Contents

Section 1: Introduction

1. ***Clinical Biochemistry Laboratory: An Introduction*** **3**
   Safety Measures in Laboratory *4*; Basic First Aid in Laboratory *6*; Safety Symbols Used in Laboratory *8*
2. ***Introduction of Basic Instruments Used in a Biochemistry Laboratory*** **11**
   Laboratory Test Tubes *11*; Test Tube Holder *14*; Test Tube Stand or Rack *14*; Bunsen Burner *16*; Spirit Lamp or Alcohol Burner *18*; Beaker *18*; Volumetric Flasks or Measuring Flask or Graduated Flask *18*; Conical Flask or Titration Flask or Erlenmeyer Flask *19*; Funnel *19*; Reagent Bottles or Media Bottles or Graduated Bottles *21*; Measuring Cylinder or Graduated Cylinder or Mixing Cylinder *22*; Pipettes *22*; Pipette Controllers or Fillers *26*; Urinometer *26*; Balances *27*; Centrifuge *28*; Laboratory Water Bath *29*; Magnetic Stirrer or Magnetic Mixer *30*; Vortex Mixer or Vortexer *30*; Glass Stirring Rod or Glass Rod or Stirring Rod or Stir Rod *30*; Hot Air Ovens *31*
3. ***Correct Procedure of Some Commonly Practiced Methods in the Biochemistry Laboratory*** **32**
   The Effective Pipetting Position *32*; Reading of Meniscus *34*; Correct Way of Reading of Meniscus *35*; Folding of Filter Paper *35*; Filtration *35*; Position of Test Tube While Heating on Bunsen Burner *36*; Boiling of the Reagents *37*; Measurement of Specific Gravity by Urinometer *37*
4. ***Biomedical Waste Disposal*** **39**
   Types of Biomedical Waste *39*; Major Steps Involved in Biomedical Waste Management *39*
5. ***Sample Collection, Use of Preservatives and Anticoagulants*** **42**
   Some Common Sites of Collection or Sources of Samples *42*; Urine Preservatives *44*; Hemolysis *44*
6. ***Buffer Solutions and Preparation of Buffers*** **45**
   Buffer Solutions *45*

Section 2: Urine Analysis

7. ***Normal Urine Analysis*** **49**
   Composition of Normal Urine *49*; Physical Examination *50*; Test for Inorganic Constituents of Urine *50*; Test for Organic Constituents of Urine *51*
8. ***Analysis of Abnormal Urine*** **55**
   Physical Examination *55*; Chemical Examination *55*
9. ***Urine Analysis for Inborn Errors of Metabolism*** **61**

Section 3: Demonstration

10. ***Automation in Clinical Biochemistry*** **69**
    Automation *69*
11. ***Quality Control in Clinical Biochemistry*** **74**
    Quality Control *74*; Control Charts *74*
12. ***pH Meter*** **79**
    Principle of pH Meter *80*; Operation of pH Meter *80*; Calibration *80*; Storage of the Glass Probes *80*

13. *Photometry* **81**

Colorimetry *81*; Laws of Absorption of Light *81*; Beer-Lambert Law *82*; Parts of Photo Colorimeter *82*; Spectrophotometer *83*

14. *Ion Selective Electrode or Specific Ion Electrode* **85**

Application of ISE *85*; Types of ISE *85*; Principle of ISE *85*; Components of ISE *86*; Advantages of ISE *87*

15. *Enzyme-linked Immunosorbent Assay* **88**

Principle *88*; Types of ELISA *88*; Applications of ELISA *90*

16. *Arterial Blood Gas Analysis* **94**

Principles of Arterial Blood Gas Analysis *94*

17. *Electrophoresis* **98**

Principles of Electrophoresis *98*; Types of Electrophoresis *98*; Uses of Electrophoresis *99*

18. *Chromatography* **102**

History *102*; Principle *102*; Some Common Terms Used in Chromatography *102*

19. *DNA Isolation* **108**

Biological Sources for DNA Isolation *108*; Procedure of DNA Isolation from Biological Sample *108*

Section 4: Quantitative Analysis

20. *Estimation of Blood Glucose* **113**

Different Types of Sample Used *113*; Collection of Blood Sample *113*; Different Methods Used for Estimation of Blood Glucose *113*; Enzymatic Methods of Estimation *114*; Reduction Methods of Estimation *114*; Clinical Interpretation *114*

21. *Glucose Tolerance Test* **117**

Indications *117*; Contraindications *117*; Patient Preparation *118*; Procedure *118*; Results *118*; Oral Glucose Challenge Test: For Detection of Gestational Diabetes *119*; Renal Glycosuria *119*; Alimentary Glycosuria or Alimentary Diabetes or Digestive Glycosuria *119*

22. *Estimation of Urea* **122**

Estimation *122*; Colorimetric Method: Diacetyl Monoxime Method *122*

23. *Urinary Urea Estimation and Calculation of Urea Clearance* **126**

Urea Clearance *126*; Method of Estimation *126*; Interpretation *127*; Grading of Renal Function on the Basis of Urea Clearance *127*

24. *Estimation of Serum Creatinine, Urinary Creatinine and Calculation of Creatinine Clearance* **129**

