

**1. Deputy Director (Technical Cadre) (RO-13)**

| Sr.No.                  | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Weightage  | Difficulty Level | Sources                                                                                                                                                                                                                                                                            |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | Verbal Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 10%        | Medium           | DRAP's official Website: <a href="http://www.dra.gov.pk">www.dra.gov.pk</a>                                                                                                                                                                                                        |
| 2                       | Analytical Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10%        |                  |                                                                                                                                                                                                                                                                                    |
| 3                       | DRAP Act 2012, Drugs Act 1976 and Rules framed there under:<br><br>1. The Drugs Licensing, Registration & Advertising Rules, 1976<br>2. The Drugs (Appellate Board) Rules, 1976<br>3. The Drugs (Import & Export) Rules, 1976<br>4. The Drugs (Federal Inspectors, Federal Drug Laboratory and Federal Government Analysis) Rules, 1976<br>5. The Drugs (Appellate Board) Rules, 1976<br>6. Drugs (Specifications) Rules, 1978<br>7. The Drug Research Rules, 1978<br>8. The Alternative Medicines and Health Products (Enlistment) Rules, 2014.<br>9. The Medical Device Rules, 2017<br>10. The Bio Study Rules, 2017<br>11. The Ethical Marketing to Healthcare Professional Rules, 2021<br>12. The Pharmacovigilance Rules, 2022<br>13. Control of Narcotic Substances Act, 1997<br>14. UN Conventions on Controlled Substances | 30%        |                  |                                                                                                                                                                                                                                                                                    |
| <b>Subject Related:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>50%</b> |                  |                                                                                                                                                                                                                                                                                    |
| 4                       | Pharmacology, Pharmacy Practice, Pharmaceutics / Drug Development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 15%        |                  |                                                                                                                                                                                                                                                                                    |
|                         | Pharmaceutical Chemistry, Analytical Chemistry, Pharmaceutical Microbiology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10%        |                  | 4. Rang and Dale's Pharmacology<br>5. Jennie Watson, Pharmacy Practice<br>6. Ansel's Pharmaceutical Dosage form and Drug Delivery System<br><br>3. Wilson and Griswold's text book of Organic medical and pharmaceutical chemistry<br>4. Pharmaceutical Microbiology by Tim Sandle |
|                         | Pharmacognosy, Phytochemistry, Principles of Homeo, Alternative Medicines Fundamentals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10%        |                  | 3. Trease and Evan's Pharmacognosy<br>4. Wichtl M. Herbal Drugs and Phytopharmaceuticals                                                                                                                                                                                           |
|                         | Guidelines:<br>3. ICH (Quality & Safety)<br>4. WHO (Production, Quality Control, Quality Assurance)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 15%        |                  | <a href="https://ich.org/page/ich-guidelines">https://ich.org/page/ich-guidelines</a><br>(ICH Guidelines)<br><a href="http://www.who.int/health_products/policy_and_standards">Health products policy and standards (who.int)</a><br>(WHO guidelines)                              |

**2. Assistant Director (Technical Cadre) (Pharmaceutical Evaluation / Drugs Licensing / Quality Assurance / Health & OTC / Controlled Drugs / Pharmacy Services / Biological Drugs / Medical Devices) (RO-12)**

