

पाटन स्वास्थ्य विज्ञान प्रतिष्ठान, सेवाआयोग  
प्राज्ञिक सेवा, विकृति विज्ञान समूह, प्राध्यापक एघारौं (११) तहको  
खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

**Paper II: Technical Subject**  
**Section (A) - 45 Marks**

**1. General Pathology**

- A. **Cellular adaptation, injury and death:** cellular response to injury, growth and differentiation, Morphology of cell injury and necrosis, apoptosis, intracellular accumulations, calcification
- B. **Acute and chronic inflammation:** general features, cells and chemical mediators involved, events, outcome
- C. **Tissue repair and renewal:** Normal cell proliferation and tissue growth, their control, mechanism of tissue regeneration, repair by healing, scar and fibrosis, healing by first and second intention, factors effecting wound healing,
- D. Hemodynamic disorders: Normal hemostasis, thrombosis and embolism, Infarction, Shock, Disseminated intravascular coagulation
- E. **Genetic diseases:** Mutations, Mendelian disorders, Karyotyping, Diagnosis of genetic diseases
- F. **Diseases of immunity:** Types of immunity, cell involved, cytokines, Histocompatibility molecules, Hypersensitivity reaction and types, Autoimmune diseases, Immunological immunodeficiency syndromes, AIDS, Amyloidosis
- G. **Neoplasia:** Definition, nomenclature, biology of tumor growth, cell cycle, Molecular basis of cancer, Carcinogenic agents, paraneoplastic syndrome, tumor markers, clinical features of tumors, grading and staging, laboratory diagnosis of cancer
- H. **Environmental and nutritional pathology:** Common environmental and occupational hazards, food safety, nutrition deficiencies.
- I. **Infectious disease:** General principle of microbial pathogenesis, Agents of bio-terrorism, Infections in immunocompromised host, Special techniques in diagnosing infectious agent

**1. Surgical Pathology**

- A. Components Surgical pathology Report, Limitation of Histological diagnosis
- B. Information system in surgical pathology, Digital pathology and Tele-pathology
- C. Automated surgical pathology
- D. Legal aspects of surgical pathology
- E. Gross techniques in surgical pathology: Gross room, handling of specimens, general principles, photography, radiography, Guidelines for handling common specimens
- F. WHO classification of tumors of various systems, their grading and staging
- G. Synoptic reporting system

**2. Cytopathology**

- A. Role of Diagnostic Cytology
- B. Structure and function of cells, morphological features of dysplasia
- C. Evaluation of various samples in conventional smears and liquid based preparations
- D. Cell blocks and its use in cytological diagnosis
- E. Immunochemistry and Molecular Biology in Cytological Diagnosis
- F. Digital Analysis of Cells and Tissues

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- G. Flow Cytometry
- H. Advanced techniques in diagnostic cytopathology

**3. Gynecological Cytopathology**

- A. Anatomy, Histology and Cytology
- B. Normal Female Genital Tract
- C. Bethesda system for reporting cervical cytology
- D. Inflammations, bacterial and viral infections of cervix
- E. Benign proliferative reaction, intraepithelial neoplasia and invasive cancers
- F. Cytologic Evaluation of Menstrual Disorders and Hormonal Abnormalities
- G. Proliferative Disorders and Carcinoma of the Endometrium
- H. Diseases of the Vagina, Vulva, Perineum
- I. Tumors of the Ovary and Fallopian Tube

