Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER B.TECH END SEMESTER EXAMINATIONS

10th MAY 2016

SUBJECT: ENGINEERING CHEMISTRY [CHM 1001]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Write diagrams or equations or examples wherever necessary.

1A. Give reason for the following statements;

i) Pyrex glass is used in the manufacture of oven-wares and oven-windows.

ii) Stainless steel with a composition of 18 % chromium and 8 % nickel when heated to 700 °C undergoes intergranular corrosion.

B. Describe the construction, working and reactions of methanol oxygen fuel cell and lithium secondary battery.

C. About 0.368 g of a coal sample with 72 % carbon and 4 % hydrogen was burnt in bomb calorimeter and the ash obtained on extraction with dil. HCl, followed by treatment with $BaCl_2$ provided 0.329 g of $BaSO_4$. The NH_3 evolved from the sample when subjected to Kjeldahl's method neutralized 2 mL of 1M H_2SO_4. Calculate the percentage of sulphur, nitrogen and oxygen in the coal sample if % of ash is 2.

(2+5+3)

2A. Write two differences between the following;

i) Dry and wet corrosion

ii) Electroplating and electropolishing processes of a metal

B. Discuss the construction and derive the expression for emf of a concentration cell with copper ions. Explain the construction and working of Weston cadmium cell. What requirements does it satisfy to function as a standard cell?

C. Write the cell scheme and net cell reaction of a galvanic cell containing Ag / Ag^+ and Zn / Zn^{2+} couples. Compute the cell potential if the concentration of Ag^+ and Zn^{2+} are 3.2×10^{-6} M and 2.0×10^{-3} M respectively. If $E^0_{cell} = 1.56$ V, what is the value of ΔG in kJ for the reduction of Ag^+ by Zn at the indicated ionic concentration?

(2+5+3)

3A. Justify the following statements;

i) Corrosion of zinc is faster than iron when in contact with copper.

ii) The risk due to gassing is avoided in modern maintenance free lead acid batteries.

B. What are composite materials? Explain the classification of composite materials based on matrix material and reinforcement geometry. What is the role of gypsum in cement?

C. A polymer sample has the following composition.

Degree of polymerization	200	300	400	500
% composition	10	20	30	40

Calculate the weight average molecular weight and polydispersity index if its number average molecular weight is 11200.

(2+5+3)

4A. Define the following with an example each.

i) Zero dimensional nanomaterial ii) Decomposition potential

B. Describe the cathodic protection and metallic surface coating techniques to prevent corrosion.

C. What is the principle behind the determination of calorific value of a gaseous fuel by Boy's experiment? Calculate gross and net calorific value of water gas from the following data:

Volume of fuel burnt at STP = 0.08 m^3 Weight of water used for cooling = 24 kg

Temperature of inlet water = 26 °C Temperature of outlet water = 40 °C

Latent heat of steam = 587 × 4.187 kJ/kg Specific heat of water = 4.183 kJ/kg

Weight of water produced by steam condensation = 0.03 kg

(2+5+3)

5A. Account for the following;

i) All solid materials cannot function as biomaterials.

ii) Metals are good conductors of electricity.

B. What is the composition of water gas? Describe the manufacture and uses of water gas using a neatly labeled sketch. Give any four advantages of gaseous fuels over solid fuels.

C. An emf of 0.2121 V was recorded using saturated calomel (E = 0.2422 V) and glass electrode when introduced into a HCl solution with pH = 5 at 298 K. Find the pH of another HCl sample if the same combination of electrodes offered an emf of 0.1010 V at identical temperature conditions. Explain why normal glass electrode can be employed only for measuring pH values in the range 0-10.

(2+5+3)

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