Ref. No.: EX/CON/CHEM/T/115/2017(S)

BACHELOR OF CONSTRUCTION ENGINEERING EXAMINATION, 2017

(1st Year, 1st Semester Supplementary)

CHEMISTRY

Time: Three hours **Full Marks: 100**

(50 marks for each part)

Use a separate answer script for each part

PART – I

Answer Q. no. 1 and any two from the rest.

1.

(a) With an ionic half equation of your choice clearly explain the information we get from such an equation with regard to oxidation or reduction 2

(b)(i) Create the expression for the electrode potential $\phi_{MnO_4^-/Mn^{2+}}$ for the reaction

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ [Given $\phi^0_{MnO_4^-/Mn^{2+}} = 1.507$ V] 2

(ii) What would be the effect of pH on $\phi_{MnO_4^-/Mn^{2+}}$ for the reaction. 2

(c) What is the value of ΔG for a system at equilibrium? 1

(d) Define ionic product of water. Why is it a temperature dependent parameter? 2

(e) What is spectroscopy? How is it important in chemical analysis? (2 + 2)

(f) Mention the different classifications of steel. 3

(g) Explain why corrosion is an electrochemical phenomenon. 2

2.

(a) Explain why an oxidation of Fe^{2+} by $KMnO_4$ in an acidic medium containing Cl^- requires certain modifications for a proper estimation. What are these modifications? Why the same is not required when the oxidizing agent is $K_2Cr_2O_7$? 2 + 2 + 1

(b) Define pH of an aqueous solution. What is the utility of such a parameter? 1 + 2

(c) With the help of a suitable diagram discuss the different types of electronic transitions possible for a certain molecule indicating the energies involved and the region of the electromagnetic spectrum where it occurs. 2 + 2

(d) Briefly explain atmospheric corrosion 4

3.

(a) What is Zimmermann Reinhardt solution? When is it used and how is it useful? 1½+1+2

(b) Why is H_3PO_4 added when Fe^{2+} is estimated using $K_2Cr_2O_7$ in an acidic medium? 1½

(c) Deduce the Ostwald dilution law for the dissociation of a weak base and state its significance. 3 + 1

(d) Discuss UV-Vis spectroscopy with particular reference to $\pi \rightarrow \pi^*$ transition. Why does the energy required for such transitions decrease when a molecule possesses conjugated double bonds? 5

(e) What is "Stainless Steel"? 1

4.

(a) Show with proper experimental evidence the essential components required for corrosion of metals. 3

(b) Define a buffer solution. Derive the Henderson equation for a basic buffer. Explain the mechanism of buffer action on this buffer when H^+ and OH^- are added separately to it. (1 + 1½ + 1½ + 1½)

(c) A solution is 0.4 (M) with respect to acetic acid and sodium acetate. Calculate the pH of the solution. What will be the change in pH if 10 ml of 1 (N) NaOH is added to 1 litre of this solution. [Given K_a for acetic acid at 25°C is 1.8×10^{-5}; neglect change in volume upon adding NaOH]. (1 + 2)

(d) Explain the following: 4½

(i) Reduction potential (ii) Absorbance (iii) Nitriding of Steel

B. Cons. Engg. 1ST YR 1ST SEM. SUPPLEMENTARY EXAMINATION 2017

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PART-II

Answer ***any five*** questions

1.a) Describe wet process for manufacturing of Portland cement and discuss the related reactions. 6

b) Compare merit and demerit of wet process and dry process for manufacturing the cement. 4

2.a) What do you mean by 'setting' and 'hardening' of cement? Discuss the reactions involving cement for its 'setting' and 'hardening'. 3+5

b) What do you understand by 'soundness of cement'? 2

3.a) Discuss about additive of cement. 5

b) How do you compute the amounts of constituents in cement? 5

4.a) Calculate the temporary and permanent hardness of a water sample having 6

$Mg(HCO_3)_2 \equiv 146$ mg/litre

$Ca(HCO_3)_2 \equiv 324$ mg/litre

$CaSO_4 \equiv 136$ mg/litre

$CaCl_2 \equiv 111$ mg/litre

$NaCl \equiv 317$ mg/litre

Given atomic weight: Ca = 40, Mg =24, Na = 23, Cl = 35.5, C = 12, H = 1, O =16, S = 32

b) What are 'temporary' and 'permanent' hardness of water? 4

5.a) Discuss principle for the EDTA method to determine hardness of water. Draw the related structures involved in this method. 6

b) Discuss the ion-exchange resin method for the deionization of hard water. 4

6. Match the following 10

Group A	Group B
i) Tricalcium silicate	a) Shale
ii) Gypsum	b) Chalk
iii)Argillaceous material	c) Cement + sand + coarse aggregates
iv) ppm	d) $CaCO_3$ equivalent
v) High alumina cement	e) Lowest ultimate strength
vi)Tetracalcium silicate	f) Flash set
vii) Concrete	g) Complexometric indicator
viii) Zeolite	h) Retarder
ix) Eriochrome Black T	j) Ion exchanger
x) Calcareous material	k) Superior chemical resistance to sea water