PATHOLOGY

I) GOAL

The broad goal of the teaching of undergraduate student in Pathology is to provide the students with a comprehensive knowledge of the mechanisms and causes of disease, in order to enable him/her to achieve complete understanding of the natural history and clinical manifestations of disease.

II) SPECIFIC LEARNING OBJECTIVES

a) **Knowledge**

At the end of the course, the student should be able to:

1. Describe the structure and ultra structure of a sick cell
2. Mechanisms of cell degeneration.
3. Cell death and repair and be able to correlate structural and functional alterations.
4. Describe the mechanisms and patterns to tissue response to injury such that she/he can appreciate the patho-physiology of disease processes and their clinical manifestations.
5. Explain the patho-physiological processes which govern the maintenance of homeostasis and mechanisms of their disturbance and the associated morphological and clinical manifestations.
6. Correlate normal and altered morphology (gross and microscopic) of different organ systems in common diseases including neoplasia to the extent needed for the understanding of disease processes and their clinical significance.
7. Develop an understanding of neoplastic change in the body in order to appreciate the need for early diagnosis and its role in the management of neoplasia.

b) **Skills**

At the end of the course, the student should be able to:

1. Describe the rationale and principles of technical procedures of the diagnostic laboratory tests
2. Interpretation of the results
3. Perform simple bed-side tests on blood, urine and other biological fluid samples
4. Draw a rational scheme of investigations aimed at diagnosing and managing patients with common disorders
5. Understand biochemical/physiological basis of tests to understand the disturbances that occur as a result of disease in collaboration with pre-clinical departments.
6. Understand the need and methodologies for proper interpersonal relationships between the diagnostic wing and patient care wing of the hospital.
7. Understand the need for quality control in such tests.

c) **Integration**

At the end of training he/she should be able to integrate the knowledge of

1. Normal tissue morphology,
2. Causes of Disease,
3. Relationship of various causative factors (social, economic and environmental),
4. Tissue changes due to such diseases,
5. Effect of such changes on the patients well being,
6. Easy, Accurate and Low Cost Methods of Diagnosis of such diseases
7. Long term implications of the disease on the patient and community.
8. Natural history of such diseases as prevalent in India, especially in the local region of the Teaching Hospital.

II. TEACHING METHODOLOGY AND TEACHING HOURS

No	Teaching Method	Detailed Time Distribution	**Minimal Number of Hours to be Dedicated**
1	Didactic Lectures		**110 Hours**
	a. General Pathology	40 Hours	
	b. Systemic Pathology	40 Hours	
	c. Hematology	15 Hours	
	d. Clinical Pathology	15 Hours	
2	Practical Demonstrations		**100 Hours**
	a. General Pathology	20 Hours	
	b. Systemic Pathology	50 Hours	
	c. Hematology	10 Hours	
	d. Clinical Pathology	20 Hours	
3	Integrated Teaching (Horizontal and vertical)		**40 Hours**
	a. Systemic Pathology	30 Hours	
	b. Hematology	10 Hours	
4	Clinical Interaction & Lab Work		**20 Hours**
	Clinical Pathology	8 Hours	
	Blood Banking	3 Hours	
	Cytology	3 Hours	
	Histopathology	3 Hours	
	Autopsy & Museum	3 Hours	
5	Short Term Student Research		**10 Hours**
6	Internal Assessment Tests		**20 Hours**
	Theory	12 Hours	
	Practicals	6 Hours	
	Communicative Skills Assessment (Viva Voce & OSPE)	2 Hours	
	TOTAL		**300 Hours**

NB: Each lecture class will be of one hour duration only
Each practical class will be for 2 hours duration only
Clinical interaction to include case studies, clinicopathological correlation, and performance and interpretation of relevant laboratory tests

III.THEORY SYLLABUS

A. Introduction to Pathology

Must Know

a. Role of a pathologist in a hospital and importance in diagnosis.
b. Ethics and the pathologist
c. Safe laboratory practices including universal precautions and disposal of biomedical waste