| Sr.No.                  | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Weightage  | Difficulty Level | Sources                                                                                                                                                                                                                                                               |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | Verbal Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 10%        | Medium           | DRAP's official Website: <a href="http://www.dra.gov.pk">www.dra.gov.pk</a>                                                                                                                                                                                           |
| 2                       | Analytical Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10%        |                  |                                                                                                                                                                                                                                                                       |
| 3                       | DRAP Act 2012, Drugs Act 1976 and Rules framed there under:<br><br>1. The Drugs Licensing, Registration & Advertising Rules, 1976<br>2. The Drugs (Appellate Board) Rules, 1976<br>3. The Drugs (Import & Export) Rules, 1976<br>4. The Drugs (Federal Inspectors, Federal Drug Laboratory and Federal Government Analysis) Rules, 1976<br>5. The Drugs (Appellate Board) Rules, 1976<br>6. Drugs (Specifications) Rules, 1978<br>7. The Drug Research Rules, 1978<br>8. The Alternative Medicines and Health Products (Enlistment) Rules, 2014.<br>9. The Medical Device Rules, 2017<br>10. The Bio Study Rules, 2017<br>11. The Ethical Marketing to Healthcare Professional Rules, 2021<br>12. The Pharmacovigilance Rules, 2022<br>13. Control of Narcotic Substances Act, 1997<br>14. UN Conventions on Controlled Substances | 30%        |                  |                                                                                                                                                                                                                                                                       |
| <b>Subject Related:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>50%</b> |                  |                                                                                                                                                                                                                                                                       |
| 4                       | Pharmacology, Pharmacy Practice, Pharmaceutics / Drug Development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 15%        |                  | 1. Rang and Dale's Pharmacology<br>2. Jennie Watson, Pharmacy Practice<br>3. Ansel's Pharmaceutical Dosage form and Drug Delivery System                                                                                                                              |
|                         | Pharmaceutical Chemistry, Analytical Chemistry, Pharmaceutical Microbiology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10%        |                  | 1. Wilson and Griswold's text book of Organic medical and pharmaceutical chemistry<br>2. Pharmaceutical Microbiology by Tim Sandle                                                                                                                                    |
|                         | Pharmacognosy, Phytochemistry, Principles of Homeo, Alternative Medicines Fundamentals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 05%        |                  | 1. Trease and Evan's Pharmacognosy<br>2. Wichtl M. Herbal Drugs and Phytopharmaceuticals                                                                                                                                                                              |
|                         | Guidelines:<br>1. ICH (Quality & Safety)<br>2. WHO (Production, Quality Control, Quality Assurance)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20%        |                  | <a href="https://ich.org/page/ich-guidelines">https://ich.org/page/ich-guidelines</a> (ICH Guidelines)<br><a href="http://www.who.int/publications/m/pub/health-products-policy-and-standards">Health products policy and standards (who.int)</a><br>(WHO guidelines) |

### 3. Assistant Director (Technical Cadre) (Subject Specialist-Microbiologist) (RO-12)

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                     | Weightage | Difficulty Level | Sources                                                                                  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|------------------------------------------------------------------------------------------|
| 1      | Verbal Reasoning                                                                                                                                                                                                                                                                                                            | 10%       | Medium           |                                                                                          |
| 2      | Analytical Reasoning                                                                                                                                                                                                                                                                                                        | 10%       |                  |                                                                                          |
| 3      | 1. DRAP Act 2012, Drugs Act 1976<br>2. The Drugs Licensing, Registration & Advertising Rules, 1976<br>3. The Drugs (Federal Inspectors, Federal Drug Laboratory and Federal Government Analysis) Rules, 1976<br>4. Drugs (Specifications) Rules, 1978<br>5. The Ethical Marketing to Healthcare Professional Rules, 2021    | 10%       |                  | Available on DRAP's Website                                                              |
| 4.     | <b>Subject Related (70%)</b>                                                                                                                                                                                                                                                                                                |           |                  |                                                                                          |
|        | <b><u>Pharmaceutical Microbiology</u></b><br>1. Laboratory evaluation of antimicrobial agents<br>2. Chemical disinfectants, antiseptics and preservatives<br>3. Sterilization procedures and sterility assurance<br>4. Sterile pharmaceutical products<br>5. The manufacturer and quality control of immunological products | 40%       |                  | Hugo & Russel's Pharmaceutical Microbiology 8 <sup>th</sup> Edition                      |
|        | <b><u>WHO Guidelines</u></b><br>1. WHO TRS 961 Annex 2, WHO practices for pharmaceutical microbiology laboratories<br>2. WHO TRS 1052 Annex 4, WHO Good practices and pharmaceutical quality control laboratories.                                                                                                          | 15%       |                  | WHO TRS 1052 Annex 4, WHO Good Practices and Pharmaceutical Quality Control Laboratories |
|        | (61) Microbiological examination of non-sterile products: microbial enumeration tests<br>(62) Microbiological examination of Non-sterile products: tests for specified microorganisms.<br>(71) Sterility tests<br>(81) Antibiotics – microbial assays<br>(85) Bacterial endotoxins test                                     | 15%       |                  | United States Pharmacopeia 2024                                                          |

