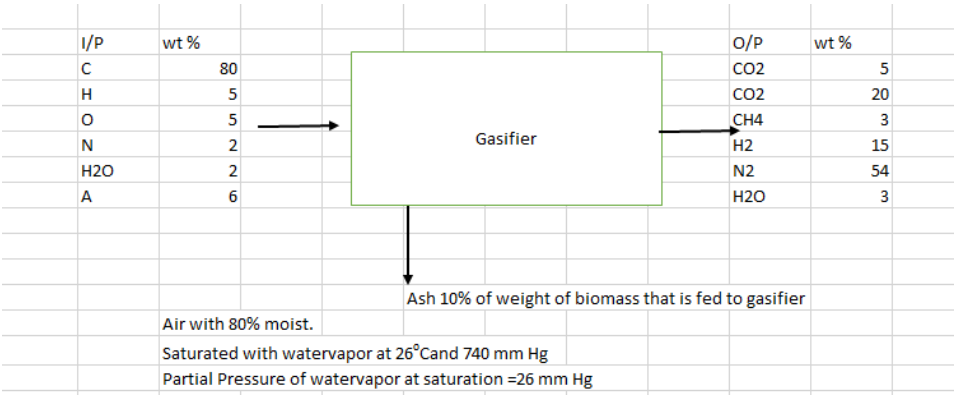
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Biomass Conversion Technologies — **Semester: III**
Program: M. Tech REE — **Time: 03 hrs.**
Course Code:EPEC7021 — **Max.Marks:100**

SECTION A
(Scan and Upload) — **(5Qx4M = 20Marks)**

		Marks	COs
Q 1	Explain the physical and chemical characterization of solid waste?	4M	CO1
Q 2	List the design parameters for a fluidized bed gasifier.	4M	CO2
Q 3	Draw a neat diagram of a semi batch pyrolysis reactor.	4M	CO2
Q 4	What is carbonization process?	4M	CO3
Q 5	List the properties of biodiesel?	4M	CO3

SECTION B
(Scan and Upload) — **(4Qx10M = 40Marks)**

Q 1	Pine needle is used to produce bio oil in a slow pyrolysis unit. The % of bio oil , char and gas are 30%, 40% and 30%. The average molecular formula of the bio char is determined as $CH_{0.56}O_{0.28}N_{0.013}$ and for the bio oil is $CH_{1.47}O_{0.36}N_{0.005}$. The composition of gas is as follows: H_2 10%, CO_2 45%, CO 30% and CH_4 15%. Calculate the percentage of carbon converted to bio oil.	10M	CO2
Q 2	The analysis of various inputs of biomass and outputs are given.  Find a)Volume of producer gas per kg of biomass b)Volume of moist air at 25°C , 1 atm pressure per kg of biomass	10M	CO4

Q 3	a) Classify the pyrolysis based on heating rate. b) Illustrate the different modes of heat transfer involved in pyrolysis.	**10M**	**CO3**
Q 4	Bio oil extracted from an oil seed sample has 90% triglycerides containing three long chains which can produce methyl esters of lauric acid ($CH_3(CH_2)10COOH$), myristic acid ($CH_3(CH_2)12COOH$) and palmitic acid ($CH_3(CH_2)14COOH$) in equal molar ratio during transesterification using methanol and NaOH catalyst. Calculate the amount of biodiesel produced by the transesterification of 20 kg of bio oil. Assume efficiency of the conversion is 75%, and 12% of palmitic acid is converted to soap. How much glycerol will be produced and how much soap will be produced? How can we improve the efficiency of the transesterification?	**10M**	**CO4**
	SECTION C **(Scan and Upload)**		**(2Qx20M = 40Marks)**
Q 1	a) What are the different types of briquetting, briquetting processes and its characteristics and applications? b) Explain the mechanism and microorganisms for anaerobic digestion. c) Illustrate the operation of a two stage anaerobic digester and its process.	**(8+6+6) 20M**	**CO3**
Q 2	Determine the volume of the digester chamber and dimension of the chamber for the biogas production from the cow dung of 15 cows having body weight of 200 kg each. Assume the temperature is 30^oC, the solid content of the cow dung is 15%, and HRT is 40 days. One cow produces 10 kg cow dung daily.	**20M**	**CO4**
	(Or)		
	In a high rate bio gas plant food waste is anaerobically digested to produce biogas. The slurry contains 8% of solid food grains. The elemental composition of the food grains on dry basis is C:60%, H:5%, O:25%, N:10% (mass basis). Around 80% of the food grains are converted into biogas and all the converted hydrogen forms methane. If the flow rate of the slurry is 4500 liter per day, calculate the rate of biogas produced.	**20M**	**CO4**