पाटन स्वास्थ्य बिज्ञान प्रतिष्ठान, सेवा आयोग
प्राज्ञिक सेवा, जीव रसायन समूह, सह प्राध्यापक पद (१० औं) तहको
खुल्ला र अन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम
एवं **परीक्षायोजना**

यस पाठ्यक्रम योजनालाई दुई चरणमा विभाजनगरिएको छ :

प्रथम चरण :– लिखित परीक्षा (Written Examination) पूर्णाङ्क :– २००

द्वितीय चरण :– अन्तर्वार्ता (Interview) पूर्णाङ्क :– ३०

प्रथम चरण (First Phase) : **<u>लिखित परीक्षा योजना (Written Examination Scheme)</u>**

Paper	Subject		Marks	Full Marks	Pass Marks	No. Questions & Weightage		Time Allowed
I	General Subject	Part I: Management, General Health Issues, Academic Research and Teaching-Learning Practices	50	100	40	10 × 5 = 50 (Subjective)	1.30 hrs	2.15 hrs
		Part II: Technical Subject (Relevant Subject)	50			50 × 1 = 50 (Objective Multiple Choice)	45 min	
II	Technical Subject (Relevant Subject)			100	40	7 × 10 = 70 (Long answer) 2 × 15 = 30 (Critical Analysis)		3.00 hrs
	द्वितीय चरण (Second Phase)							
	Interview			30		Oral		

द्रष्टव्य :

1. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।
2. प्रतिष्ठानको प्राज्ञिक सेवा अन्तर्गत समान तहका सबै समूह/सबै उपसमूहहरुको लागि प्रथमपत्रको Part I पाठ्यक्रमको विषयवस्तु एउटै हुनेछ र एकै पटक परीक्षा संचालन हुनेछ ।
3. प्रथम पत्रको Part II र द्वितीयपत्रको पाठ्यक्रम समूह/उपसमूह अनुरुप फरक फरक हुनेछ ।
4. प्रथम पत्रको Part II र द्वितीय पत्रको विषयवस्तु एउटै समूह/उपसमूहहरुको हकमा समान हुनेछ ।
5. प्रथम पत्रको Part II र द्वितीय पत्रको परीक्षा संचालन एकै दिन फरक समयमा हुनेछ ।
6. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरुको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
7. वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital letter) A,B,C,D मा लेख्नुपर्नेछ । सानो अक्षर (Small letter) a, b, c, d लेखेको वा अन्य कुनै सङ्केत गरेको भए उक्त उत्तर रद्द हुनेछ ।
8. बहुवैकल्पिक प्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
9. विषयगत प्रश्नहरुको हकमा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरु (Short notes) सोध्न सकिने छ ।
10. विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

पाटन स्वास्थ्य बिज्ञान प्रतिष्ठान, सेवा आयोग
प्राज्ञिक सेवा, जीव रसायन समूह, सह प्राध्यापक पद (१० औं) तहको
खुल्ला र अन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

11. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भएतापनि पाठ्यक्रममा परेका कानून, ऐन, नियम, विनियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्क्रममा परेको सम्झनु पर्दछ ।
12. प्रथम चरणको परीक्षाबाट उर्त्तिण भई छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
13. पाठ्यक्रम लागु मिति : २०८२/०९/३०

पाटन स्वास्थ्य बिज्ञान प्रतिष्ठान, सेवा आयोग
प्राज्ञिक सेवा, जीव रसायन समूह, सह प्राध्यापक पद (१० औं) तहको
खुल्ला र अन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

Paper I: General Subject

Part I:

(Management, General Health Issues, Academic Research and Teaching - Learning Practices)