4. Assistant Director (Technical Cadre) (Subject Specialist-Chemist) (RO-12)

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Weightage | Difficulty Level | Sources                                                                                                                                          |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Verbal Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10%       | Medium           |                                                                                                                                                  |
| 2      | Analytical Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10%       |                  |                                                                                                                                                  |
| 3      | 1. DRAP Act 2012, Drugs Act 1976:<br>2. The Drugs Licensing, Registration & Advertising Rules, 1976<br>3. The Drugs (Federal Inspectors, Federal Drug Laboratory and Federal Government Analysis) Rules, 1976<br>4. Drugs (Specifications) Rules, 1978<br>5. The Ethical Marketing to Healthcare Professional Rules, 2021                                                                                                                                                                               | 10%       |                  | Available on DRAP's Website                                                                                                                      |
| 4.     | <b>Subject Related (70%)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                  |                                                                                                                                                  |
|        | <b>Pharmaceutical Analytical Chemistry</b><br>1. Fundamentals of bases, acids, solubility, polarity, partition, and stereochemistry;<br>2. Chemical analysis of pharmaceutical ingredient<br>3. Chemical analysis of pharmaceutical preparations<br>4. Titration<br>5. Introduction to spectroscopic methods<br>6. UV-Vis spectrophotometry<br>7. IR Spectrophotometry<br>8. Atomic Spectrometry<br>9. Separation principle in liquid chromatography<br>10. Gas Chromatography<br>11. Mass spectrometry | 40%       |                  | Introduction to Pharmaceutical Analytical Chemistry STIG PEDERSEN-BJERGAARD, BENTE GAMMELGAARD, TRINE GRONHAUG HALVORSEN 2 <sup>ND</sup> EDITION |
|        | <b>WHO Guidelines</b><br>WHO TRS 1052 Annex 4, WHO Good Practices and Pharmaceutical Quality Control Laboratories                                                                                                                                                                                                                                                                                                                                                                                       | 15%       |                  | WHO TRS 1052 Annex 4, WHO Good Practices and Pharmaceutical Quality Control Laboratories                                                         |
|        | (11) USP Reference standards<br>(621) Chromatography<br>(711) Dissolution<br>(905) Uniformity of dosage units<br>(1224) Transfer of analytical procedures<br>(1092) The Dissolution Procedure: Development and Validation                                                                                                                                                                                                                                                                               | 15%       |                  | United States Pharmacopeia 2024                                                                                                                  |

**5. Assistant Director (Technical Cadre) (Subject Specialist-Bio-Medical Engineer) (RO-12)**

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                       | Weightage | Difficulty Level | Sources                                                                                                             |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|---------------------------------------------------------------------------------------------------------------------|
| 1      | Verbal Reasoning                                                                                                                                                                                                                                                                                                                                                              | 10%       | <b>Medium</b>    |                                                                                                                     |
| 2      | Analytical Reasoning                                                                                                                                                                                                                                                                                                                                                          | 10%       |                  |                                                                                                                     |
| 3      | 1. DRAP Act 2012, Drugs Act 1976<br>2. The Drugs (Federal Inspectors, Federal Drug Laboratory and Federal Government Analysis) Rules, 1976<br>3. The Ethical Marketing to Healthcare Professional Rules, 2021                                                                                                                                                                 | 10%       |                  | Available on DRAP's Website                                                                                         |
| 4.     | <b>Subject Related (70%)</b>                                                                                                                                                                                                                                                                                                                                                  |           |                  |                                                                                                                     |
|        | <b><u>Non-invasive instrumentation and measurement in medical diagnosis</u></b><br>1. Measurement of electrical Potentials and Magnetic Fields from the Body Surface<br>2. Non-invasive measurement of blood pressure<br>3. Ocular Tonometry<br>4. Non-invasive tests using ultrasound (excluding imaging)<br>5. Innovations in non-invasive instrumentation and measurements | 40%       |                  | Non Invasive Instrumentation and Measurement in Medical Diagnosis, Taylor & Francis, 2 <sup>nd</sup> Edition, 2019. |
|        | <b><u>Medical Instrumentation: Application and Design</u></b><br>1. Clinical laboratory instrumentation<br>2. Chemical biosensors<br>3. Therapeutic and prosthetic devices<br>4. Measurement of flow and volume of blood<br>5. Blood pressure and sound<br>6. Bio-potential amplifiers                                                                                        | 10%       |                  | Medical Instrumentation: Application and Design, 5 <sup>th</sup> Edition John G. Webster, Amit J. Nimunkar.         |
|        | WHO TRS 1019 Annex 3, Good manufacturing practise: guidelines on validation                                                                                                                                                                                                                                                                                                   | 10%       |                  | WHO TRS 1019 Annex 3, Good manufacturing practise: guidelines on validation                                         |
|        | Medical Devices Rules 2017                                                                                                                                                                                                                                                                                                                                                    | 10%       |                  | Available on DRAP's Website                                                                                         |

