| | Utech |
|---------------------------|----------------------------|
| Name: | |
| Roll No.: | To Opening State Confident |
| Invigilator's Signature : | |

CS/B.Tech (ICE/EIE(O))/SEM-8/EI-801C/2010 2010

ANALYTICAL INSTRUMENTATION

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

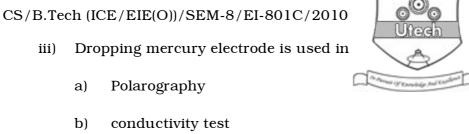
Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

- 1. Choose the correct alternatives for any ten of the following: $10 \times 1 = 10$
 - i) Katharometer cell is used to measure the
 - a) pH of the liquid
 - b) conductivity of the liquid
 - c) thermal conductivity of gas
 - d) potential difference.
 - ii) Non-dispersive type instrument uses
 - a) wide frequency band
 - b) no restriction on frequency
 - c) narrow frequency band
 - d) single frequency.

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- c) pH measurement
- d) dissolve oxygen analysis.
- iv) Gow-Mac densitometer is used to measure the density of
 - a) solid b) liquid
 - d) none of these. c) gas
- Magneto dynamic type oxygen analyzer dumbel is filled v) up with
 - a) oxygen
 - b) nitrogen
 - hydrogen c)
 - water vapour. d)
- Viscosity of non-Newtonian fluid is measured by vi)
 - Saybold viscometer a)
 - b) Redwood viscometer
 - Cone and plate type viscometer c)
 - d) Englar viscometer.

- a) capacity factor b) resolution
- c) elution time d) selectivity factor.
- viii) The analyzer cell where a third electrode may be added to increase life of the cell is
 - a) Zirconia fuel cell
 - b) Polarographic cell
 - c) Hot wire TCD analyzer
 - d) Hersh cell.
- ix) The mass spectrometer which uses Mattauch-Herzog geometry is
 - a) Quadrupole
- b) ESR
- c) Double focusing
- d) Time of flight.
- x) Pyroelectric detector is formed as temperature sensitive
 - a) resistor
- b) inductor
- c) capacitor
- d) diode.
- xi) Force acting on electron charge e, mass m moving with a velocity v in a direction parallel to uniform magnetic field H is
 - a) 0

b) Hev/r^2

c) mv^2/r

d) mv/r.

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- xii) Which of the following microwave bands is suitable for moisture measurement?
 - a) S band
 - b) X band
 - c) both S band & X band
 - \mathbf{d}) K band.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. 3×5

 $3 \times 5 = 15$

- 2. What is meant by polarization of solution in context of conductivity measurement? How can it be minimized? 2 + 3
- 3. Briefly discuss the working principle of electrolytic hygrometer with the help of schematic diagram. What is the main source of error in such hygrometer? 4+1
- 4. What are the detectors used for UV absorption spectrometry?
- 5. How can microwave be used for moisture measurement?

 Explain with neat sketch.
- 6. What is the function of coalescer ? Draw and discuss the scheme of a steam-injected suction system. 1+4

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GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following.

 $3 \times 15 = 45$

- 7. a) Why is IR spectroscopy called vibrational spectroscopy?

 Prove that molecular electronic excitation, vibrational excitation, rotational excitation take place in UV-visible,

 NIR, FIR regions of electromagnetic wave spectrum respectively. 2+4
 - b) Write some examples of application field where pH measurement as well as control are necessary. What is buffer solution? 2+1
 - c) Draw & discuss different procedures of feeding the sample gas to the hot wire cell in case of hot wire TCD analyzer.
 - d) Give an example of source commonly used in atomic absorption spectroscopy.

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| 8. | a) | Draw a diagram of the gas chromatography | set-up and |
|----|----|------------------------------------------|---------------------|
| | | In American control | Sample and Explains |
| | | explain the function of the components. | 3 + 4 |

- b) Explain, with a diagram, the principle of operation of the Electron capture detector.
- c) Define retain factor. Derive the expression of capacity factor. $1+2 \label{eq:condition}$
- 9. a) How do you estimate the percentage in sample gas by heat of reaction method?
 - b) What is cell constant of conductivity cell? Why is it different in different cells? 2+3
 - c) What do you mean by pH of solution?
 - d) What is the requirement of reference cell in pH measurement?

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| 10. | a) | Write down a comparison between thermomagnetic and |
| | | zirconia oxygen analyzer method. |
| | b) | Discuss the difference between the dispersive and non- |
| | | dispersive IR spectrometer. 4 |
| | c) | Explain the working principle of the FT IR spectrometer |
| | | based on Michelson interferometer principle. 7 |
| 11. | Writ | te short notes on any <i>three</i> of the following : 3×5 |
| | a) | Flame ionization detector |
| | b) | Golay detector |
| | c) | Vibrating U tube densitometer |
| | d) | Time of flight type mass spectrometer |
| | | |

e) Working principle of dropping mercury electrode.