Section (A) - 20 Marks

1. Management

1.1. Health care management system in Nepal and other parts of the world
1.2. Fundamental principles of healthcare institution and hospital management.
1.3. Effective hospital management principles
1.4. Purpose of medical and non-medical data and records
1.5. Ethics and responsibility of management
1.6. Concept of management and its application in health care including hospital
1.7. Management: Concept, principles, functions, scope and role, level and skills of manager
1.8. Planning: Concept, principles, nature, types, instruments and steps
1.9. Leadership: Concept, function, leadership styles, leadership and management
1.10. Coordination: Concept, types, techniques of effective coordination
1.11. Communication and counselling: Concept, communication processes and barrier to effective communication, techniques for improving communication
1.12. Decision making: Importance, types, rational process of decision making, problem solving techniques, improving decision making
1.13. Participative management: Concept, advantage and disadvantage, techniques of participation
1.14. Time management: Concept, essential factors and strategies for effective time management
1.15. Conflict management: Concept, approaches to conflict, levels of conflict, causes of conflict and strategies for conflict management
1.16. Stress management: Concept, causes and sources of stress, techniques of stress management
1.17. Change management: Concept, sources of organizational change, resistance to change, management of resistance to change
1.18. Appreciative inquiry: Concept, basic principle and management
1.19. Human resource management: Concept, functions and different aspects
1.20. Health manpower recruitment and development
1.21. Financial management: Concept, approaches, budget formulation and implementation, Auditing and topics related to fiscal administration

2. General Health Issues

2.1. Present constitution of federal republic of Nepal (including health and welfare issues)
2.2. Organizational structure of Ministry of Health at national/federal, regional/state, district (if applicable), municipal and village council level
2.3. Professional council and related regulations
2.4. National Health Policy
2.5. Health Service Act and Regulation
2.6. Second Long term health plan

2.7. Health Management Information System, forms, indicators, annual reports
2.8. Human Development Indices, Sustainable Development Goals
2.9. Health volunteers in the national health system, its rationale, use and effectiveness
2.10. Local governance and community participation in health service delivery
2.11. Health Insurance and financing in health care

2.12. Alternative health care system: Ayurveda, homeopathy, Unani, Chinese etc.
2.13. Indigenous and traditional faith health and health practices
2.14. International Health Agencies: Roles and responsibilities of WHO, UNICEF, UNFPA, Inter-agency relationships, Government-agency coordination: Joint Annual Review meeting
2.15. Supervision, types and its usage in health sector
2.16. Monitoring and evaluation system in health sector
2.17. National Health Training Centre
2.18. National and International Disaster Plan, Coordination
2.19. Patan Academy of Health Sciences Act, Mission, Goals, Organogram
2.20. Scope and function of Patan Academy of Health Sciences executive bodies (senate, executive committee, academic council, faculty board, hospital management committee, subject committee), various other committees

Section (B) - 30 Marks

3. Academic Research

3.1 Ethics, Bio-ethics and Professionalism
3.2 Human dignity and Human Right
3.3 Benefit and Harm
3.4 Autonomy and Individual responsibility
3.5 Consent and capacity to consent
3.6 Privacy and confidentiality
3.7 Respect for humans and personal integrity
3.8 Non-discrimination and non-stigmatization
3.9 Respect for cultural diversity and pluralism
3.10 National Health Research Council (NHRC) and its guidelines
3.11 Research process: ethical research proposal development, research principles, methods and materials, conclusion/recommendation/lesson learnt, commonly used referencing styles
3.12 IRB/IRC forms, types, use, importance; getting IRB/IRC clearance
3.13 Ethics on research methodology: sample selection, sample size calculation, ensuring reliability and validity of the instruments as well as methods proposed for health research
3.14 Quantitative and Qualitative studies
3.15 Data analysis (data visualization, descriptive statistics, inferential statistics with statistical hypotheses and appropriate tools/methods for quantitative studies; theme and code generation, thematic analysis, content analysis, grounded theory for qualitative and triangulation for mixed method studies)
3.16 Research ethics on vulnerable and non-vulnerable population
3.17 Research proposal/protocol/publication:

