calculate the required retention time in the maturation ponds if 3 ponds are placed in series to achieve a required faecal coliforms concentration of 10^3/ 100ml for the effluent. (15 marks)

QUESTION 4

(a) The biological treatment techniques used may be classified under three categories namely:

(i) attached growth processes   (ii) Suspended growth processes, and (iii) combined processes. Explain each one of these process and list one treatment technique falling under each category. (11marks)

(b) A screen is inclined at 50^0 angle with the horizontal. The circular bars have diameter of 20mm and a clear spacing of 25mm. Determine the head loss when the bars are clean and the velocity approaching the screen is 1.0m/sec. Assume shape factor = 2.4.
 (14 marks)

QUESTION 5

(a) Explain in brief the various methods used for aeration in the activated sludge process plants. (12 marks)

(b) For a waste water sample, 5 day BOD at 20^0C is 200mg/L and is 67% of the ultimate BOD, what will be the 4 day BOD at 30^0C.   (13marks)