UNIVERSITY OF GHANA

BSc. ENGINEERING

SECOND SEMESTER EXAMINATIONS: 2014/2015

FPEN 308: ENVIRONMENTAL EGINEERING IN FOOD PROCESSING (2 Credits)

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ATTEMPT ANY THREE QUESTIONS
Graph sheet will be provided.

(1) (a) What is sustainable solid waste management?

(b) With the aid of a diagram show the four facets of the environment

(c) With the aid of a flow sheet show the components and activities of solid waste management.

(d) With the aid of a flow sheet show a typical wastewater treatment process.

(e) What are the environmental issues associated with landfill sites?

(2) (a) Fuel used as the main energy source for an incinerator contains X % of carbon. The amount of carbon dioxide produced per year is 250,000,000 kg per year. Determine X % if the inlet flowrate is 0.3 kg per second and 93% of the carbon is converted complete to carbon dioxide.

(b) Biochemical Oxygen Demand analyses on a food processing industry were carried out at 78.8°F. The results of the analyses are presented in the Table below.

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Time (days)	BOD (mg/l)
1	2
2	12
3	18
4	20
5	22
6	24
7	30
8	36
9	40

Determine the day Five BOD of the wastewater at 20°C.

(3) (a) A food industry produces 36,000 kg of solid waste per month. If M % of the solid waste is recycled after which 2 M % is diverted before the remaining is sent to a land fill site. The volume of land fill site required per year is 618 m^3. Determine the amount of solid waste recycled and diverted. Assume the density of the solid waste is 450kg/m^3.

(b) A town of 25,000 people is to discharge treated domestic sewage into a stream with minimum flow of 0.13 m^3/s and BOD 2 mg/l and the sewage dry weather flow is 160 litres person per day and the per capita BOD contribution is 0.068 kg/day. The stream also receives treated wastewater from an industry upstream. The treated industrial effluent has a flow of 0.02m^3/s and a BOD of 30 mg/l. If the BOD in the stream below is not to exceed X mg/l, determine the maximum permissible BOD for the domestic sewage if the treatment plant for the domestic sewage is 85%.

(4) (a) Will a grit of diameter 0.11 mm and a specific gravity of 2.65 be collected in a horizontal grit chamber that is 14.3 m in length if the average grit-chamber flow is 0.16 m^3/s, the width of the chamber is 0.57 m, and the horizontal velocity is 0.25 m/s? Assume the kinematic viscosity to be 0.975 x 10^{-6} m^2/s.

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(b) The combined wastewater in a municipality with a sewered population is 3,000 person includes a dairy and poultry plant. The milk waste is 20,000 litres/day with a BOD concentration of 900 mg/l. The poultry dressing industry processes 5,000 chickens per day discharging 16,000 litres/day containing 1500 mg/l BOD. If the total combined wastewater flow for the community is 276,000 litres/day and the average BOD of the combine wastewater is 726 mg/l determine the flow rate in litres per day and the BOD per person per day. Design a primary sedimentation tank for the combined wastewater if the dimensions of the tank, length: breadth and depth is to be 5:3: 0.5 m.

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