**4. Non-gynecological cytopathology:**

- A. Normal findings in different cytological specimens of upper and lower respiratory tract
- B. Cytology of bronchogenic carcinomas in sputum, bronchial brushing and Broncho-alveolar lavage
- C. Sampling of Oral Cavity, Larynx, Trachea, Nasopharynx, and Paranasal Sinuses
- D. Benign, reactive and malignant lesion of Oral Cavity, Larynx, Trachea, Nasopharynx, and Paranasal Sinuses
- E. Tumors of the Urinary Tract in Urine and Brushings
- F. Non-neoplastic findings in samples of urinary tract
- G. Different cytology samples of gastrointestinal tract, including hepatobiliary tract and pancreas and normal their cytological findings
- H. Cytology non neoplastic lesion of gastrointestinal tract, hepatobiliary tract and pancreas
- I. Cytology of tumors of gastrointestinal tract, hepatobiliary tract and pancreas
- J. Various types of effusions and their normal findings
- K. Non neoplastic lesions in effusions
- L. Neoplastic lesions in effusion, including cytology of CSF in leukemia

**5. Fine needle aspiration cytology**

- a. Techniques of Fine Needle Aspiration, Smear Preparation, and Principles of Interpretation
- b. Imaging methods for guidance of aspiration cytology
- c. Diagnostic pitfalls in FNA diagnosis of various lesions
- d. FNAC diagnosis and differential diagnosis of different lesions of head and neck, including salivary gland
- e. FNAC diagnosis and differential diagnosis of different lesions in lymph node. FNAC findings of different lymphomas
- f. Reporting FNAC of thyroid nodules. FNAC findings in various thyroid lesions.
- g. Cytology reporting categories of breast nodules. FNAC diagnosis of various non-neoplastic and neoplastic lesions of breast
- h. FNAC diagnosis of various lesions of lung, mediastinum, chest wall pleura
- i. FNAC diagnosis of various lesions of kidney, adrenal and retroperitoneum
- j. FNAC diagnosis of bone and soft tissue lesions
- k. Evaluation of FNAC of testes for male infertility
- l. FNAC diagnosis and differential diagnosis of testicular tumors and other lesions

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of male genital tract

**6. Histo/cyto techniques**

- A. Organization of Histopathology/cytopathology Laboratory
- B. Various Histological equipment, their uses and care
- C. Reception and recording of specimen
- D. Theory of routine (H/E, Pap) and special stains and their practical implication
- E. Preparation, reagent preparation, procedure and quality control of all routine and special stains used in Histopathology/cytopathology
- F. Grossing technique of various surgical specimens
- G. Technique of processing various tissues including bone for histological studies, Errors in sectioning and remedies
- H. Frozen section and their uses, processing tissue for frozen section and its interpretation
- I. Stains for bacteria, AFB, fungi, amoeba in tissue
- J. Preparation of cell blocks and their interpretation
- K. Fine needle aspiration techniques involved in preparation of smear and staining
- L. Different types of cytology specimens, their preservation and transport, processing of various cytology specimens, smear preparation and staining
- M. Liquid based cytology; principle, instruments, procedure advantage, disadvantage
- N. Cyto centrifuge and its uses in diagnostic cytopathology
- O. Immunohistochemistry: Principle, procedure, uses, quality control, Immunohistochemical markers of various neoplasms
- P. Use of microwaves in histopathology/cytopathology
- Q. Principle and use of flow cytometry in cytopathology
- R. Preparation and Quality control of various stains, reagents and methods used in histopathology/ cytology
- S. Molecular methods in histopathology and cytopathology
- T. Principle, method and use of In-situ Hybridization, recent methods in hybridization techniques
- U. Enzyme histochemistry: principle, reagent and specimen preparation, procedure and application

**7. Histopathology**

- A. Tissue processing techniques
- B. Different stains used in bone marrow trephine biopsies and lymph node biopsies
- C. Interpretation of bone marrow trephine biopsies and lymph node biopsies
- D. Use of immunohistochemistry in bone marrow and lymph nodes for diagnosis of leukemias and lymphomas and other disorders

**8. Cytogenetics, Molecular Pathology and Immunopathology**

- A. Methods, procedures, and interpretation of standard karyotyping analysis
- B. Principle and use of fluorescent in situ hybridization and more specialized techniques
- C. Cytogenetics of myeloid, lymphoid and plasma cell disorders, their use in prognosis and therapy monitoring
- D. Basic concepts in molecular biology and pathology
- E. Basic gene structure and function
- F. Principle, brief procedure and interpretation of Molecular pathology tests pertinent to hematopathology: Southern blot, PCR and its different types,