3.18 Publication ethics, plagiarism including self-plagiarism

4. Teaching - Learning, Assessment and Evaluation

4.1 Lancet Commission Report on Education of Health Professionals

4.2 Adult learning: Theories, principles, use, importance and outcomes, Adragogy vs. Pedagogy

4.3 Conventional teaching - learning: Didactic lectures, Teacher centred approaches, use and importance

4.4 Surface learning, deep learning and metacognition

4.5 Integrated teaching: Genesis, use, importance and outcomes

4.6 Problem-based learning: Genesis, use, importance and outcomes

4.7 SPICES model its use, importance and outcomes

4.8 Socialization, self-directed learning, mentoring, role model

4.9 Community orientation/community posting, re-orientation of medical education camp, community based learning and community engaged teaching-learning methods/models, use, importance and outcomes

4.10 Outcome Based Education (Competency-based Medical/Health Professions Education): Genesis, use, importance and outcomes

4.11 Experiential learning, Reflective practice, Feedback and feed-forward, Situated learning, Co-operative learning, Communities of practice

4.12 Assessment of students

4.12.1 Blueprinting (Table and specification) : use, importance and outcomes

4.12.2 Bloom's taxonomy of cognitive, psychomotor and affective domains, use and importance

4.12.3 Diagnostic, Formative, Summative and Professional exams

4.13 Assessment of knowledge: Selection methods like Multiple Choice Questions, Extended Matching Items and supply methods like Short Answer Question, Problem Based Question, Long Answer Question with or without model answers and marking schemes, unstructured, semi-structured and structured viva-voce examination, advantages and limitations, use and importance, outcomes and its use in quality control

4.14 Assessment of performance (in-vitro): Direct observation of skills in the simulated setting, lab, ward etc. with or without checklist, Objective Structured Practical Examination, Objective Structured Clinical Examination, Standardized patients, use and importance, analysis, quality assurance, outcomes and its use in quality control

4.15 Assessment of performance (in-vivo): Mini-Clinical Evaluation Exercise (Mini-CEX), Direct Observation of Procedural Skills (DOPS), Case-Based Discussion (CbD), OSATS/ PBA, Multi-Source feedback (360 degree evaluation) use and importance for competency based health professions education, analysis, quality assurance, outcomes and its use in quality control

4.16 Assessment of observable behaviours in small groups e.g. Problem Based Learning sessions, Community Based Learning and Education sessions, Clinical clerkship rotations

4.17 Evaluation: Difference between assessment and evaluation, theory of change and its use in health professions education, process and outcome evaluation, qualitative, quantitative and mixed methods used in evaluation of health professions education

पाटन स्वास्थ्य बिज्ञान प्रतिष्ठान, सेवा आयोग
प्राज्ञिक सेवा, जीव रसायन समूह, सह प्राध्यापक पद (१० औं) तहको
खुल्ला र अन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

Paper I

Part II: Technical Subject

Section (C) - 25 Marks

1. Biomolecules and Metabolism

1.1 **Basics:** Acid-Base, pH, Henderson Hasselbach equation, pH measurements, Buffer solutions, biological membrane and transport system, Gibbs Donnan equilibrium

1.2 **Biomolecules**

1.2.1 Carbohydrates: Introduction, biochemical importance, classification, structure, isomerism, properties, detection of carbohydrates

1.2.2 Lipids: Introduction, biochemical importance, classification, properties of lipid; Fatty Acids, lipoproteins, triglycerides, phospholipids, glycolipids and steroids; Prostaglandins and their biological significance

1.2.3 Proteins: Classification, structure and properties of amino acid; Structure, classification, properties and techniques of separation for proteins

1.2.4 Nucleic Acids: Nucleosides, nucleotides, nucleoproteins and nucleic acids; Structure, properties, types and functions of DNA and RNA

1.3 **Enzymes:** Definitions, classification, nomenclature, catalysis, mechanism of enzyme action, factors affecting the enzyme activity, units of activity, diagnostic/clinical enzymology.

