

## M. Tech. (Energy Science &amp; Technology) First Year Second Semester Examination – 2019

## Subject: BIO-ENERGY SYSTEMS

Time: Three hours

Full Marks: 100

Answer any five questions.

1. Describe the batch and continuous processes for anaerobic biomethanation of organic residues. Make a comparison between the advantages and disadvantages of both the processes. 20
2. What is the concept behind the recycling of 'active biomass' in an anaerobic digester ? Describe the working principles of 'anaerobic filter reactor' and 'anaerobic sludge blanket reactor'. 20
3. a) What is loading of an anaerobic reactor ? Show that for a CSTR without cell recycle Mean Cell Retention Time and Hydraulic Retention Time are same. 6  
b) A primary sewage sludge containing 4% dry solids of which 65% are volatile, is produced at a rate of  $100 \text{ m}^3$  per day and is to be digested sufficiently to destroy 50% of the volatile solids. What volume must the digester have and what will be the loading on the digester, if the temperature is maintained at  $35^\circ\text{C}$  ? Required MCRT (mean cell retention time) for 50% destruction of volatile solids at  $35^\circ\text{C}$  is 13 days. 14
4. Deduce the Michaelis Menten equation for enzyme catalyzed biochemical reaction. How do you obtain the values of  $K_m$  and  $V_m$  from the Michaelis Menten Equation ? 20
5. Discuss the functions of the different components of an Improved Wood Stove. Describe how the thermal efficiency of a wood stove is measured. 20
6. What are the impurities present in biodiesel after the transesterification process? Describe the different techniques used for purification of biodiesel. 20

7. a) What do you understand by biomass and bio-energy ?

b) Discuss different properties of biomass are to be considered while selecting a conversion technology and designing of a reactor.

4+16

8. a) What do you understand by biomass gasification process?

b) Compare up-draft and down-draft gasifier from technical design and power generation point of view.

c) With the help of a schematic diagram describe different components of biomass gasifier based power generation system.

3+7+10