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restriction fragment length polymorphism, Real-time PCR

- G. DNA & RNA extraction techniques
- H. Separation of lymphocytes using density gradient and centrifugation
- I. Recent advances and other emerging techniques and technologies in hematopathology

**9. Laboratory management:**

- A. Fundamental of Total Quality management
- B. Statistical process in quality control
- C. Element of quality assurance program
- D. Concept of Evidence based medical practice
- E. Concept of critical values and alert values in laboratory practice
- F. The laboratory information system
- G. Concept of reference laboratory
- H. Implementation of reference system in laboratory medicine
- I. Standard operating procedure and their preparation
- J. Errors and identification of the source of error in hematology laboratory
- K. Internal and External quality control and proficiency testing
- L. Preparation of quality policy manual
- M. Laboratory Accreditation, Key component of accreditation, ISO 15189 and others laboratory related accrediting bodies
- N. Quality control in procedure, equipment, NEQAS, EQAS
- O. Ethics in medicine
- P. Health and Safety measures (Physical/Chemical/Biological/Radiation)
- Q. Waste disposal
- R. Management of under resourced laboratory

**Section (B) - 55 Marks**

**10. Systemic pathology**

- A. Gross anatomy, relevant physiology and histology of specimens and tissues of gastrointestinal, cardiovascular, respiratory systems, genitourinary system, male and female reproductive system, Endocrine system, central nervous system, peripheral nervous system, Musculoskeletal system and neurosensory system
- B. **Skin:** Inflammatory diseases, dermatoses, vesiculobullous diseases, degenerative diseases, tumors and tumor like conditions
- C. **Oral cavity and oropharynx:** Congenital anomalies, inflammatory and non-neoplastic diseases, Tumors and tumor like conditions of surface epithelium, odontogenic epithelium, disease of temporo-mandibular joints. Tumors and tumorlike lesions of salivary gland of Salivary gland
- D. **Respiratory system & mediastinum:** Inflammations, cysts, neoplastic diseases of larynx and trachea. Pleuritis, tumors of pleura, Non neoplastic diseases of lung. Lung tumors. Cyst in mediastinum, mediastinal tumors
- E. **Endocrine system;** Congenital anomalies, inflammatory lesions, tumors and tumor like conditions of thyroid, parathyroid, adrenal glands and paraganglia, pituitary, hypothalamus
- F. **Urinary tract:** Congenital anomalies, cystic diseases of kidney, Glomerular lesion associated with nephrotic and nephritic syndrome, vascular lesions, Hereditary diseases, pyelonephritis, interstitial nephritis, Renal transplant rejection, lithiasis. Tumors, tumor like conditions