1.4 **Metabolism:** Concepts, Biochemical Roles, Importance and Related Disorders

1.4.1 Carbohydrates: Glycolysis, Kreb's cycle, gluconeogenesis, glycogen metabolism, HMP pathway and metabolism of fructose, galactose, amino sugars and lactose synthesis; Biological oxidation and Bioenergetics including the Electron Transport Chain and Oxidative Phosphorylation.

1.4.2 Lipids: Fatty acid oxidation, biosynthesis of fatty acids, cholesterol and triacylglycerol, lipoprotein metabolism (composition, metabolism, function and significance of chylomicron, VLDL, LDL and HDL), apolipoproteins and their role in lipoprotein metabolism, dyslipidemia, arthrosclerosis, obesity.

1.4.3 Proteins: Transamination, deamination, urea cycle, ammonia transport and its toxicity and individual amino acids metabolism.

1.4.4 Nucleic Acids: Synthesis and degradation of purine and pyrimidine; Replication, Transcription and post transcriptional modification, Translation and post translational modifications, types of mutation and its repair mechanisms, gene regulation, operon hypothesis.

1.5 **Inborn Errors of Metabolism (Congenital disorders):** Carbohydrate disorders, Amino acids metabolism disorders, Lipids and Lipoprotein metabolism disorders,

Purine, Pyrimidine and Nucleic Acids disorders, laboratory findings, and their management

1.6 **Integration of Metabolism:** Feed and fast cycle, metabolic interrelationships of tissues (Liver, Brain, Skeletal muscles, Adipose tissue, Placenta), metabolism in obesity, starvation, exercise, pregnancy, stress, injury, liver disease, renal disease and acid-base disorder

2. Nutrition

2.1 Principal food components, General nutritional requirements, Energy requirements, Biological value of proteins, Thermogenic effect of food, Balanced diet, diet formulations in health and disease, mixed diet, Nutritional supplements, Food toxins and additives, Parenteral nutrition, National Nutrition Program. Minerals: Biochemical roles, roles in metabolism and disease, bulk and trace elements, mineral deficiencies and toxicity

2.2 Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, under-nutrition, laboratory diagnosis of nutritional disorders

2.3 Vitamins: Classification, biochemical role, sources, RDA and deficiency state of each vitamin (including diagnostic tests for deficiency and treatment)

2.4 Minerals: Classification, biochemical role, sources, requirement and deficiency state of each mineral (including diagnostic tests for deficiency and treatment)Nutritional Value of Food: BMR, Respiratory Quotient and its significance; Energy calculation, balanced diet, plan diet in health and disease, biological value of proteins, protein energy malnutrition, malabsorption, parental nutrition, Modification and supplementation of dietary requirements in health and disease.

3. Cell Biology

3.1 An overview of cellular structure and function

3.2 Prokaryotic and eukaryotic cells

3.3 Structure of eukaryotic cells-sub cellular organelles, cytosol, endoplasmic reticulum, nucleus, nucleolus, mitochondria, lysosomes, ribosomes, Golgi apparatus, peroxisomes, plasma membranes and their functions

3.4 Receptor-mediated endocytosis

3.5 Properties of biological membranes -motility, permeability, concept of semi permeable membranes, electrochemical gradient, pumps, and liposomes

3.6 Transport across membranes- active, facilitated and passive. Transport mechanisms-ion channels including gated channels, carrier proteins, glucose transporters (GLUT), active transporter, symporters and antiporters