Estimation of Serum Creatinine by Jaffe's Alkaline Picrate Method *129*; Estimation of Urinary Creatinine *130*; Creatinine Clearance *130*

25. *Estimation of Uric Acid* **133**

Sample *133*; Method of Uric Acid Estimation *133*; Carway's Method *133*; Uricase Enzymatic Method *134*; Normal Range *134*; Clinical Significance *134*

26. *Estimation of Serum Total Proteins* **136**

Biuret Method *136*; Other Methods of Protein Estimation *137*

27. *Estimation of Serum Albumin* **140**

Estimation of Albumin *140*; Salt Precipitation Method *140*; Estimation of Serum Albumin by Colorimetry *141*

28. *Estimation of Serum Bilirubin* **144**

Malloy and Evelyn Method *144*

29. *Estimation of Transaminases* **147**

Transamination Reaction *147*; Estimation of Serum ALT or SGPT *147*; Normal Range *148*; Estimation of Serum AST or SGOT *148*

30. *Estimation of Serum Alkaline Phosphatase* **151**

Method *151*; Principle *151*; Sample *151*; Reagents *151*; Procedure *151*; Calculation *151*; Normal Range *152*; Clinical Significance *152*

31. *Estimation of Total Serum Cholesterol* **154**

Specimen *154*; Methods *154*; Estimation of Serum High Density Lipoprotein Cholesterol Commonly Used Methods *155*; Estimation of Serum Low Density Lipoprotein Cholesterol *155*

32. *Estimation of Serum Triglycerides or Triacylglycerol* **158**

Methods *158*; Specimen *158*; Reagents *158*; Procedure *159*; Calculation *159*; Normal Range *159*; Clinical Significance *159*

33. *Estimation of Total Serum Calcium* **161**

Sample Preparation *161*; Principle *161*; Clinical Significance of Serum Calcium *162*

34. *Estimation of Inorganic Phosphorus in Serum or Urine* **164**

Principle *164*; Clinical Significance of Phosphorus *165*

Section 5: Organ Function Tests

35. *Liver Functions Tests* **169**

Classification of LFT *169*; Assessment and Clinical Interpretation of Biochemical Parameters Related to LFT *170*; Differential Diagnosis of Diseases Based on Altered LFT *171*

36. *Kidney Function Test or Renal Function Test* **173**

Significance of KFT *173*; Classification of Kidney Function Test *173*; Novel Biomarkers *177*; Immunological Tests Used to Detect Kidney Diseases *177*

37. *Pancreatic Function Tests* **178**

Indication of Pancreatic Function Test *178*; Pancreatic Function Tests for Diseases of Exocrine Pancreas and Exocrine Pancreatic Insufficiency *179*

38. *Gastric Function Test* **181**

Clinical Significance of Analysis of Gastric Fluid *181*; Composition of Gastric Fluid *181*; Interpretation of Abnormal Color *182*; Interpretation of Abnormal Odor *182*; Interpretation of Abnormal pH *182*

39. *Thyroid Function Tests* **185**

Function of Thyroid Hormones *185*; Indications of Thyroid Function Test *185*; Classification of Thyroid Function Test *185*; Significance of Thyroid Function Test *186*; Diagnostic Markers for Thyroid Disorders *186*; Laboratory Evaluation of Thyroid Hormones *187*

Section 6: Milk and CSF Analysis

40. *Analysis of Milk* **191**

Composition of Milk *191*

41. *Analysis of Cerebrospinal Fluid* **192**

Collection of Cerebrospinal Fluid Sample *192*; Composition of Normal Cerebrospinal Fluid *192*; Clinical Significance of Cerebrospinal Fluid *193*; CSF Findings in Various Disease Condition *194*

Section 7: Clinical Case Study

42. *Case Studies* **197**

Case 1: A Case Study on Lactose Intolerance *197*
Case 2: A Case Study on Glucose-6-phosphate Dehydrogenase Deficiency *198*
Case 3: A Case Study on Familial Hypercholesterolemia or Hyperlipoproteinemia Type II *199*
Case 4: A Case Study on Phenylketonuria *199*
Case 5: A Case Study on Gout *200*
Case 6: A Case Study on Obstructive Jaundice (Cholestasis) *201*

Case 7: A Case Study on Myocardial Infarction *202*
Case 8: A Case Study on Alcohol-induced Acute Pancreatitis *203*
Case 9: A Case Study on Enlarged Prostate Gland Suggestive of Prostate Cancer *203*
Case 10: A Case Study on Nephrotic Syndrome *204*
Case 11: A Case Study on Gestational Diabetes Mellitus *205*
Case 12: A Case Study on Diabetic Nephropathy *206*
Case 13: A Case Study on Hypothyroidism *206*

Section 8: Point of Care Testing

43. *Point of Care Testing* **209**

Advantages of POCT *210*; Disadvantages of POCT *210*

Section 9: Sample Spotters

44. *Sample Spotters for Practical Examination* **213**

Spotter 1 *213*
Spotter 2 *213*
Spotter 3 *213*
Spotter 4 *214*
Spotter 5 *214*
Spotter 6 *215*
Spotter 7 *215*
Spotter 8 *215*
Spotter 9 *216*
Spotter 10 *216*

Section 10: Reference Values

45. *Reference Values in Clinical Biochemistry* **221**

Index ***225***