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- G. **Male Reproductive system:** Congenital anomalies, cryptorchidism, atrophy and infertility, Tumors of testes and paratesticular tissue, hydrocele, Prostatitis, Prostatic, hyperplasia, Tumors of prostate
- H. **Female reproductive system:** Inflammatory and other non-neoplastic disease of vulva and vagina, Pelvic inflammatory diseases, Lesions of cervix. Cervical intraepithelial neoplasia, Tumors of cervix, Menstrual cycle, Endometrial dating, Non neoplastic and neoplastic lesions of uterus. Abortion, ectopic pregnancy, endometriosis. Lesion of ovary, polycystic ovarian diseases, ovarian tumors, Gestational trophoblastic diseases, lesions of placenta, Neoplastic and non-neoplastic disease of fallopian tubes, Inflammatory, other non neoplastic and neoplastic disease of breast
- I. **Gastrointestinal tract:** Congenital anomalies of GIT, Reflux and other esophagitis, tumors and tumor like conditions of esophagus Gastritis and Peptic ulcers, Polyps of stomach and intestine, tumors and tumor like conditions of stomach, Gastrointestinal stromal tumors, Malabsorption, Diseases associated with malabsorption, inflammatory bowel disease, Intestinal obstruction, AIDS related inflammatory diseases of intestine, tumors and tumor like conditions of intestine, infections, hemorrhoids, rectal prolapse, diseases of peritoneum and retroperitoneum
- J. **Hepatobiliary System:** Viral hepatitis, Cirrhosis, Alcohol, drug and toxin induced liver injury, Cholestasis, disorders of metabolism, vascular disorders, Liver diseases in pregnancy, Liver involvement in systemic illness, Liver pathology in organ transplant, tumors and tumor like conditions of liver, Cholelithiasis, cholecystitis, Tumors of gall bladder and intra as well as extrahepatic bile ducts, Pancreatitis, tumors and tumor like conditions pancreas, Ampullary carcinoma
- K. **Cardiovascular system:** congenital anomalies, Myocardial infarction, atherosclerosis, vasculitis and other vascular disorders, Hypertension, Tumors of heart and pericardium, Rheumatic heart diseases, infective endocarditis, valvular anomalies, myocarditis and cardiomyopathies, blood vessels tumors,
- L. **Musculoskeletal system:** Histochemistry of Muscle biopsy, Muscle diseases, atrophies, neuromuscular junction disorders, myopathies Fractures, Osteomyelitis, Pagets disease, osteopetrosis, tumors and tumor like lesions of bone Non neoplastic diseases of joints, gout, rheumatoid arthritis, osteoarthritis, tumors and tumor like lesions of joints, histopathological evaluation of bone marrow biopsies
- M. **Neurosensory system;** Congenital anomalies, cerebrovascular accidents, inflammatory and infectious diseases of CNS, meningitis, Tumors of brain and meninges, Neuropathies, Diseases of peripheral nerves, Inflammatory and infectious disease of eye and ear, tumors and tumor like lesions of eye and ear
- N. **Lymphoreticular system:** Lymph node evaluation, patterns of hyperplasia, Inflammatory/hyperplastic disease of lymph node, malignant lymphomas, metastatic tumors, Congenital anomalies of spleen, neoplastic and non-neoplastic diseases of spleen, Hypersplenism.

## 11. Basic Hematology

- A. Morphology, physiology and biochemistry of blood, marrow, lymphatic tissue and spleen
- B. Basic morphology and basic concepts of hematopoiesis
- C. Normal hemostatic mechanism, pathophysiology of blood coagulation

- and thrombosis
- D. Development of Immune system
  - E. Cell Cycle and Carcinogenesis
  - F. Principles of chemotherapy
  - G. Effects of other systemic disorders on the blood, blood - forming organs and lymphatic tissue
  - H. Genetic aspects of hematology
  - I. Relevant drugs, their mechanisms of actions, pharmacokinetics and clinical indications and limitations, including effects, toxicity, and interactions
  - J. Infections and hematological problems
  - K. Cluster of differentiation antigens (CD markers) relevant to hematological diseases, their distribution, detection and use in diagnosis
  - L. Use of radioisotopes in hematology