3.7 Non-membrane organelles-cytoskeleton, microfilaments, microtubules and microvilli

3.8 Cell interactions and adhesion- types of junctions: tight junctions and gap junctions

3.9 Adhesion molecules-cadherins, selectins, integrins (beta 1 and beta 2 integrins)

3.10 Cell cycle, regulation of cell cycle, apoptosis, biochemistry of aging

3.11 Stem cells and their differentiation

3.12 Cell as experimental models- *E.coli*, yeast, *Drosophila melanogaster*, viruses

3.13 Programmed cell death

4. Molecular Biology

4.1 DNA Replication: Replication process, DNA Repair, Recombination between homologous DNA sequences, DNA Rearrangements

4.2 Transcription: Prokaryotic and Eukaryotic transcription, Regulation of transcription in Eukaryotes, RNA processing and turnover

4.3 Translation: Prokaryotic and Eukaryotic Protein synthesis, Regulation of translation, Protein folding, Post-translational modification, Protein degradation.

4.4 Regulation of gene expression: The operon concept in prokaryotes; Role of general and gene specific transcription factors. Small interference RNA (siRNA) and micro-RNA (miRNA); Other modes of regulation of gene expression: alternative splicing, alternative promoter usage, DNA methylation, Histone acetylation / deacetylation, RNA editing, alterations of RNA stability

4.5 Genetic code and mutations: Characteristics of the genetic code; Molecular basis of degeneracy of the genetic code (Wobble hypothesis); Mutagens- examples of physical, chemical and biological mutagens. Types of mutations – point mutations and chromosomal mutations; Relationship of mutations with specific diseases

4.6 Stem Cell and differentiation, Apoptosis

4.7 Cancer genetics: Carcinogenic Agent- Radiation, chemicals and viruses, Oncogenes, Tumor suppressor genes, Genetic cancer syndromes- familial breast cancer, familial adenomatous polyposis coli and retinoblastoma Inherited conditions and predispose to development of cancer (e.g., Ataxia-telangiecatasia, Xeroderma pigmentosum, Fanconi syndrome), Mechanisms of action of cytotoxic drugs, application of molecular biology to cancer prevention and treatment.

4.8 Recombinant DNA technology: A knowledge of Recombinant DNA, vector, cloning, restriction enzyme, blotting techniques, miRNA and their application in medicine.

4.9 Polymerase Chain Reaction: Introduction, Primer and its designing, Phases of reactions (denaturation, annealing and annexing), Open array, digital PCR and their application.

4.10 Genetic mapping and Physical mapping, DNA Sequencing, Human genome project, cDNA Library and Gene Bank, Gene Therapy.

4.11 Genetic Testing: Restriction fragment length polymorphism (RFLPs), Its application in mutation detection and DNA fingerprinting, Analysis of Gene Expression: Microarray, Western blot

5. Human Genetics

5.1 Structure and organization of chromosomes and chromatin remodeling

5.2 Principles of human genetics: Alleles, genotypes and phenotypes; Patterns of inheritance: monogenic and polygenic inheritance; Population genetics; Genetic factors in causation of diseases

5.3 Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders

5.4 Screening for genetic diseases and prenatal testing.

5.5 Ethical and legal issues related to medical genetics

5.6 Overview of Human Genome Project; Genomics

5.7 Cytogenetic: Inheritance, Karyotyping, Chromosomal abnormalities

6. Bioinformatics and computational Biology: Genomics, proteomics and bioinformatics, computer aided drug design and discovery, genome guided personalized medicine, Basic Local Alignment Search Tool (BLAST) for protein and nucleic acid, protein data base. DNA and protein sequences, acquisition of databases, aligning different sequences, comparing them, viewing 3-D models of protein structures, studying the molecular interaction and carrying out drug discovery analyses.

Section (D) - 25 Marks

7. Immunology:

7.1 Concept, mechanisms and role of innate and acquired immunity, humoral and cell mediated immunity, antigen and antibodies, antibody diversity, class switching, MHC.