**6. Assistant Director (Technical Cadre) (Subject Specialist-Biotechnology) (RO-12)**

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Weightage | Difficulty Level | Sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Verbal Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10%       | Medium           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2      | Analytical Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 10%       |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 3      | 1. DRAP Act 2012, Drugs Act 1976<br>2. The Drugs Licensing, Registration & Advertising Rules, 1976<br>3. The Bio Study Rules, 2017<br>4. The Ethical Marketing to Healthcare Professional Rules, 2021<br>5. The Pharmacovigilance Rules, 2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10%       |                  | Available on DRAP's Website                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 4.     | <b>Subject Related (70%)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|        | Subject content/ books/ topics to be shared by the Director BE&R and approved by the Committee.<br>i. Cell Biology/ Molecular Biology (CELL BIOLOGY Introduction to cell theory including historical perspective; chemical constituents of the cell and their function, cell organelles including ribosomes, endoplasmic reticulum, lysosome, golgi apparatus, mitochondria, peroxisome, vacuole, chloroplast, structure and their functions, composition and structure of cell membranes; membrane receptors and transport mechanisms; nucleus; structure and function of chromosomes; cell cycle, mitosis and meiosis; cell movement, structure and function of cytoskeleton, centriole, cilia and flagella) | 10%       |                  | 1. Alberts B and Johnson A, 2006. Molecular Biology of the Cell. 4th Edition; Garland Publishers, New York. (available at <a href="http://www.ncbi.nlm.nih.gov">www.ncbi.nlm.nih.gov</a> )<br>2. Karp, 2002. Cell and Molecular Biology. 3rd Edition; John Wiley and Sons, New York.<br>3. Alberts et al., 2009. Essential Cell Biology. 3rd Edition; Garland Publishers, New York.<br>4. Lodish et al., 2007. Molecular Cell Biology. 6th Edition; Freeman and Company, New York. (available at <a href="http://www.ncbi.nlm.nih.gov">www.ncbi.nlm.nih.gov</a> ) Cooper GM and Hausman RE, 2009. The Cell, a molecular approach. 5th Edition; Sinauer Associates, Inc. |
|        | ii. Organic Chemistry (Introduction to Organic Chemistry, Chemical Bonding and Properties of Organic Molecules, Classes and Nomenclature of Organic Compounds, Functional Group Chemistry)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10%       |                  | 1. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", Oxford University Press, New York. II.<br>2. Loudon, G. M., "Organic Chemistry", Oxford University Press, New York<br>3. Sorrell, T. N., "Organic Chemistry", Viva Books Private Ltd., New Delhi.<br>4. Finar, I. L., "Organic Chemistry", Vol. 1, Pearson Education, Delhi.<br>5. Carey, F. A., "Organic Chemistry", McGraw-Hill, New York.<br>6. Ahluwalia, V. K. and Goyal, M., "A Text Book of Organic Chemistry", Narosa Publishing House, New Delhi                                                                                                                                 |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |        | 7. March, J., "Advanced Organic Chemistry", John Wiley & Sons, New York. Bansal, R. K., "Organic Reaction Mechanisms", Tata McGraw-Hill Publishing Company Ltd., New Delhi                                                                                                                                                                                                                                                                                                                                                                   |
|  | <p>iii. <b>Fundamentals of Genetics</b> (Mendelian Genetics, principle of segregation, monohybrid crosses, dominance, recessiveness, codominance, semidominance, principle of independent assortment, dihybrid and trihybrid ratios, gene interaction, epistasis, multiple alleles, ABO blood type alleles in humans, Rh factor alleles in humans, probability in Mendelian inheritance, structure of chromosomes and Genes, function of DNA and RNA, classes of RNA, DNA as storage of Genetic information, experimental evidence that DNA is genetic material; physical and chemical structure of DNA, Difference between Prokaryotic and Eukaryotic Genetic material, sex determination and differentiation, sex-linked traits, sex anomalies, linkage and crossing over)</p>                                                                                                                  | 10% | Medium | <ol style="list-style-type: none"> <li>1. Snustad DP and Simmons MJ, 2008. Principles of Genetics. 5th Edition; John Wiley &amp; Sons, New York.</li> <li>2. Klug WS and Cummings MR, 2008. Concepts of Genetics. 9th Edition; Prentice Hall, USA.</li> <li>3. Pierce B, 2004. Genetics: A Conceptual Approach. 2nd Edition; WH Freeman, New York.</li> <li>4. Brooker R, 2011. Genetics: Analysis and Principles. 4th Edition; McGraw-Hill. Pierce BA, 2011. Genetics: A conceptual approach. 4th Edition. WH Freeman Publisher.</li> </ol> |