## 12. Clinical Hematology and Hemato-pathology

### a. Erythrocytes:

- i. Production, composition, destruction of erythrocytes
- ii. Clinical manifestations and classification of erythrocyte disorders
- iii. Definition and classification of anemia
- iv. Iron metabolism. Vitamin B12 and folic acid metabolism
- v. Causes, clinical features laboratory diagnosis of iron deficiency anemia, megaloblastic anemia, anemia resulting from other nutritional deficiencies, anemia of chronic diseases
- vi. Etiopathogenesis, clinical features, diagnosis and treatment of congenital dyserythropoetic anemia
- vii. Etiopathogenesis, clinical features, diagnosis and treatment of congenital paroxysmal nocturnal hemoglobinuria
- viii. Acquired and inherited aplastic anemia and pure red cell aplasia: etiopathogenesis, clinical and laboratory findings, diagnosis, management
- ix. Anemia in systemic disorders, endocrine disease and associated with marrow infiltration
- x. Red blood cell membrane disorders: hereditary spherocytosis, elliptocytosis and related disorders
- xi. Disorders of red cell resulting from enzyme abnormalities
- xii. Thalassemia and hemoglobinopathies: epidemiology, etiopathogenesis, classification, genetic mechanism, clinical and hematological features, complications, laboratory diagnosis, antenatal diagnosis, management
- xiii. Sickle cell anemia and related abnormalities; epidemiology, etiopathogenesis, classification, genetic mechanism, clinical and hematological features, complications, laboratory diagnosis, management
- xiv. Classification, etiology, clinical and laboratory diagnosis of hemolytic anemias and Hemolytic anemias due to physical, chemical, microbial causes and immune mechanisms
- xv. Red cell disorders in the newborn
- xvi. Hemolytic disease of newborn: Basis, diagnosis, clinical and laboratory features
- xvii. Hereditary and acquired sideroblastic anemias;

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etiopathogenesis, diagnosis, clinical and laboratory features, management

xviii. Primary and secondary polycythemia: etiopathogenesis, clinical and hematological features, complications, laboratory diagnosis, management

xix. Red cell disorders in pregnancy

b. Leucocytes:

i. Morphology, composition, production, function, distribution and fate of different WBCs

ii. Classification, clinical manifestations and diagnosis of qualitative and quantitative disorders of neutrophils

iii. Production, function, morphology and disorders of eosinophils, mast cells and basophils,

iv. Classification, clinical manifestations and diagnosis of monocytes and macrophages, Inflammatory and malignant histiocytosis, etiopathogenesis, clinical and laboratory features, diagnosis

v. Lipid storage disorders; Types, genetic basis, etiopathogenesis, clinical and laboratory features, complications, management

vi. Hematological manifestation of AIDS

vii. Production, morphology and functions of lymphocytes. Lymphocytosis and lymphocytopenia.

viii. Etiopathogenesis, classification, clinical features, diagnosis, treatment, genetic and molecular evaluation, prognostic markers and complications of acute and chronic myeloid and lymphoid leukemias

ix. Leucocyte cytochemistry

x. Etiopathogenesis, classification, clinical features, diagnosis, treatment, genetic and molecular evaluation, prognostic markers and complications of various myeloproliferative disorders and Molecular diagnosis, Monitoring response to therapy in CML

xi. Hodgkin and Non Hodgkin Lymphomas: pathophysiology, classification, clinical and laboratory findings, diagnosis, prognosis

xii. Plasma cell disorders: Etiopathogenesis, classification, clinical features, diagnosis, treatment

c. Hemostasis and Thrombosis:

i. Overview of megakaryopoiesis

ii. Biochemistry, morphology and function of platelets

iii. Various coagulation factors, their molecular biology and biochemistry  
iv. Pathophysiology of blood coagulation and thrombosis, pathways of hemostasis

v. Classification, clinical manifestation, evaluation, treatment of disorders of hemostats

vi. Etiopathogenesis, clinical and laboratory features, treatment and prognosis of Hereditary and acquired qualitative disorders of platelets, effect of drugs on platelet function.

vii. Hematological and systemic disorders associated with abnormal platelet function

viii. Thrombocytopenia, their causes, clinical and laboratory features, diagnosis

ix. Thrombocytosis, causes, clinical and laboratory

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features, reactivethrombocytosis

- x. Hemophilia a & B, Von willebrand disease, Disseminated intravascular coagulation,
- xi. Thrombotic thrombocytopenic purpura and Heparin induced thrombocytopenia: Etiopathogenesis, clinical and laboratory features, complications, management
- xii. Anticoagulant monitoring

