P. P. SAVANI UNIVERSITY

Third Semester of B.Sc. Examination

December -2021

SSES2190-Instrumentation & Analytical Techniques I

11.12.2021, Saturday Time: 09:00 a.m. to 11:30 a.m. Maximum Marks: 60

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

Section-I (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a Walsh laid down the foundation of atomic absorption analysis in the year:

- **A** 1955
- **B** 1975
- **C** 1988
- **D** 2001

1.1b Shifting of wavelength of the scattered radiation due to exchange of energy between the radiation and the matter is:

- **A** Resonance spectroscopy
- **B** Inelastic scattering
- **C** Coherent spectroscopy
- **D** NMR spectroscopy

1.1c Flame photometer consists:

- **A** Burner
- **B** Monochromator
- **C** Detector
- **D** All of the above

1.1d The emission wavelength for Lithium is:

- **A** 515 nm
- **B** 622 nm
- **C** 670 nm
- **D** 766 nm

1.1e The flame color for Barium is _____.

- **A** Lime green
- **B** Yellow
- **C** Black
- **D** Grey

1.1f An increase in absorption intensity due to presence of substituent with chromophore is called:

- **A** Blue shift
- **B** Hypochromic effect
- **C** Hyperchromic effect
- **D** Red shift

1.1g The temperature range for nitrous oxide acetylene fuel + oxidant mixture is _____.

- **A** 3100 – 3200 Celsius
- **B** 2900 – 3000 Celsius

C 2700 – 2800 Celsius
D 2500 – 2700 Celsius

1.1h Absorption maxima for alkanes is:
A 150 nm
B 200 nm
C 280 nm
D None of the above mentioned

1.1i Impedance spectroscopy involves:
A The studies of the ability of a medium to slow the transmittance of energy.
B Release of energy absorbed by the material.
C The reflection or scattering the incident radiations by a material
D All of the above mentioned

1.1j The temperature range for hydrogen oxygen fuel + oxidant mixture is _____.
A 3100 – 3200 Celsius
B 2900 – 3000 Celsius
C 2700 – 2800 Celsius
D 2500 – 2700 Celsius

1.2 Answer the following:(True/False/Short question/Fill in the Blanks)[05]

1.2a Monochromator is used to select the light of a specific wavelength from the flame. (True/False)

1.2b Radiation is emitted when the excited atoms move back to the ground state. (True/False)

1.2c Chemiluminescent reaction is used by flame photometric detector in the hydrogen-air flame. (True/False)

1.2d The part of molecule or group of atoms which is responsible for absorption is called cation. (True/False).

1.2e Spectroscopy is a branch of science that involves the study of the _____ of electromagnetic radiations with matter. (Fill in the blanks)

Q.2 Short Notes (Attempt any two) [06]

A Write 3 limitations of flame photometry.
B Origin of UV Visible spectra.
C 3 types of transitions in UV visible spectroscopy.

Q.3 Explain in detail (Attempt any two) [14]

A What are auxochromes? Explain in detail.
B What are chromophores? Explain in detail.
C Explain the principle (with diagram) and uses of flame photometry

Section-II (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a Atomic Absorption Spectroscopy was introduced for analytical purpose by:

- **A** Walsh and Alkemade
- **B** Robert Boyle
- **C** John Dalton
- **D** Robert Bunsen

1.1b In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

- **A** Tungsten lamp
- **B** Xenon mercury arc lamp
- **C** Hydrogen or deuterium discharge lamp
- **D** Hollow cathode lamp

1.1c Which of the following is the principle of Atomic Absorption Spectroscopy?

- **A** Medium absorbs radiation and transmitted radiation is measured
- **B** Radiation is absorbed by non-excited atoms in vapour state and are excited to higher states
- **C** Colour is measured
- **D** Colour is simply observed

1.1d In Atomic Absorption Spectroscopy, with what material is the cathode in Hollow cathode lamp constructed?

- **A** Tungsten
- **B** Quartz
- **C** Element to be investigated
- **D** Aluminium

1.1e The functioning of Atomic absorption spectroscopy is based upon the principles of:

- **A** Lambert – Beer's Law.
- **B** Avogadro's Law
- **C** Kohlrausch law
- **D** None

1.1f The degree of conformity and closeness to the true value is known as:

- **A** Precision
- **B** Measuring scale
- **C** Error
- **D** Accuracy

1.1g Precision is defined as:

- **A** The closeness of a result to the true value.
- **B** A measure of consistency
- **C** Both A and B
- **D** None

1.1h The middle value in a set of data that has been arranged in numerical order is:

- **A** Mean
- **B** Median
- **C** Average
- **D** Outlier

1.1i A t-test is a significance test that assesses:

- **A** The means of two independent groups
- **B** The medians of two dependent groups
- **C** The modes of two independent variables
- **D** The standard deviation of three independent variables

1.1j Rounding means:

A Adding a number with an approximate value that has a longer, difficult, or more non-explicit representation.

B Multiplying a number with an approximate value that has a longer, difficult, or more non-explicit representation.

C Replacing a number with an approximate value that has a shorter, simpler, or more explicit representation.

D None of the above

1.2 Answer the Following: (True/False/Short Question/Fill in the Blanks) [05]

1.2a Atomic absorption is a process involving the absorption of light by free atoms of an element at a wavelength specific to that element. (True/False)

1.2b Atomic Absorption Spectroscopy is used for the analysis of metals. (True/false).

1.2c Indeterminate error causes the mean of the data set to differ from the accepted value. (True/false).

1.2d _____ is a measure of difference between the observed value of a variable and some other value, often that variable's mean. (Fill in the blanks)

1.2 e Write population standard deviation equation.

Q.2 Short Notes (Attempt any two) [06]

A Write 3 applications of Atomic Absorption Spectroscopy.

B Explain the principle of Atomic Absorption Spectroscopy

C Define absolute error and relative error.

Q.3 Explain in detail (Attempt any two) [14]

A Explain the methodology of Atomic Absorption Spectroscopy.

B Explain the types of errors in experimental data.

C Explain F-test.