|  | <p>iv. <b>Molecular Biology</b> (Overview of Molecular Biology, Macromolecules, chemical structures of the major classes of Macromolecules: Proteins, Nucleic Acids, Polysaccharides, Nucleic Acids, DNA Helix, Form of DNA Helix, Factor that determine structure of DNA, properties of Genetic Material (storage and Transmission of Genetic information by DNA). Transmission of information from parent to progeny, chemical stability of DNA, Ability of DNA to change, DNA Replication, Enzymology of DNA Replication. Events in the Replication Fork, Initiation of synthesis of Leading and lagging strands, Okazaki fragments, importance of 3' <math>\rightarrow</math> 5' and 5' <math>\rightarrow</math> 3' Exonuclease activities of DNA polymerase, Rolling circular Replication, Loop Rolling circular Replication, Difference between Prokaryotic and Eukaryotic Replication)</p> | 10% | Medium | <ol style="list-style-type: none"> <li>1. Molecular Biology by David Freifelder, Jones &amp; Bartlett Publisher, Boston<br/>Molecular Biology of the cell by B. Alberts. D. Brag, J. Lewis. M. Raff, K. Roberts and J. D. Watson, Garland Publishers. Jones &amp; Bartlett Publisher, Boston</li> </ol>                                                                                                                                                                                                                                      |
|  | <p>v. <b>Biochemistry</b> (Introduction to metabolism and basic aspects of bioenergetics and biochemical thermodynamics (endergonic and exergonic reactions); phosphoryl group transfer and ATP production; metabolism, oxidation-reduction; carbohydrate metabolism and regulation (glycolysis, glycogenolysis; gluconeogenesis; pentose phosphate pathway); citric acid cycle (reactions, energetics and control), electron transport chain, oxidative phosphorylation, shuttle mechanisms (glycerolphosphate shunt), lipid metabolism (energy yield from fatty acid oxidation, ketone bodies, acyl glycerol, compound lipids, cholesterol); Calvin Cycle; metabolism of nitrogenous</p>                                                                                                                                                                                                        | 10% | Medium | <ol style="list-style-type: none"> <li>1. Biochemistry, D. Voet, J.G. Voet, 3rd (2004), John Wiley and Sons Inc.</li> <li>2. II. Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, 3rd edition (2000), Worth Publishers.</li> <li>3. Lippincott's Biochemistry, P.C. Champe, R.A. Harvey, D.R. Ferrier, 4th edition (2008), J.B. Lippincott Company.</li> </ol>                                                                                                                                                                       |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | compounds (amino acid synthesis, catabolism, purine and pyrimidine synthesis); nucleic acid metabolism and control; urea cycle.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |        | <ol style="list-style-type: none"> <li>4. An Introduction to Practical Biochemistry, D. T. Plummer, 3rd edition (1987), McGraw-Hill.</li> <li>5. Modern Experimental Biochemistry, R.F. Boyer, 3rd edition (2000), Pearson Education</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|  | <p><b>vi. Immunology</b> (Overview of the body defense mechanisms, the immune system, elements of innate and acquired immunity, antibody structure and function, antigenantibody interactions, cells of the immune system, monoclonal antibodies, Genetics of antibody structure and diversity, Activation and function of T and B cells and their receptors, Major histocompatibility complex, Complement system, Hypersensitivity, cytokines, Autoimmunity, resistance and immunity to infectious diseases, cell- mediated effector response, leukocyte migration and inflammation, vaccines, diseases of the immune system - autoimmunity, transplantation immunology)</p>                                                                                                                                    | 10% | Medium | <ol style="list-style-type: none"> <li>1. Immunology, J. Kuby, 6th edition (2007), W.H. Freeman and Co.</li> <li>2. Immunobiology - The immune system in health and disease, C.A. Janeway, P.Travers, 3rd edition (1997), Garland Publication Inc. New York.</li> <li>3. Roitt's Essential Immunology, Ivan Roitt, 11th edn (2007), Blackwell Scientific Publication.</li> <li>4. Harlow ED, David L., Antibodies - A laboratory Manual, (1988), Cold Spring Harbor laboratory Press.</li> <li>5. Methods for protein analysis, R.A. Copeland, (1994), Chapman and Hall.</li> <li>6. The Basic Protein and Peptide Protocols, J.M. Walker (1994), Humana Press.</li> <li>7. The Protein Protocols Handbook, J.M. Walker (1996), Humana Press. Basic Biochemical Methods, R.R. Alexander, J. M. Griffiths, 2nd edition (1993), Wiley Liss</li> </ol> |
|  | <p><b>vii. Recombinant DNA Technology</b> (Introduction and History of Recombinant DNA technology, An overview of cloning steps; Preparation of insert, restriction endonucleases, restriction mapping, vectors and their types, cloning vectors, cloning strategies, site-directed mutagenesis, sequencing strategies, transformations, regeneration through tissue culture techniques, expression of recombinant proteins and their purification by affinity chromatography; Polymerase Chain reaction, analysis of nucleic acids by gel electrophoresis, analysis of proteins by native and SDS-PAGE; 2-D gels; generation of antibodies and their uses; Southern, Western, Northern blotting. Application of recombinant DNA Technology (agriculture, health, industry, environment and basic research).</p> | 10% | Medium | <ol style="list-style-type: none"> <li>1. Robert F.W., 2005. Molecular Biology. McGraw-Hill.</li> <li>2. Dale, J.W. and von Schantz, M. 2002. From Genes to Genomes: Concepts and Applications of DNA Technology. John-Wiley and Son Limited.</li> <li>3. Meyers, R.A., 2006. Genomics and Genetics. John-Wiley and Son Limited.</li> <li>4. Primrose, S.B., and Twyman, R.M. 2006. Gene Manipulation and Genomics 6th edition. Blackwell Publishing.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                    |