7.2 Recognition of antigens: Primary interaction, antigen processing and presentation Immune response: Lymphocyte maturation, activation of T and B lymphocytes, cytokines, regulation of immune response, immunodeficiency, tumor immunity, transplantation, immunosuppression and immunopotentiation including vaccination

7.3 Transplant Biochemistry: Overview of Organ Transplantation; Major Histocompatibility Complex (MHC), Antigen Presentation, T- cell and B – cell; Immunologic basis of rejection; Role of biochemistry in immunosuppressive therapy; Cell and molecular biology in transplantation; Metabolism and organ specific consideration

8. Organ System Function

8.1 **Cardio - Vascular System:** Characteristics features of heart muscles and its metabolism, ischaemic heart disease, atherosclerosis, pre-disposing factors leading to ischemia and infarction, myocardial infarction, cardiac markers (enzymatic and non-enzymatic), iron containing haem and non-haem proteins and their functions, intestinal absorption, distribution kinetics in the body, process of haem biosynthesis and catabolism, iron deficiency anaemia and acute intermittent porphyria, diagnostic tests for iron deficiency states, classification of porphyria, causes, diagnosis and management of porphyria

8.2 **Respiratory System and Acid Base Balance:** Physiological buffer system, oxygen content, oxygen saturation, pKa, acid base balance, acidemia, alkalemia, compensated and no compensated, Neonatal Respiratory Distress Syndrome and its biochemical basis and management, function of haemoglobin and properties of dissociation curve of oxyhaemoglobin, different forms of carbon dioxide existence in blood and mechanism of transport, interrelationship among Hb, O_2, CO_2, H^+ and 2-3 DPG, Carbon monoxide poisoning, Anion gap and its significance and ABG analysis and interpretation.

8.3 **Gastrointestinal and Hepatobiliary System:** Gastrointestinal composition and biochemical methods of investigation of gastric secretion; Tests of carbohydrate and fat absorption, Gastric function tests and clinical significance; Investigation of malabsorption and diarrhea; Characteristic features and metabolism of liver, role of liver in metabolism of carbohydrates, lipids, proteins and foreign toxic substances, types of jaundices and their biochemical features, bilirubin metabolism, acute and chronic liver disease, cirrhosis of liver, alcoholic liver disease, cholestatic liver disease, infiltration of liver, Liver function tests and interpretations in different liver disease; Chemical composition and biochemical basis of formation of gall stones and their analysis; Exocrine functions of pancreas, acute and chronic pancreatitis, pancreatic function tests and clinical significance, biochemical tests for steatorrhoea.

8.4 **Renal System and Electrolyte Balance:** Role of kidneys in acid base balance, characteristic features and metabolism of kidney cells, interrelationship between water, sodium and extra-cellular fluid and osmolality, role of aldosterone and natriuretic peptide hormones in maintaining ECF osmolality, renal handling of sodium and potassium, Renal function tests and interpretations, glomerular function tests, tubular functions tests, clearance tests, Glomerular filtration rate, urine azotemia, uremia, hyper and hypo conditions of electrolytes (Na+, K+, Cl- etc.) osmolality and renal concentration tests, renal failure and its consequences, nephrotic syndrome, glomerulonephritis, Fanconi syndrome, its basis and biochemical findings, chemical composition and biochemical basis of formation of renal stones and their analysis.

8.5 **Endocrine and Metabolic System:** Introduction and biomedical importance of hormones, mechanism of action of hormones, Bio-signaling and signal transduction mechanisms, hypothalamic releasing factors and their functions; Pituitary hormones, their functions, hyper and hypo conditions (diabetes insipidus its basis and management) biochemical basis; Biosynthesis, secretion, transportation, regulation and functions of thyroid hormone of thyroiditis, hypothyroidism, hyperthyroidism and goiter; Synthesis and biochemical functions adrenal gland hormone; Causes, molecular basis and biochemical investigation of Addison's disease, Cushing's syndrome and Cohn's disease; Synthesis, biochemical functions and disorders of parathyroid hormone, mode of action and biological functions of insulin, glucagon and somatostatin, diabetes mellitus and it's type, gestational diabetes, biochemical investigations and interpretations, biochemical basis of complications of diabetes, composition of lens- biochemical changes during cataractogenesis.

