Registration No: | | | | | | | | | | |

Total Number of Pages: 2 **B.TECH**

PAC1A101

1st Semester Regular Examination 2016-17
APPLIED CHEMISTRY
BRANCH(S): ALL
Time: 3 Hours
Max Marks: 100
Q.CODE: Y801

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions:** **(2 x 10)**

a) Why λ_{max} for aniline shift from 230nm in neutral medium to 203 nm in acidic medium?

b) Find the value of the function f(x) after application of the operator on it: $\hat{A} = d/dx$; $f(x) = 3x^2 + 5x$

c) Which of the following molecules exhibit microwave spectra?
H_2, NH_3, CO_2, H_2O

d) Write the selection rule for pure vibrational spectra.

e) Write the name of two catalysts used for hydrogenation of alkenes.

f) What is the average composition of producer gas?

g) Which type of metal oxide film formation cause rapid corrosion?

h) Caustic embrittlement is a particular case of which type of corrosion?

i) Calculate the energy associated with electromagnetic radiation of wavelength 300 nm.

j) What is the maximum degree of freedom possible for a one component system?

Q2 **Answer the following questions:** **(2 x 10)**

a) What do you mean by Eigen Value and Eigen value problem? Prove that Schrödinger equation is an Eigen value problem.

b) Write the selection rule for pure rotational spectra.

c) Prove that e^{ax} is an eigenfunction of operator d/dx. What is its eigen value?

d) Define Pilling-Bedworth's rule.

e) Write four important features of a good fuel.

f) Calculate the zero-point energy of an harmonic oscillator having its frequency 2.0×10^{-13}Hz.

g) Write the molecular structure of ferrocene.

h) Corrosion of water filled in steel tanks occurs below the waterline. Explain.

i) Why fusion curve of ice has negative slope and transition curve of sulphur has positive slope?

j) Why a mixture amount of ethyl bromide is always added to petrol along with knocking agent TEL?

Part – B (Answer any four questions)

Q3 **a)** State Beer's Lambert law. Discuss various types of transition occur when a molecule absorb electromagnetic radiations from UV-VISIBLE region. **(10)**

b) What do you mean by eutectic system? Discuss general phase diagram of an eutectic system. **(5)**

Q4 **a)** What is EAN rule? Justify that the following organometallic compounds satisfy the EAN rule: (i), $CH_3Mn(CO)_5$; (ii) $Fe(\eta^5\text{-}C_5H_5)_2$; (iii) $[Cp_2Co]^+$. **(8)**

b) Define term octane number and cetane number. **(3)**

c) What is the physical interpretation of wavefunction of a particle? **(4)**

Q5 **a)** What do you mean by water gas and producer gas? Discuss their methods of synthesis and uses. **(5)**

b) Define auxochrome and chromophore. Explain how an auxochrome exert bathochromic shift on a chromophore? **(5)**

c) Describe the details on the 1^{st} postulate of quantum mechanics. **(5)**

Q6 **a)** The CO molecule (rigid type) has bond length r = 1.20 x 10^{-10} m. Calculate its rotational constant in joules, cm^{-1} and Hz. **(7)**

(Atomic mass units: C = 12.00u; O = 15.9949u)

b) Write the principle of naming of κ, μ and η types of organometallic compounds. Give one example from each. **(8)**

Q7 **a)** The frequency of oscillation of HF is 5.0 x 10^{12} Hz. Calculate the vibrational energy and its force constant. **(7)**
(Atomic mass units: H = 1.0078u; F = 18.9984u)

b) Define hydroformylation. Write the name of two catalysts used for hydroformylation reaction with one example from each. **(4)**

c) What do you mean by corrosion? Discuss the various factors affecting corrosion. **(4)**

Q8 **a)** A sample of coal was found to have the following percentage composition:C= 75 %; H = 5.2%; O = 12.1%; N = 3.2% and Ash = 4.5% **(8)**

(i) Calculate the Minimum air required for complete combustion of 1 Kg coal.
(ii) Calculate HCV and LCV of coal sample.

b) What are the limitations of EAN rule? **(7)**

Q9 **a)** Write short notes on(any two) **(2X5)**
(i) Pitting corrosion
(ii) Compressed Natural gas (CNG)
(iii) Cracking .

b) Describe the merits and limitations of phase rule. **(5)**

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