

Department of Zoology

Revised Syllabus of Diploma Courses (PG)

Preamble:

The basic objective of this course is to provide information regarding modern analytical tools used in life sciences as well as this course is introduced to bridge the gap between academics and industry. The number of conventional and modern analytical techniques along with their principle, instrumentation and applications are included in the course.

Program Objectives of the Course:

- To understand and handling of biological instrument.
- To understand the biomolecules and molecular reactions.
- To understand the statistical methods and their applications.
- To understand components in immunology and immunological techniques.

Program Outcomes:

- The student will be able to get knowledge of molecules of life.
- He will be able to understand the role of carbohydrates, fats, proteins, vitamins and their metabolic activities.
- The student will encompass the methodology and theory of statistics applied to problems in the life and health sciences.
- They will be able to understand and apply statistical methods in their research.
- Students will be able to identify the basic structure of cells, tissues and organs.
- They will be able to interpret histological images and identify the tissue source and structures.
- Student will be able to understand how these molecules interact within the cell for proper growth and development of cell.
- They will be able to emphasize molecular mechanisms

Advanced Diploma Course

1. Title: **Biomedical instrumentation**
2. Year of Implementation: 2020
3. Duration: Two Year
4. Pattern: Semester

5. Medium of Instruction: English

6. Contact hours: 7 hours/week

8. Structure of Course:

For PG

Year	Semester	Paper No.	Paper Code	Contact Hours	Credits (1Credit =12H)	Marks			
						Semester/ Annual Exam	Internal	Attendance	Total
1	I	PT I	AD* T 101	30	2	50	20	5	75
	II	PT II	AD* T 202	30	2	50	20	5	75
	I	PL I	AD* L101	60	2	120	20	10	150
	II	PL II	AD* L202	60	2	120	20	10	150
		PP I	AD* P101	60	2	150	-		150
		Total			240	10	490	80	30
2	III	PT II	AD*T 301	30	2	50	20	5	75
	VI	PT IV	AD*T 404	30	2	50	20	5	75
	III	PL II	AD*L 303	60	2	120	20	10	150
	VI	PL IV	AD*L 404	60	2	120	20	10	150
		PP II	AD*P 202	60	2	150	-	-	150
		Industrial/Incubation Training		30	2	-	-		-
	Total			270	12	490	80	30	600
Total				510	22	980	160	60	1200

Total No. of Papers: Theory: 6, Practical: 3, Project: 3

Number of Lectures per week: 08

Theory: Semester, Practical and Project: Annual

PT: Paper Theory, PL: Paper Lab, PP: Paper Project, AD: Advance Diploma, * : Name of Subject, T : Theory, L: Lab, P: Project

Semester I

ADZT 101: Biomolecules and Biostatistics

(Contact Hrs: 30 Credits: 02)

Learning Objectives:

- Students will be able to get the knowledge about biomolecules and their metabolic activities.
- Students will be able to understand the role of carbohydrates, fats, proteins, vitamins and their metabolic activities.
- Students will be able to get knowledge about statistical methods for solving problems in life sciences.
- Students will be able to understand the application of statistical methods in their research.

Unit I: Bio molecules

(15)

- 1) The molecular logic of life: The chemical unity of diverse living organisms, composition of living matter. Concept of thermodynamics and Properties of water.
- 2) Bio molecules: Carbohydrate, Amino acid, Protein, Lipid, Vitamins co-enzymes.
- 3) Enzyme structure, Classification, Mechanism of action.
- 4) Carbohydrate Metabolism: Biochemistry of Hormone Insulin and glucagon action.

Unit II: Biostatistics (15)

- 1) Introduction and application of Biostatistics, Probability
- 2) Measurement of central tendency, Measures of Dispersion,
- 3) Correlation: Types and methods of correlation, Testing hypothesis, Null hypothesis
- 5) Analysis of Variance (ANOVA)

Learning Outcomes:

- ✓ After completion of the unit, student will be able to understand the role of carbohydrates, fats, proteins, vitamins and their metabolic activities.
- ✓ The student will encompass the methodology and theory of statistics applied to problems in the life and health sciences.

ADZL101: (Practical): Based on ADZT 101
(Contact Hrs: 60 Credits: 02)

Learning Objectives:

- Students will be able to understand handling of instruments
- Students will be able to understand application of Statistical methods for data analysis.

List of Practicals

- 1) Introduction to measurements: balances and pipetting.
- 2) Preparation of solutions of given normality and its standardization.
- 3) Examples based on Mean
- 4) Examples based on Median
- 5) Examples based on Mode
- 6) Examples based on Student t-test
- 7) Examples based on ANOVA
- 8) Examples based on Probability
- 9) Examples based on Correlation coefficient
- 10) Handling of light microscope, binocular microscope
- 11) Photography of histological slides.