8.6 **Reproductive System and Infertility:** Male and female reproductive hormones, gonadal hypo and hyper function, infertility, amenorrhea, hirusitism, fetoplacental disorders, genetic defects, placental hormones, biochemistry of conception, reproduction and contraception.

8.7 **Neurological System :** Clinical features, laboratory diagnosis of disorders of the nervous system, disturbances of neuro-anatomic systems, inherited disorders with neurological systems e.g. acute intermittent porphyria, metachromatic leucodystrophy [Shilder's disease], mucopolysaccharide storage diseases, disorders of neurotransmission : Alzheimer's disease, Myasthenia gravis, dopaminergic

systems, Parkinson's disease, Schizophrenia, depression, mania, epilepsy, Huntington's disease, Multiple sclerosis, meningitis, biochemical changes in cerebrospinal fluid.

8.8 **Musculoskeletal System :** General knowledge of pathophysiology of broad spectrum of disorders affecting the joints, diffuse connective tissue disease, malignant hyperthermia, fuels of muscle, molecular basis of muscle contraction, role of troponin and calcium in muscle contraction , fuels used by red and white muscles, metabolism in marathon runners and sprinters, hormones involved in calcium and phosphate homeostasis, conditions related with hypo and hypercalcemia and along with their biochemical basis.

8.9 **Pregnancy and Related Disorders:** Maternal serum screening, triple test, amniotic fluid and fetal blood examination, ectopic pregnancy, diabetes, pre-eclampsia.

8.10 **Pediatric and Geriatric Clinical Biochemistry**

9. Clinical Biochemistry

9.1 **Basic Laboratory Principles**

9.1.1 Sample collection, preservation, transport and storage

9.1.2 Handling and use of laboratory equipments (Centrifuge, Water Bath, Electronic Balance, pH Meters, Pippettes, Glassware, Dispensers, Hot Air Oven)

9.2 **Instruments:** Principles, operation protocols and applications of photometry; Concepts of colorimeter, visible and ultraviolet spectrophotometer, turbidometry, nephelopmetry, fluorimetry, flame Photometer, ion selective electrodes, atomic adsorption and mass spectrometry.

9.3 **Separation Techniques**

9.3.1 Chromatography: Planar vs. column, gas vs. liquid, adsorption, affinity, ion-exchange, partition and size exclusion techniques, direct and reverse phase liquid chromatography, high performance liquid chro

9.3.2 Electrophoresis: Agarose, capillary, microchip, polyacrylamide, capillary zone, isotachophoresis, isoelectric focusing, immunofixation, two dimensional (2D).

9.3.3 Cenrifugation and its types; Subcellular fractionation/marker enzymes for organelles to demonstrate fractionation

9.4 **Immunoassays**

9.4.1 Enzyme based Assays: Principle and applications of ELISA and EIA, modified enzyme based investigative techniques and Chemiluminescent Immunoassay and Enhanced Chemiluminescent Immunoassays

9.4.2 Radioactivity and RIA: Application of radioactive substances in medicine and hazards of radioactivity and prevention; principle and applications of Radioimmuno assay

9.5 Automation Techniques in Clinical Chemistry (Autoanalyzers, Automated Immunoassays)

9.6 **Body Fluids:** Biochemical analysis of ascetic, peritoneal, pleural and synovial fluids, CSF and urine analysis

9.7 **Analytical Biochemistry and Data Interpretation**

9.7.1 **General Tests:** Knowledge, principle, application and predictive values for routine biochemical tests along with their evolution over time

9.7.2 **Drugs:** Knowledge, principle and application of drug levels in the diagnosis, treatment and monitoring of disease states and immunomodulation

9.7.3 **Diagnostic Tests:** Knowledge of diagnostic tests in endocrinology including Dexamethasone suppression test, Synacthen test, Ham's test, Water Deprivation test, Schumm's test, Schilling test

