

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER- V EXAMINATION – SUMMER 2026

Subject Code:3151302

Date:09-06-2026

Subject Name: Advance Environmental Instrumentation

Time: 02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Define: scattering, absorption & emission, with reference to optical instruments. **03**
(b) Differentiate between visual and instrumental method of turbidity analysis. **04**
(c) Define Chromatography. With the help of neat sketch explain components of Gas chromatography. **07**
- Q.2** (a) Explain principle of UV-Visible spectrophotometer. **03**
(b) List various types of molecular vibrations due to irradiation of low energy light. Explain them with neat sketch **04**
(c) Explain the working principle of Atomic absorption spectrophotometer. Draw its neat sketch and highlight its applications. **07**
- OR**
- (c) Write a note on visual method of turbidity analysis. **07**
- Q.3** (a) Which factors affect the chromatographic separation? Explain them. **03**
(b) Enlist different types of detectors used in chromatographic analysis. Mention application of each type of detector. **04**
(c) Which types of columns are used in gas chromatography. Explain them with applications. **07**
- OR**
- Q.3** (a) Highlight the applications of HPLC. **03**
(b) Explain following chromatographic parameters: retention time, retention volume, resolution, peak asymmetry. **04**
(c) Draw a neat sketch and explain instrumentation of HPLC. **07**
- Q.4** (a) Briefly explain the type of spectrum. **03**
(b) Discuss the principle of Infrared Spectrophotometer and list its components. **04**
(c) Derive the equation of specific conductance and explain principle of conductivity meter. **07**
- OR**
- Q.4** (a) Explain principle of ion selective meter and DO meter. **03**
(b) Enlist the oxidation methods used in TOC analyzer for oxidation of organic compounds. Explain them. **04**
(c) Enlist components of pH meter and explain them. **07**
- Q.5** (a) Write down the expressions to find: Average deviation, relative average deviation, standard deviation, coefficient of variance, variance and Students'T. **03**
(b) Highlight the need of analytical instrument in environmental engineering field. **04**
(c) Enlist and explain the types on online sensors used in environmental engineering field. **07**

OR

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|------------|---|-----------|
| Q.5 | (a) Explain accuracy and precision with example | 03 |
| | (b) Differentiate between determinate and indeterminate error. | 04 |
| | (c) Write a note on column chromatography. | 07 |

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V EXAMINATION – SUMMER 2025

Subject Code:3151302

Date:17-05-2025

Subject Name:Advance Environmental Instrumentation

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed

- Q.1**
- (a) Discuss the Stefan- Boltzmann law with its applications. 03
- (b) Explain the different types of electronic transitions in molecules. 04
- (c) Discuss the significance of ‘Advanced Environmental Instrumentation’ in environmental engineering field. 07
- Q.2**
- (a) Derive the beer-lambert’s law. 03
- (b) 1. Explain the various affecting factors the absorption spectral bands in organic compounds. 03
2. Calculate molar absorptivity of a solution containing 2.5×10^{-5} M of a substance if in a 2 cm cell at 400 nm is 56%. 01
- (c) Draw a block diagram of IR Spectroscopy and discuss working principle in detail. 07

OR

- (c) Draw a block diagram of UV-Visible Spectroscopy and discuss working principle in detail. 07
- Q.3**
- (a) Highlight the environmental significance of turbidity. 03
- (b) Explain Retention time and Retention volume as chromatographic parameters. 04
- (c) Explain working of Gas Chromatography and draw schematic block diagram. 07

OR

- Q.3**
- (a) Explain the measurement of turbidity by visual method with neat sketch of the instrument. 03
- (b) Explain Capacity factor, Resolution, and Peak asymmetry as chromatographic parameters. 04
- (c) Explain working of High Performance Liquid Chromatography and draw schematic block diagram. 07
- Q.4**
- (a) Explain the terms: Conductance, Resistances, Cell constant. 03
- (b) Along with the neat sketch explain the pH and DO electrode. 04
- (c) Enlist different methods of oxidation used in TOC analyzer. 07

OR

- Q.4** (a) Explain the principle of conductivity meter. **03**
(b) Highlight the applications of Ion- selective meter and pH meter. **04**
(c) Highlight the significance of TOC. Discuss the classification of TOC. **07**
- Q.5** (a) Explain the statistical techniques to treat data with random errors. **03**
(b) Discuss the application of Atomic Absorption Spectrophotometer in environmental engineering field. **04**
(c) Discuss the Continuous Effluent Monitoring system in detail. **07**

OR

- Q.5** (a) Differentiate between determinant error and indeterminate error. **03**
(b) Discuss the application of Gas Chromatography in environmental engineering field. **04**
(c) Discuss the Continuous Emission Monitoring system in detail. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024****Subject Code: 3151302****Date: 21-05-2024****Subject Name: Advance Environmental Instrumentation****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