Learning Outcomes:

- ✓ Students is able to handling of instruments

- ✓ Students is able to apply Statistical methods for data analysis.

Reference Books:

1. Biochemistry, Zubay, Addison Wesley and Co.
2. Textbook of Physiology, Guyton
3. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh 7.Principles of Biochemistry, Lehninger C Rs. Publ. (1982).

Semester II

ADZT 202: Cell and Molecular biology and genetic engineering
(Contact Hrs: 30 Credits: 02)

Learning Objectives:

- Students will be able to identify the basic structure of cells, tissues and organs.
- Students will be able to understand the handling the microtome and preparing the histological and histochemical slides.
- Students will be able to interpret histological images and identify the tissue source and structures.

Unit I: Cell biology and Histology (15)

- 1) Fundamentals of histology: Tissue structure and their organization, Cell membrane, cell organelle and Marker Bio molecules
- 2) Microscopy: Light microscope, Phase contrast microscope, Scanning electron microscope, Transmission
- 3) Electron microscope
- 3) Preparation of slide: Fixatives Types and choice, Sample preparation, Microtome
- 4) Stains: Methods tools and techniques for tissue staining, Principles of histochemical reactions Staining and visualization of a) carbohydrates b) proteins c) lipids d) Nucleic acid

Unit II: Molecular biology and genetic engineering (15)

- 1) Nucleic Acid: Structure and biochemistry of nucleic acid, Central dogma of molecular biology (Replication, transcription, Translation) Process of Mitosis and meiosis.
- 2) Genetic Engineering- Vector, Plasmid, Ti-plasmid, Restriction Endonucleases, Exonucleases, Antibiotic resistance transfer by plasmid
- 3) Modern tools and technique used in Taxonomy- DNA amplification by PCR, DNA Barcoding, DNA sequencing

- 4) Immune System: system overview, innate and acquired immune system. Components of immune system. B cell and T cell mediated Immune System, Antigen Antibody interaction.

Learning Outcomes:

- ✓ After completion of the unit, student will be able to interpret histological images and identify the tissue source and structures.
- ✓ Student will be able to understand how these molecules interact within the cell for proper growth and development of cell.

Reference Books:

1. Biochemistry, Zubay, Addison Wesley and Co.
2. Biochemistry, L. Stryer, W.H. Freeman, San Francisco.
3. Biochemistry by Voet and voet
4. Biochemistry by Zubay
5. Color Textbook of Histology Textbook by LESLIE P GARTNER

ADZL202: (Practical): Based on ADZT 202 (Contact Hrs: 60 Credits: 02)

Learning Objectives:

- Students will be able to understand handling of instruments
- Students will be able to perform experiments
- Students will be able to understand different immunological techniques.
- Students will be able to prepare histological slides and different staining techniques

List of Practical's

- 1) Spectrophotometer: Record Absorbance of DNA and Protein at 260nm and 280nm respectively
- 2) Colorimetry: Quantitative estimation of protein by biuret test and DNA by Di-Phenyl Amine method
- 3) Buccal smear – Identification of Barr Body
- 4) Tissue fixation, Processing and sectioning using Microtome
- 5) Staining and permanent slide preparation.
- 6) Detection of carbohydrates/ Lipids/ mucopolysaccharides/nucleic acids /proteins
- 7) Isolation of Genomic DNA from Liver
- 8) Qualitative Analysis of DNA with the help of Agarose gel electrophoresis
- 9) Demonstration of PCR
- 10) Demonstration of blotting techniques.

- 11) Practicals related to use of microscopes
- 12) Immunoprecipitation
- 13) ELISA Technique

Learning Outcomes:

- ✓ Students is able to handle different laboratory instruments
- ✓ Students is able to prepare histological slides and different staining techniques

Reference Books:

1. Biochemistry, L Stryer, Freeman and Co, NY
2. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
3. Practical Biochemistry by David Plummer

ADZP 101 (Project)

(Contact Hrs. 60, Credits 2)

Semester III

ADZT 303: Centrifugation, spectroscopy and microscopy

(Contact Hrs. 30, Credits: 02)

Learning Objectives:

- Students will be able to get knowledge about centrifugation techniques.
- Students will be able to understand Spectrophotometry working
- Students will be able to get knowledge about different microscope.