7. **Assistant Director (Management Information Systems Division) (RO-12):**

| Sr. No.                 | Content                                                                 | Weightage  | Difficulty Level | Sources                                                                                                                                                                  |
|-------------------------|-------------------------------------------------------------------------|------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | Verbal Reasoning                                                        | 10%        | Medium           |                                                                                                                                                                          |
| 2                       | Analytical Reasoning                                                    | 10%        |                  |                                                                                                                                                                          |
| <b>Subject Related:</b> |                                                                         | <b>80%</b> |                  |                                                                                                                                                                          |
| 3.                      | Programming (Php/.Net)                                                  | 30%        |                  | 1.Net Programming (Practical Guide using C#) by Pradeep Tapadiya.<br>2.PHP Programming with my Sql (The web technologies series 2 <sup>nd</sup> Edition) by Don Gosselin |
|                         | Databases (Mysql, SQL)                                                  | 20%        |                  | SQL server 2016 Developers Guide by Dejan Sarka,                                                                                                                         |
|                         | Website Designing & Development (HTML, CSS, JAVA Scripting, CMS)        | 15%        |                  | 1. HTML, CSS, JAVA Script, 3 <sup>rd</sup> Edition by Julie C, Meloni<br>2. Web Programming with HTML, CSS, and JAVA Script by John Dean                                 |
|                         | Information Security (Database Security, Application Software Security) | 15%        |                  | Securing SQL Server by Denny Cherry 2 <sup>nd</sup> Edition                                                                                                              |

