BACHELOR OF CONSTRUCTION ENGINEERING EXAMINATION, 2018

(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 provided by such an equation with regard to oxidation or reduction   2

(b)(i) Create the expression for the electrode potential $\phi_{PbO_2/Pb^{2+}}$ for the reaction

$$PbO_2 + 4H^+ + 2e^- \rightarrow Pb^{2+} + 2H_2O. \quad [Given \; \phi^0_{PbO_2/Pb^{2+}} = 1.45 \; V].$$ 2

(ii) What would be the effect of pH on $\phi_{PbO_2/Pb^{2+}}$ during the course of the reaction.   1½

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

(ii) From the expression $\Delta G = \Delta G^0 = RT \ln K$, where the terms have their usual meaning derive the equilibrium constant of any reaction   2

(d)   pH is a temperature dependent parameter. Explain.   2

(e)   What is spectroscopy? Why has spectroscopy become an essential component of chemical investigations today.   (1½ + 2)

(f)   What information do we get from UV-Vis and IR spectroscopy respectively for a particular molecule.   2

(g)   What are alloy steels? Give an example with proper composition.   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. Why was such a parameter introduced to express the strength of hydrogen ions in solution?   1 + 2

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

(d) What are carbon steels? Discuss the different types with an application of each.   1 + 3

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 acid and state its significance.   3 + 1

(d) Discuss UV-Vis spectroscopy with particular reference to a $\pi \rightarrow \pi^*$ 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) Define ionic product of water (K_w) and show that it is dependent on temperature.   (1 + 1)

(b) What is a buffer solution? Derive the Henderson equation for an acidic buffer. Explain mechanism of buffer action on this buffer when H^+ and OH^- are separately added to it.   (1 + 2 + 1½ + ½)

(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 + 2½)

(d) Define any three of the following: 1½ × 3 = 4½

    (i) Spectrum   (ii) Absorbance   (iii) Stretching vibration

    (iv) Nitriding of Steel   (v) Annealing of Steel

B. E. Construction Engineering 1ST YR 1ST SEM. SUPPLEMENTARY EXAMINATION

2018

Subject: Chemistry

Use a separate Answer script for each part

PART-II

Answer *any five* questions

1.a) Describe dry process for manufacturing of Portland cement, draw schematic diagram of rotary kiln and discuss the related reactions.   6

b) Write down composition of Portland cement.   4

2.a) Define 'setting' and 'hardening' of cement? Discuss elaborately about the reactions involving cement for its 'setting' and 'hardening'.   4+6

3.a) Discuss about at least four additives of cement.   4

b) Write advantages and disadvantages of wet and dry processes for manufacturing the cement.   6

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

$Mg(HCO_3)_2 \equiv 292$ mg/litre

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

$CaSO_4 \equiv 136$ mg/litre

$CaCl_2 \equiv 222$ mg/litre

$KCl \equiv 217$ mg/litre

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

b) Define 'temporary' and 'permanent' hardness of water?   4

5.a) Discuss principle and method to determine hardness of water by EDTA. Draw the structures EDTA, Ca-EDTA complex and indicator used.   8

b) What is the unit of hardness of water?   2

6. Match the following

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