Unit I Centrifugation techniques and spectroscopy (15)

- Principle of sedimentation and centrifuges and uses
- Laboratory Centrifugation (Micro centrifuge, Clinical centrifuges, Multipurpose high-speed centrifuges, Ultracentrifuges)
- Differential centrifugation
- Gradient centrifugation
- Centrifuge tubes
- Uses

Spectrometry and spectroscopy

- U-V Spectrophotometry
- Principle
- Application –
- Micro spectrophotometry
- FTIR (Aourier transform infrared spectroscopy)- Application
- Atomic Absorption Spectroscopy (AAS)

Unit II Microscopy (15)

- Light microscope
- Phase contrast microscope
- Fluorescence microscope
- Electron microscope (SEM and TEM)
- Scanning probe microscopy
 Ultrasonic force
- Ultraviolet microscopy
- Infrared microscopy
- Digital pathology (Virtual microscopy)
- Laser microscopy
- Application in Forensic science

Learning Outcomes:

- ✓ Students get knowledge about centrifugation techniques.
- ✓ Students will acquire knowledge about spectrophotometer working
- ✓ Students will acquire knowledge about different microscopes and their working.

Reference Books:

1. Biochemistry, L Stryer, Freeman and Co, NY
2. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
3. Practical Biochemistry by David Plummer

ADZL303: (Practical): Based on ADZT 303 (Contact Hrs: 60 Credits: 02)

Learning Objectives:

- Students will be able to understand handling of centrifuge
- Students will be able to do separation of different solvents
- Students will be able to handle spectrophotometer.

List of Practicals

- 1) To find absorption spectrum of hemoglobin, bovine serum albumin and tyrosine by UV-spectrophotometry.
- 2) To estimate protein content in vegetable / animal tissue by Lowry's method.
- 3) Handling and adjustment of microscopic component of light microscope.
- 4) Photography of different histological slides/ small insects by light microscope.
(Microscopic image documentation technique)
- 5) For Electron microscopy technique visit to other institute.
- 6) Separation of blood serum and blood cells by centrifugation.

Learning Outcomes:

- ✓ Students is able to handle different types of centrifuge
- ✓ Students is able to separate the solvent and prepare homogenate.
- ✓ Students is able to measure optical density of different solutions and prepare graph.
- ✓ Students is able to do quantitative estimations of different biomolecules.

Semester IV

ADZT 404: Analytical techniques

(Contact Hrs. 30, Credits: 02)

Learning Objectives:

- Students will be able to get knowledge different chromatographic techniques.
- Students will be able to understand working of different medical instruments.
- Students will be able to understand efficiency of medical instruments.

Unit I Chromatography

(15)

History

- Terms in Chromatography
- Column Chromatography
- Planar Chromatography
 - Paper Chromatography
 - Thin layer Chromatography
- Ion exchange Chromatography
- Affinity Chromatography
- HPLC (High performance liquid chromatography)
- GC-MS (Gas chromatography mass Spectrometry)
- LCMS (Liquid chromatography mass Spectrometry)
- Applications

Unit II Medical instrumentation

(15)

- ECG (Electrocardiogram)
- MRI (Magnetic Resonance Imaging)
 - Basic principles
 - Application
- MRS (Magnetic Resonance Spectroscopy)
- X-rays
 - History, Types, Properties, Productions, Detectors, Medical uses, adverse effects
- Radioimmunoassay (RIA)
 - Methods, History, Applications
- Immunohistochemistry (IHC)

Learning Outcomes:

- ✓ Students get knowledge about different chromatographic techniques.
- ✓ Students will acquire knowledge about medical instruments working

Reference Books:

1. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
2. Practical Biochemistry by David Plummer

ADZL404: (Practical): Based on ADZT 404
(Contact Hrs: 60 Credits: 02)

Learning Objectives:

- Students will be able to understand handling of centrifuge
- Students will be able to do separation of different solvents
- Students will be able to handle spectrophotometer.

List of Practicals

- 1) Separation of amino acid by paper chromatography.
- 2) Detection of pesticide from vegetables / tissue by HPLC method.
- 5) Detection of heavy metal from animal tissue by Atomic Absorption Spectroscopy (AAS).
- 6) Detection of pesticide by TLC method from water sample.
- 7) Study of Electrogram (ECG). (Normal and Abnormal)
- 8) Phytochemical analysis of plant extract (any medicinal plant) by GC-MS.
- 12) Immunohistochemical localization of neurosecretory cells in the rat/ mouse/ insect/ crab/ fish.
- 13) Study of radiograph (X-ray), tomographic image.

Learning Outcomes:

- ✓ Students is able to handle different medical instruments.
- ✓ Students is able to separate the different biomolecules by chromatographic techniques.
- ✓ Students is able to interpret normal and abnormal ECG. .
- ✓ Students is able to interpret radiograph.

ADZP 202 (Project)
(Contact Hrs. 60, Credits 2)

BOS Sub Committee

1. Prof. V. Y. Deshpande – Chairman
2. Dr. P. S. Pawar – Member

Expert Committee

1. Dr. Rajiv Kamble
2. Mr. Yogesh Nalawade.