**8. Assistant Director (Legal Affairs Division) (RO-12)**

| Sr.No.                  | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Weightage  | Difficulty Level | Sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | Verbal Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10%        | Medium           | <p>1. DRAP's official Website:<br/><a href="http://www.dra.gov.pk">www.dra.gov.pk</a></p> <p>2. DRAP's official Website:<br/><a href="http://www.dra.gov.pk">www.dra.gov.pk</a></p> <p>3. Establishment Division's official Website: <a href="http://www.establishment.gov.pk">www.establishment.gov.pk</a></p> <p>4. ESTA Code, 2021</p> <p>Constitution of Islamic Republic of Pakistan, 1973 with up to date case laws</p> <p>Code of criminal procedure code by M. Mahmood</p> <p>Pakistan Penal Code Act, 1860 by M. Mahmood</p> <p>Code of Civil Procedure by Amir Raza</p> <p>Qanun-e-Shahadat Order 1984 by M Mahmood</p> <p>Transfer of Property Act &amp; Specific Relief Act</p> <p>Trade Mark Ordinance, 2001 and Patent Ordinance, 2000</p> <p>Control of Narcotics &amp; Substance Act, 1997 and Control of Narcotics &amp; Substance Rules, 2001</p> <p>Import &amp; Export Policy Orders, 2022</p> <p>Income Tax Ordinance, 2001 and Sales Tax Act, 1990</p> |
| 2                       | Analytical Reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 3                       | Drugs Act 1976 & DRAP Act, 2012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 20%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | <ul style="list-style-type: none"> <li>i. The Drugs (Licensing, Registering &amp; Advertising) Rules, 1976</li> <li>ii. The Drugs (Import &amp; Export) Rules, 1976</li> <li>iii. The Drug Research Rules, 1978</li> <li>iv. The Appellate Board Rules, 1976</li> <li>v. The Drugs (Labelling &amp; Packing) Rules, 1986</li> <li>vi. The Drugs (Specification) Rules, 1986</li> <li>vii. The Drugs (Federal Drugs Inspectors, Federal Drug Laboratory &amp; Federal Government Analysts) Rules, 1976</li> <li>viii. Medical Devices Rules, 2017</li> <li>ix. Alternative Medicines &amp; health Products (Enlistment) Rules, 2014</li> <li>x. Drug Pricing Policy, 2018</li> </ul> |            |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | DRAP Employees Service Regulations, 2015<br>DRAP Accounting Procedure & Financial Rules, 2015<br>Civil Servants Act, 1973                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 10%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Subject Related:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>50%</b> |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 4                       | Constitution of Pakistan 1973                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Criminal Procedure Code 1898                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Pakistan Penal Code Act, 1860                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Code of Civil Procedure and Limitation Act, 1908                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Qanun-e-Shahadat Order 1984                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Transfer of Property Act & Specific Relief Act                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Intellectual Property Law i.e Trade Mark Ordinance, 2001 and Patent Ordinance, 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Control of Narcotics & Substance Act, 1997, Control of Narcotics & Substance Rules, 2001 & UN Conventions on controlled Substances                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Import & Export Policy Orders, 2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                         | Income Tax Ordinance, 2001 and Sales Tax Act, 1990                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 05%        |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**9. Assistant Director (Budget & Accounts/ Costing & Pricing) (RO-12)**

| Sr.No.                  | Content                                                                                                                                                                                                        | Weightage  | Difficulty Level | Source                                                                                                                                                                                                             |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | Verbal Reasoning                                                                                                                                                                                               | 10%        | Medium           | -                                                                                                                                                                                                                  |
| 2                       | Analytical Reasoning                                                                                                                                                                                           | 10%        |                  | -                                                                                                                                                                                                                  |
| 3                       | <ul style="list-style-type: none"> <li>• DRAP Act, 2012</li> <li>• DRAP Accounting Procedure &amp; Financial Rules, 2015</li> <li>• DRAP Employees Service Regulations, 2015 (as amended till date)</li> </ul> | 10%        |                  | Available on DRAP website                                                                                                                                                                                          |
|                         | <ul style="list-style-type: none"> <li>• Public Procurement Rules, 2004</li> <li>• Procurement of Consultancy Services Regulations, 2010</li> </ul>                                                            | 5%         |                  | Available on Public Procurement Regulatory Authority's website                                                                                                                                                     |
|                         | <ul style="list-style-type: none"> <li>• Pension Rules of Federal Government</li> <li>• General Provident Fund (Federal Services) Rules</li> </ul>                                                             | 5%         |                  | Available on Finance Division's website                                                                                                                                                                            |
|                         | <ul style="list-style-type: none"> <li>• TA/DA Rules of Federal Government</li> <li>• Fundamental Rules and Supplementary Rules (FR &amp; SR) (Volume I &amp; II) of Federal Government</li> </ul>             | 5%         |                  | Available on Finance Division's website                                                                                                                                                                            |
|                         | <ul style="list-style-type: none"> <li>• General Financial Rules (GFR) of Federal Government (Volume I &amp; II)</li> <li>• Treasury Rules of Federal Government (Volume I &amp; II)</li> </ul>                | 5%         |                  | Available on Finance Division's website                                                                                                                                                                            |
|                         | <ul style="list-style-type: none"> <li>• Income Tax Ordinance, 2001</li> <li>• Income Tax Rules, 2002</li> </ul>                                                                                               | 5%         |                  | Available on Federal Board of Revenue's website                                                                                                                                                                    |
|                         | <ul style="list-style-type: none"> <li>• The Sales Tax Act, 1990</li> <li>• Sales Tax Rules, 2006</li> <li>• The Islamabad Capital Territory (Tax on Services) Ordinance, 2001</li> </ul>                      | 5%         |                  | Available on Federal Board of Revenue's website                                                                                                                                                                    |
| <b>Subject Related:</b> |                                                                                                                                                                                                                | <b>40%</b> |                  |                                                                                                                                                                                                                    |
| 4                       | <ul style="list-style-type: none"> <li>• Financial Accounting</li> <li>• Financial Management</li> </ul>                                                                                                       | 10%        |                  |                                                                                                                                                                                                                    |
|                         | <ul style="list-style-type: none"> <li>• Managerial Accounting</li> <li>• Cost Accounting</li> </ul>                                                                                                           | 10%        |                  |                                                                                                                                                                                                                    |
|                         | <ul style="list-style-type: none"> <li>• International Financial Reporting Standards (IFRS)</li> </ul>                                                                                                         | 10%        |                  | Available on IFRS website <a href="http://www.ifrs.org">www.ifrs.org</a> .                                                                                                                                         |
|                         | <ul style="list-style-type: none"> <li>• Auditing</li> <li>• International Standards on Auditing (ISAs)</li> </ul>                                                                                             | 10%        |                  | <ul style="list-style-type: none"> <li>• Auditing Books</li> <li>• ISAs (available on International Auditing And Assurance Standards Board's website: <a href="http://www.iaasb.org">www.iaasb.org</a>)</li> </ul> |

