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Reg. No.: \_\_\_\_\_

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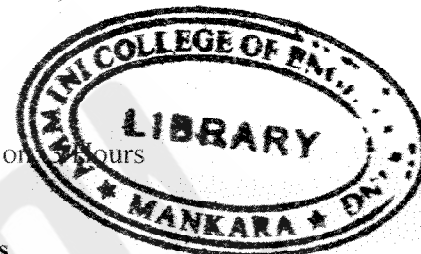
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
FIRST/SECOND SEMESTER B.TECH DEGREE SPECIAL EXAMINATION, AUGUST 2016

Course Code: CY100

Course Name: ENGINEERING CHEMISTRY

Max. Marks: 100

Duration: 3 hours

**PART A**

Answer all questions, each question carries 2 marks

1. How many modes of vibrations are there in water molecule? State whether all are IR active?
2. Calculate the amount of electrical energy available from a dry cell corresponding to the consumption of 6.55g zinc metal ( cell emf = 1.5V, atomic wt. of Zn = 65.5 )
3. Differentiate between the terms retention time and retention factor used in chromatography.
4. Write down the structures of BS and Kevlar.
5. Lubricants with higher aniline point are desirable. Why?
6. What is natural gas? Give its approximate composition.
7. What is the role of  $\text{NH}_3\text{-NH}_4\text{Cl}$  buffer solution in the determination of hardness of water by EDTA method?
8. The dissolved oxygen content of a sample of water is low. What comments you can make about the water quality?

**PART B**

Answer all questions, each question carries 3 marks

9. Why is TMS taken as reference to determine chemical shift value in NMR spectroscopy?
10. Draw a well labelled diagram of calomel electrode. Write down the electrode representation.
11. What are the methods used for visualisation of spots in TLC?
12. Carbon nano materials are promising materials in electronics and reinforcing field. Justify the statement.
13. A sample of fuel was found to have the following percentage composition. C-72%, H-8.2%, O-12%, N-3.3% and ash 4.5%. Calculate HCV and LCV of coal sample.
14. What is biodiesel? Write any three advantages of the fuel.
15. Why chloramine is a better disinfectant than chlorine?
16. Write a note on sewage water treatment by USAB process.

### PART C

Each question carries 10 marks

17. (a) Write the mathematical representation of the law governing absorption of light by molecules of a solution. A dye solution of concentration 0.05M shows an absorbance of 0.055 at 540nm while a test solution of the same has an absorbance of 0.025 under same conditions. Calculate concentration of test solution.

(b) What is meant by the term shielding in NMR spectroscopy? Arrange the  $\text{CH}_3\text{F}$ ,  $\text{CH}_3\text{Cl}$ ,  $\text{CH}_3\text{Br}$  and  $\text{CH}_3\text{I}$  in the increasing order of shielding effect. Give the reason for your answer.

(c) Give the reason for high  $\delta$ -value of aromatic protons. (3+3+4)

OR

18. (a) Define IR spectrum. Why HCl is IR active, but hydrogen molecule is not. Write the reason for the statement.

(b) What is meant by spin-spin coupling in NMR spectroscopy? Predict the different types of protons, the number of signals and the ratio of area of peaks in the NMR spectrum of  $\text{CH}_3\text{-O-CH}_2\text{-CH}_3$

(c) What is MRI? How is it useful in the field of medicine? (3+4+3)

19. (a) Write the half-cell reactions when a Li - ion cell acts as an electrolytic cell.

(b) Sketch the electrochemical cell, write the cell reactions of the following cell:  $\text{Cd(s)} \mid \text{CdSO}_4(0.01\text{M}) \parallel \text{CuSO}_4(0.5\text{M}) \mid \text{Cu(s)}$ . Calculate the emf of the cell at 25 °C if the  $E^0$  cell is 0.38V.

(c) What are the functions of a salt bridge? (4+3+3)

OR

20. (a) Write the construction and working of a hydrogen oxygen fuel cell.

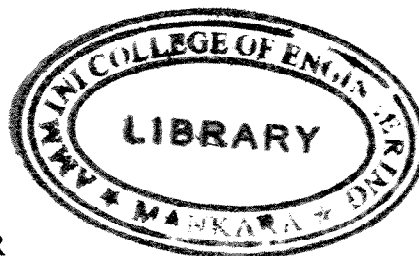
(b) A hydrogen electrode is immersed in a solution of pH 4.9 and is coupled with SHE. Calculate the emf of the cell? (7+3)

21. (a) What is HPLC? Give its principle.

(b) Give a well labelled diagram of HPLC.

(c) List two applications of HPLC.

(d) How does HPLC differ from GC? (3+3+2+2)



OR

22. (a) Give the principle of DTA.

(b) Give a neat labelled diagram of DTA apparatus.

(c) List applications of DTA. (3+3+4)

23. (a) What are nano materials? How are they classified based on dimension? Give one example for each type.

(b) Write the main difference between intrinsically conducting polymers and extrinsically conducting polymers. List two advantages of using conducting polymers instead of metals.

(4+6)

OR

24. (a) What are conducting polymers? Write the structure of two conducting polymers with their respective monomers.

(b) What is OLED? Give an example.

(c) Write three advantages of OLED display? (4+3+3)

25. (a) Distinguish between (i) cloud point and pour point and (ii) flash point and fire point. Write the significance of these terms of lubricating oil.

(b) Write the working of a Bomb calorimeter for the determination of calorific value of a solid fuel with a neat diagram. (5+5)

OR

26. (a) Write a note on liquid lubricants.

(b) Differentiate between oil dag and aquadag? Mention their applications.

(c) What is meant by knocking of petrol? Arrange the following compounds benzene, n-hexane and cyclohexane in the increasing order of knocking tendency. Reason your answer.

(4+3+3)

27. (a) Water for use in a hospital has to be disinfected. An ozone plant and a chlorination plant are under consideration. What are the advantages and disadvantages of the suggested methods?

(b) Calculate the temporary and permanent hardness of a sample of water containing  $\text{Mg}(\text{HCO}_3)_2$ -10mg/L,  $\text{Ca}(\text{HCO}_3)_2$ -10mg/L,  $\text{CaSO}_4$ -12mg/L and  $\text{MgSO}_4$ -14mg/L

(c) Correlate COD and BOD. Give the significance of BOD in water analysis. (4+3+3)

OR

28. (a) Name the indicator used in EDTA titration for estimation of hardness of water. How does it act?

(b) An advertisement of a water purifier mentions that it uses an ion exchange resin capsule, activated carbon and UV light for purification of water. How does each of these help in the purification of water?

(c) 25 mL of standard hard water containing 1 mg of pure  $\text{CaCO}_3$  per mL consumed 10 mL of EDTA. 25ml of water sample consumed 12.5 ml of the same EDTA solution. Calculate the total hardness of water sample in ppm. (3+3+4)