Marks

- Q.1** (a) Give the modern classification of chromatographic techniques with one example of each. **03**
- (b) Give the difference between visible and instrumental method for measurement of turbidity **04**
- (c) What is Advanced Environmental Instrumentation? What is its Importance? **07**
- Q.2** (a) Draw the figure of pH electrode and explain its working principle. **03**
- (b) Explain the merits of gas chromatography. **04**
- (c) Define the following terms in detail: (i) Mean (ii) Medium (iii) Range (iv) Average Deviation (v) Relative average deviation (vi) Standard deviation (vii) Co-efficient of variation. **07**
- OR**
- (c) Explain the working principle and operation of each unit of Nephelo turbidity meter with neat sketch. **07**
- Q.3** (a) What wavelength range is characteristics of (i) visible radiation (ii) ultraviolet radiation (iii) infrared radiation **03**
- (b) State the applications of High Performance Liquid Chromatography. **04**
- (c) Derive and explain Lambert's and Beer's law. **07**
- OR**
- Q.3** (a) Give the significance of DO in environment. **03**
- (b) Differentiate between Single beam and Double Beam UV – Visible Spectrophotometer. **04**
- (c) Differentiate between UV Visible Spectroscopy & Atomic Absorption Spectroscopy (AAS). **07**
- Q.4** (a) State different instrumental method of analysis useful for analysis of the following compounds: (i) metals (ii) inorganic ions (iii) volatile organic compound (iv) nonvolatile organic compound **03**
- (b) Discuss the application of TOC analyzer in environmental engineering field. **04**
- (c) Explain the working principle and operation of each unit of High Performance Liquid Chromatography with sketch. **07**
- OR**
- Q.4** (a) What do you mean by Online sensors? **03**
- (b) List down components of Flame photometer. Explain each component. **04**
- (c) State and explain different types of errors with at least one example of each. **07**
- Q.5** (a) Define: (i) elution (ii) atomization (iii) chromatograph **03**
- (b) Enlist the types of Detectors used in Spectroscopy. **04**
- (c) Explain the working principle and operation of each unit of Colorimeter with sketch. **07**

OR

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|------------|-----|--|-----------|
| Q.5 | (a) | Write applications of Potentiometry. | 03 |
| | (b) | Differentiate between Accuracy and precision. | 04 |
| | (c) | Write down the application, advantages and disadvantages of Ion Selective Electrode. | 07 |

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- V EXAMINATION-SUMMER 2023****Subject Code: 3151302****Date: 27/06/2023****Subject Name: Advance Environmental Instrumentation****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Define potentiometry, polarography, conductivity **03**
 (b) Explain need of Advanced Environmental Instrumentation in environmental engineering field. **04**
 (c) Explain principle and working nephelometer with neat sketch. **07**
- Q.2** (a) Explain principle of Atomic Absorption Spectroscopy. **03**
 (b) State working principle of Raman spectroscopy with neat sketch. **04**
 (c) With the help of neat sketch explain importance of each components of Atomic Absorption Spectrophotometer. **07**
- OR**
- (c) Explain the working principle of Infrared spectroscopy with neat sketch. **07**
- Q.3** (a) Explain the principle of Gas Chromatography. **03**
 (b) State principle of ion chromatography. Highlight its application. **04**
 (c) Enlist components of Gas Chromatography and explain its working with neat sketch. **07**
- OR**
- Q.3** (a) Explain the principle of HPLC. **03**
 (b) State principle of HPLC. Highlight its application. **04**
 (c) With help of neat sketch explain components of HPLC. **07**
- Q.4** (a) Write down the applications of Absorption Spectrophotometer and Flame Photo meter. **03**
 (b) Explain accuracy and precision with example. **04**
 (c) Explain working principle of pH meter. Explain the components of pH electrode with neat sketch. **07**
- OR**
- Q.4** (a) Write down the applications of Ion selective electrode. **03**
 (b) Explain determinate and indeterminate error with example. **04**
 (c) List down components of UV-visible Spectrophotometer. Explain each component.. **07**
- Q.5** (a) Define Beer's law and Lambert's law. Give its application. **03**
 (b) Discuss the principle of Column Chromatography in detail. **04**
 (c) Write a note on TOC analyzer. **07**
- OR**
- Q.5** (a) List down components of Infrared Spectrophotometer. Explain any two components. **03**
 (b) Define: Variance, standard deviation & mean **04**
 (c) What is polarography? Explain the online DO meter with neat sketch. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V(NEW) EXAMINATION – SUMMER 2022****Subject Code:3151302****Date:09/06/2022****Subject Name:Advance Environmental Instrumentation****Time:02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define (i)Retention time, (ii) elution,(iii) Chromatograph	03
	(b) Explain the working principle of flame photometer with neat diagram.	04
	(c) Which principle is involved in Normal Phase and Reverse Phase chromatography?	07
Q.2	(a) Differentiate between isocratic and gradient elution technique.	03
	(b) State and derive Beer-Lambert's Law.	04
	(c) Explain Instrumentation of UV-Visible spectrophotometer.	07
	OR	
	(c) Describe instrumental method of turbidity measurement with neat diagram.	07
Q.3	(a) Explain Fundamental modes of Molecular vibrations.	03
	(b) Describe thermal detectors used in IR spectrophotometer.	04
	(c) Draw the sketch and explain in detail Gas chromatography with its applications and limitations.	07
	OR	
Q.3	(a) Give the applications TOC analyzer.	03
	(b) Write factors affecting ion exchange chromatography	04
	(c) Describe principle and applications of Atomic absorption spectroscopy	07
Q.4	(a) Mention the classification of chromatography.	03
	(b) Differentiate between HPLC and LC	04
	(c) Explain the principle and instrumentation of HPLC with neat diagram.	07
	OR	
Q.4	(a) Give significance of chromatographic analysis in environmental field.	03
	(b) Give brief account on resins used in ion exchange chromatography.	04
	(c) Explain the working of Ion Chromatography	07
Q.5	(a) Explain in detail sensor method for determination of dissolved oxygen	03
	(b) Explain the term with examples (i) Standard Deviation (ii) Relative Deviation	04
	(c) Define the types of errors with at least one example of each.	07
	OR	
Q.5	(a) Write down the application of Ion Selective Electrode.	03
	(b) Discuss about methods for comparing results.	04
	(c) Give the significance of DO in environment and explain in details of DO probe (electrode).	07
