Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: BIOFUELS ENGINEERING [BIO4014]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A.	Define and distinguish between the following with examples a) First Generation biofuel b) Second Generation biofuel c) Third Generation biofuel d) Fourth Generation biofuel	**3**
1B.	Explain the suitability of the following feedstocks for ethanol- Cassava, Sorghum, Sugar Beet	**2**
1C.	What is Life Cycle Analysis (LCA)? Illustrate using schematic diagram, how to get LCA for biodiesel from Microalgae using Raceway Ponds.	**3**
1D.	What are the desired characteristics of Lignocellulosic feedstock for ethanol	**2**
2A.	Explain the features, advantages, disadvantages of the following biomass pretreatment- Steam Explosion	**3**
2B.	How is ethanol purified from fermentation broth? Describe	**2**
2C.	What are the various components of corn and describe the wet milling process	**3**
2D.	Calculate the theoretical ethanol yield (L) from 1 kg of corn containing 10% moisture and 65% starch on dry basis. Density of ethanol = 0.79 kg/L	**2**
3A.	What are the undesirable effects of the following on the performance of diesel vehicle a) Water b) FFA	**2**
3B.	Write the features of heterogeneous acid catalysis and free lipase catalysis for biodiesel production from the perspectives of cost, recyclability, FFA &water, reaction conditions, purification of products and product yield?	**3**
3C.	Explain the working, advantages , disadvantages of the following lipid extraction methods from microalgae - Bead mill, supercritical fluid extraction, homogenizer, solvent extraction	**3**
3D.	In the purification of biodiesel after transesterification, illustrate the following a) Separation of biodiesel phase from Glycerol phase b) Recovering excess alcohol, FFA, soap from biodiesel	**2**
4A.	Explain the voltage polarization curve for MFC	**2**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

4B.	The formula of a sludge as feed to biogas plant is $C_{22}H_{30}O_2NS$. 100 kg of this feed was subjected to anaerobic degradation. Efficiency of degradation was 80 %. Compute, a) Gas composition b) Nm^3 of gas obtained c) Selling price of the gas obtained (Rs) International Gas Price =\$4.5 per MM Btu; C.V of CH_4 = 55.7 KJ/g; 1 Btu =1055J, 1\$=Rs 65 The Coefficients of CO_2 is 1/8(4c-h+2o+3n+2s).	**4**
4C.	Describe the operations of a UASB for biogas. What are (crucial) process parameters? For a UASB treatment process, treating an industrial waste water, determine a) Size and dimensions of the reactor b) Detention time Data: $Q = 750 m^3/d$. L_{org} = 9 kg COD/m^3.d. s COD = 1500 g/ m^3 p COD = 300 g/ m^3 v = 28.8 m/d E = 0.90 Gas collection is 25% of liquid height.	**3**
4D.	A biogas from an industrial waste degradation has to be compressed and distributed. What are the pretreatments required for the raw biogas?	**1**
5A.	Consider a single chamber MFC with air cathode operated in a batch mode with anode. <u>DATA</u> Anode Surface area = 5 x 10^{-4} m^2 Anode Chamber volume = 0.035L Resistance = 1200 Ω Glucose concentration = 0.75 g/L (a) <u>With PEM</u> voltage output increased quickly to 0.45V and slowly dropped to 0.3 V over 100 hours, with an average of 0.35 V (b) <u>Without PEM</u>, the maximum voltage increased suddenly to 0.65,but decreased rapidly to <0.03V after 20 hours, an average of 0.25 V Calculate a. Peak power density for MFC with PEM in W/m^2 and mW/L b. Coulombic efficiency for MFC with PEM c. Peak power density for MFC without PEM in W/m^2 and mW/L d. Coulombic efficiency for MFC without PEM.	**3**
5B.	Describe the following factors that affect the performance of a MFC – Electrode area and spacing, electrode materials, pH.	**2**
5C.	Explain in depth the four strategies for enhancing the biological Hydrogen production. a) Pretreatment b) Cell immobilization c) Sequential dark and photo fermentation d) Combined dark and photo fermentation	**5**