9.7.4 **Special Tests:** Testing principles and applications of hormone tests, iron profile, lipids, special proteins and other emerging biomarkers

9.7.5 **Other Tests and Tumor Markers:** Principle, application and techniques for tests used for collagen disorders, tumor markers in diagnosis and monitoring of cancers, hormone profiles, metals, vitamins and enzymes in clinical syndromes

9.8 **Biochemical monitoring of treatment of various diseases**

10. Laboratory Management Organization And Operation

10.1 Principles of leadership and organization: Concepts of Total Quality Management, Lean Production, Six Sigma. Interactions between the laboratory service and clients that are served by the laboratory.

10.2 Professional ethics: Professional responsibilities as a leader in laboratory medicine and research.

10.3 General aspects of financial management of laboratories: Cost-analysis (tests and instruments), Specification for the ordering of the new instruments, Decision analysis for instrumentation, delegation of budget responsibilities, work load statistics. Billing and reimbursement concepts where applicable.

10.4 Quality management: Total quality management; Laboratory errors; control of pre-analytical, analytical and post analytical variables; Establishing quality goals and the analytical performance limits, Laboratory errors Elements of a quality assurance program, Analytical traceability, Control of analytical quality using patient data, Identifying the sources of analytical errors development and monitoring of performance indicators; quality control

10.5 Standards and practices; QC material limitations; control of analytical quality using patient data. Elements of quality assurance. External quality assessments and proficiency testing programs. Accreditation requirements.

10.6 Laboratory reporting systems: Need for information to reach the attending physician within a time-frame for appropriate action. Attention to abnormal results, and critical values. Clinical interpretation. Sample identification and tracking (e.g. bar code systems).

10.7 General aspects of system design: Central vs. stand-alone systems. Laboratory information systems (LIS), hospital information systems (HIS), electronic data transfer and instrument interfacing, data-base structure, data mining (data extraction for statistical analysis or quality management reports). Security of data storage and transmission.

10.8 Medico-legal requirements: Confidentiality, record keeping, knowledge of relevant provincial legislation, personal liability, chain of custody.

10.9 Procedures: Preparation and maintenance of proper laboratory manuals, standard operating procedures.

10.10 Training of technical staff: Familiarity with the syllabi of various training programs, knowledge of the teaching requirements and level of knowledge of medical technologists.

10.11 Laboratory Information Systems (LIS): Required features and desired or ideal features of an LIS.

10.12 Selection of reference laboratories: Requirement of a referral lab (lab license, evidence of method evaluation, quality control and quality assurance). Logistical aspects of sending specimens to a referral lab.

10.13 Point of Care Testing (POCT): Aspects of quality management in POCT, challenges facing POCT in terms of regulatory and accreditation requirements and compliance, selection of POCT instruments, limitations of POCT.

10.14 Laboratory Safety: Fire, chemical, radiation and infection control; Waste disposal regulations; Blood and body fluids precautions; Workplace Hazardous Materials Information System (WHMIS) and Globally Harmonized System of classification and

labeling of chemicals (GHS); Material Safety; Any additional laboratory or institutional safety practices.

10.15 Automation in the clinical laboratory: Basic concepts; Automation of the analytical Processes; Integrated automation for the clinical laboratory; Practical considerations

11. Principles of haemo and peritoneal dialysis

12. Clinical Toxicology and therapeutics - Mechanisms and symptoms of most important types of Toxic syndromes (anticholinergics, cholinergics, opioids, sedatives, sympathomimetics), Pharmacology and analysis of specific drugs and toxins.

13. Recent Advances: Emerging biomarkers / Laboratory techniques and their implications, Point of care testing devices; SELDI-TOF MS, MALDI-TOF MS, protein profiling flow cytometers; Nanotechnology; Microfabrication, fluorescence resonance energy transfer (FRET), and surface plasma resonance (SPR).

----------XXXXXXX----------