

Post Graduate Diploma in Advanced Instrumentation
Techniques
EXAMINATION 2019

Session 2019-20

Post Graduate Diploma in Advanced Instrumentation Techniques

EXAMINATION 2019

SCHEME OF EXAMINATION

1. ELIGIBILITY FOR ADMISSION

Candidate should have B.Sc. in any discipline with minimum 50% marks.

2. PASS CRITERIA

For a pass in the examination, a candidate is required to obtain at least 25% in each paper and 36% marks of total aggregate marks of theory and practical papers separately.

3. CLASSIFICATION OF SUCCESSFUL CANDIDATE

Division	Total Marks
First Division	60% and above
Second Division	Above 48% and below 60%
Pass	Above 36% and below 48%
Fail	Below 36%

4. INSTRUCTIONS TO PAPER SETTER

The question paper contains 3 sections. **Section-A** consists of 10 questions (At least 3 questions from each unit of syllabus). **Section-B** consists of 9 questions (3 questions from each unit of syllabus). **Section-C** consists of 6 questions (2 questions from each unit syllabus). The word limit of part A, B and C are 50, 200 and 500 respectively

Post Graduate Diploma in Advanced Instrumentation Techniques

EXAMINATION 2019

Examination scheme

Paper Code	Paper Name	Exam Hours	Maximum Marks	Minimum Passing Marks
Paper-I	Basics of Laboratory management	3	100	36
Paper-II	Analytical techniques	3	100	36
Paper-III	Instrumentation techniques	3	100	36
Paper-IV	Project Work / Case study	-	200	72
Paper-V	Practical	4	100	36

Post Graduate Diploma in Advanced Instrumentation Techniques

EXAMINATION 2019

Paper I – Basics of Laboratory management

Scheme of Examination

Maximum Marks: 100

Duration: 3 Hours

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Unit I Fundamentals of Laboratory ethics

Introduction to lab safety culture, precautionary labels and safety symbols, Material Safety Data Sheets, Personal Protective Equipment (PPE), handling lab equipment safely, Risks in a Research Laboratory, handling, storing and disposing of chemicals safely, using emergency equipment and safety planning.

Unit II Basics of environmental laboratory

Preparation of some common reagents, Concept of Molarity, Molality, Normality. Pipetting devices, Preparation of Buffers, Types of Solutions, Indicators, Chemical / Waste disposal techniques, dilution.

Unit III Computation of research findings

Graphing research data using MS excel, basic softwares used in environmental research, photographic techniques for environmental research, operating of GPS instrument, Statistical Analysis of Data and Reporting Results, Testing of Hypothesis: Tests based on Normal, t, χ^2 and F distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.

Post Graduate Diploma in Advanced Instrumentation Techniques

EXAMINATION 2019

Paper II - Analytical techniques

Scheme of Examination

Maximum Marks: 100

Duration: 3 Hours

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Unit I Fundamentals of analytical Principles in water chemistry

Analysis of water and water quality parameters -concept of pH, measurement of acidity, alkalinity, hardness, residual chlorine, chlorides, DO, BOD, COD, fluoride and nitrogen. Introduction to spectral analysis, colorimetry, fluorimetry, nephelometry, turbidimetry, absorption and emission spectral methods, Flame photometry, FTIR, Atomic Absorption Spectrophotometer, Gravimetry, Volumetry.

Unit II Fundamentals of analytical Principles in air chemistry leachate analyses

Instrumental methods of analyses for particulates, HC, CO, NO_x, SO₂, bio-aerosols, TCLP (Toxicity characteristic leaching procedure) and leachate tests for solid wastes. Principles, techniques and applications of Conductometry, potentiometry, coulometry, AOX analyzer Amperometry, polarography, Neutron Activation Analysis (NAA) methods.

Unit-III Bioremediation and waste water treatment

Contaminant, Xenobiotic, Remediation, Bioaccumulation, Biomagnification, Bioaugmentation, Bioavailability, Bioventing, Consortium, Enrichment, Inoculum, Mineralisation, Phytoaccumulation, phytoextraction, Recalcitrant, Rhizosphere. Microbiology and Biochemistry in waste water treatment (Biological treatment, impact of pollutants on biotreatment, important microorganisms, role of enzymes, principles of growth, Bioaugmentation). Environmental Sampling, Processing, and Screening of Indicator Microorganisms.

Post Graduate Diploma in Advanced Instrumentation Techniques

EXAMINATION 2019

Paper III - Instrumentation techniques

Scheme of Examination

Maximum Marks: 100

Duration: 3 Hours

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit of syllabus). **Section-C** will consist of 6 questions (2 questions from each unit of syllabus). The Word limit of part A, B and C are 50, 200 and 500 respectively.

Unit-I: Electrochemistry and Microscopy

Electrochemistry : pH and buffers, potentiometric and conductometric titration

Microscopy: Principle and application of light, phase contrast, fluorescence, scanning and transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, confocal microscopy Cytophotometry and flow cytometry, fixation and staining.

Unit-II: Principle and application of Filtration and Chromatography

Principle and application of gel-filtration, ion-exchange and affinity chromatography; Paper chromatography, Column chromatography, Ion exchange Chromatography, Thin layer and gas chromatography; High pressure liquid (HPLC) chromatography, FPLC,

Unit-III: Principle and application of Centrifugation and Spectroscopy

Centrifugation: Basic principle and application; Differential, density and Ultracentrifugation, Principles of X ray diffraction, fluorescence, UV, visible, IR, NMR and ESR spectroscopy.

Paper IV - Project Work / Case study

Scheme of Examination

Maximum Marks: 200

The students formulate a new topic related to course of their own in consultation with concern supervisor and are required to inform the department for validity of the topic before undertaking any substantive research work. You need to submit one copy of the Project work in spiral bound form. Project work should be enclosed along with filled in examination application form within the dates notified in the examination schedule.

Post Graduate Diploma in Advanced Instrumentation Techniques

EXAMINATION 2019

Paper V- Practical

Scheme of Examination

Maximum Marks: 100

Duration: 4 Hours

1. GLP (Good Laboratory Practices)
2. Preparation of Standards and other experimental chemicals and reagents
3. Study of cleaning and sterilization of glass ware
4. Study of Basic Laboratory Instruments: pH Meter, Spectrophotometer, Oven, Microscope etc.
5. Determination of atmospheric humidity
6. Physical properties of soil
7. Quadrates and Species identification
8. Estimation of different types of alkalinity from given samples
9. Estimation of Dissolve CO₂ from given samples
10. Understanding the topographic map
11. Conservation of map units
12. Registration of map and digitization
13. DO (Dissolve Oxygen)
14. COD (Chemical Oxygen Demand)
15. BOD (Biological Oxygen Demand)
16. Estimation of chloride from soil
17. Determination of total calcium and Magnesium
18. Determination of total organic carbon from the given sample
19. Determination of total phosphorus from the given sample
20. Determination of total Nitrogen from the given sample
21. Estimation of chloride from water
22. Determination phosphorus from water
23. Air quality monitoring basic
24. Air quality monitoring (TSPM, RSPM, PM 2.5, Sox, NO_x, etc)
25. Industrial field visit for the study of effluent treatment plant.

Field visit and report preparation