**13. Laboratory Hematology**

- A. Interpretation of peripheral blood counts and abnormal flags
- B. Performance of WBC differential counts; subjective assessment of platelet counts and diagnostic interpretation of abnormal counts
- C. Review of normal and abnormal blood films with emphasis on morphology of red cells, white cells and platelets
- D. Supravital staining of reticulocytes, counting of reticulocytes
- E. Limitations and uses of automated WBC differentials
- F. Interpretation of RBC indices to characterize anemias
- G. Preparation and staining of thick and thin blood films for Hemoparasites
- H. Identification of different hemoparasites in blood and marrow
- I. Measurement and significance of ESR and plasma viscosity
- J. Indication, instruments, procedure of bone marrow aspiration; trephine needle biopsy, splenic aspiration
- K. Principle, procedure and interpretation of sickling test, HbS solubility test, osmotic fragility
- L. Screening for unstable hemoglobin, supravital staining of Hb H inclusions
- M. Principles, procedure and practice of separation and identification of normal and abnormal hemoglobins by electrophoresis and chromatography, interpretation of electrophoresis and HPLC data
- N. Quantitation of HbF by alkali denaturation and cellular distribution of HbF
- O. Heinz body preparation and identification screening for G6PD deficiency and quantitative estimation of G6PD and other red cell enzymes
- P. Direct and indirect Coomb's test, warm and cold autoantibody titres
- Q. Screening for cryoglobins, principles of immunoglobulin estimation and immune electrophoresis,
- R. Principle, procedure and interpretation of routine tests : PT, PTT, thrombin time, reptilase time, bleeding time, platelet count
- S. Workup of abnormal PTT and PT results
- T. Understanding of platelet kinetics, study of platelet morphology
- U. Principles, practice and interpretation of platelet aggregometry tests

**14. Immunophenotyping**

- A. Principle and practice of flow cytometry
- B. Interpretation and clinical significance of flow cytometry data in leukemias, lymphomas and other hematological disorders

**15. Transfusion Medicine**

- A. History of Transfusion Medicine
- B. Indications for blood and component transfusion
- C. Donor registration, donor selection, blood collection from donors, adverse donor reaction, predonation counselling, bleeding of the donor, post donation care, post donation counseling
- D. Blood collection room equipment, their principles, and use, emergency medicines,



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- E. Blood components –Indications, preparation of blood components, Selection of blood bags for component preparation, preparation of red Cell concentrate, Fresh Frozen plasma, platelet concentrate, cryoprecipitate, washed red cells, frozen red cells. Component Testing, Labeling, Transportation and storage of blood components, Metabolic changes in blood components during storage
- F. Blood groups and genetics, Principles of immune system central to transfusion medicine, Immunology of red blood cells, Different major and minor blood groups and their importance
- G. Red cell allo- and autoantibody formation and function
- H. Blood grouping and Compatibility testing –Major, minor, Coomb's crossmatch, Factors influencing the results of blood grouping
- I. Coomb's test –application–DCT, ICT, Rh antibody titre
- J. Gel testing for antibody screening and identification
- K. Hazards of blood transfusion, Strategies to prevent transfusion reactions
- L. Pathophysiology, clinical signs and symptoms, and Laboratory Investigation for hemolytic transfusion reactions
- M. Investigation of ABO, Rh and other immunohaemolytic diseases of the newborn
- N. Practical aspects in the selection of blood for neonatal exchange transfusion, Hemolytic disease of the new born and exchange transfusion
- O. Management of Blood Bank Issue Counter, Criteria for acceptance of requisition form, inspection of blood component prior to issue
- P. Screening of blood units for TTI, ELISA, rapid and other tests for diagnosis of transfusion transmitted infections
- Q. Nucleic acid testing
- R. Basics of Tissue banking & Cord blood banking
- S. Disposal of wastes and biologically hazardous substance in the blood bank
- T. Medico legal aspects of blood transfusion
- U. Quality control in blood banking, Quality control of bags and different blood bank components, sterility test on component
- V. Calibration, validation and maintenance of blood bank equipment, QC of blood bank techniques, external and internal quality assessment
- W. Hemovigilance in blood banking
- X. Automation in Blood Banking

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