**10. Assistant Director (Administration, HR & Logistic Division) (RO-12)**

| Sr. No.                     | Content                                                                                                                     | Weightage | Difficulty Level | Sources                                                                                                                                                                                                                                |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                           | Verbal Reasoning                                                                                                            | 10%       | Medium           | -                                                                                                                                                                                                                                      |
| 2                           | Analytical Reasoning                                                                                                        | 10%       |                  |                                                                                                                                                                                                                                        |
| 3                           | DRAP Act, 2012, DRAP Accounting Procedure & Financial Rules, 2015                                                           | 5%        |                  | DRAP's official Website: <a href="http://www.dra.gov.pk">www.dra.gov.pk</a>                                                                                                                                                            |
|                             | Civil Servant Act, 1973, Efficiency & Discipline Rules 1973, Revised Leave Rules, 1980, Civil Servant Seniority Rules 1993, | 5%        |                  | Establishment Division's official Website: <a href="http://www.establishment.gov.pk">www.establishment.gov.pk</a>                                                                                                                      |
|                             | DRAP Employees Service Regulations, 2015 as amended till date                                                               | 5%        |                  | DRAP's official Website: <a href="http://www.dra.gov.pk">www.dra.gov.pk</a>                                                                                                                                                            |
|                             | Public Procurement Rules, 2004, Rules for the Use of Staff Cars, 1980                                                       | 5%        |                  | PPRA and Cabinet Division's official websites<br><a href="http://www.ppra.org.pk">www.ppra.org.pk</a><br><a href="http://www.cabinet.gov.pk">www.cabinet.gov.pk</a>                                                                    |
|                             | Secretariat Instructions, 2004 & Rules of Business, 1973                                                                    | 5%        |                  | Establishment Division's official Website: <a href="http://www.establishment.gov.pk">www.establishment.gov.pk</a>                                                                                                                      |
|                             | The Pensions Act, 1871, A Manual of Pension Procedure, General Provident Fund (Federal Services) Rules, TA/DA Rules         | 5%        |                  | Finance Division's official website<br><a href="http://www.finance.gov.pk">www.finance.gov.pk</a>                                                                                                                                      |
| <b>Subject Related: 50%</b> |                                                                                                                             |           |                  |                                                                                                                                                                                                                                        |
| 4                           | i. Human Resource Planning & Job Analysis                                                                                   | 10%       |                  | 4. Fundamentals of Human Resource Management by David A. Decenzo, Stephen P. Robbins & Suzan L. Verhulst<br>5. Human Resource Management by Garry Dessler<br>6. Introducing Human Resource Management by Margaret Foot & Caroline Hook |
|                             | ii. Training & Development of Employees                                                                                     | 10%       |                  |                                                                                                                                                                                                                                        |
|                             | iii. Strategic HRM Management & Organizational Dynamics                                                                     | 10%       |                  |                                                                                                                                                                                                                                        |
|                             | iv. Performance Management System & Employee Benefits                                                                       | 10%       |                  |                                                                                                                                                                                                                                        |
|                             | v. Leadership & Motivation                                                                                                  | 10%       |                  |                                                                                                                                                                                                                                        |