Desirable to Know

a. History of pathology with special mention of pioneers
b. Evolution of pathology with special mention of the role of autopsy in development of modern pathology and its present day importance.
c. The cell in health and disease
Cellular housekeeping and cell signalling,
d. Signal transduction pathways
e. Cytoskeleton and cell-cell Interactions

B. Cell injury and Adaptations:

Must Know

a. Causes and mechanisms of cell injury and the macroscopic and microscopic features of reversible and irreversible cell injury
b. Definition and types of necrosis and characteristics of each type of necrosis with examples
c. Apoptosis : definition, examples, , morphological changes and its difference from necrosis
d. Definition of gangrene ,different types of gangrene with morphology and examples
e. Adaptations – Definitions of hyperplasia, hypertrophy, atrophy, metaplasia, dysplasia, hypoplasia with examples. Differences between hypertrophy and hyperplasia, atrophy and hypoplasia
f. Calcification – Types and Importance

Desirable to Know

Mechanism of apoptosis

Nice to Know

a. Basics of Cellular Ageing
b. Necroptosis

C. Inflammation & Repair

Must Know

a. Acute inflammation: Definition of acute inflammation and its causes
b. Vascular phenomena of inflammation
c. Cellular phenomenon chemotaxis, phagocytosis and formation of exudates
d. Chemical mediators of inflammation with special reference to histamine, complement, arachidonic acid metabolites, coagulation cascade
e. Clinical features , morphological types and outcome of acute inflammation with examples

f. Chronic inflammation: Definition, examples, morphology and cells of chronic inflammation with emphasis on epithelioid cells & giant cells

g. Granuloma: definition pathogenesis & description of a granuloma with special emphasis on tuberculous granuloma Other types of granulomas: Syphilis, Sarcoidosis and Leprosy and foreign body
h. Giant cells different types, morphology & examples
i. Tissue repair, regeneration and fibrosis
j. Cell cycle and different types of cells
k. Normal cell growth and Regeneration
l. Repair : role of collagen, formation and morphology of granulation tissue, angiogenesis and fibrosis
m. Wound healing first and second intention
n. Factors affecting wound healing
o. Complications of wound healing
p. Healing in bone and specialized tissue

Desirable to Know

a. Cytokines, interleukins, mononuclear phagocytic system
b. Mechanisms of microbial killing

Nice to Know

a. Steps in angiogenesis
b. Role of growth factors and extracellular matrix

D. Hemodynamic disorders, thromboembolism and shock

Must Know

a. Hyperemia and congestion: definition and morphology
b. Normal hemostasis: mechanism and pathways
c. Thrombosis : definition, pathogenesis, causes, morphology and fate
d. Differences between thrombophlebitis and phlebothrombosis
e. Differences between antemortem thrombus and postmortem clot
f. Embolism & Infarction: definition, types and pathogenesis with examples
g. Oedema : definition, types, pathogenesis with examples
h. Differences between transudate and exudate
i. Shock: definition, types, pathogenesis, clinical manifestations and examples

Desirable to Know

a. Role of endothelium in coagulation and hypercoagulable state

Nice to Know:

a. Antiphospholipid syndrome
b. Anticoagulant proteins

E. Neoplasia

Must Know

a. Definition of neoplasia (Willis' definition), classification and nomenclature
b. Characteristics of benign and malignant neoplasms
c. Differences between benign and malignant neoplasms and carcinoma and sarcoma
d. Spread of a malignant tumor, routes of spread with examples, mechanisms of spread
e. Metastasis : Definition, mechanisms and significance
f. Carcinogenesis: Physical, chemical & biological carcinogens and their mechanisms of action
g. Molecular basis of carcinogenesis and role of TP53 and RB1 genes
h. Clinical features and staging and grading of neoplasia
i. Laboratory diagnosis of neoplasia

Desirable to Know

a. Epidemiology of cancer
b. Pre-cancerous lesions
c. Hallmarks (physiological properties) of cancer cells
d. Systemic changes due to neoplasia and paraneoplastic syndromes
e. Multistep carcinogenesis and progression of cancer
f. Occupational cancers

Nice to know

a. Knudson's two-hit hypothesis
b. Genetic changes in cancer
c. Tumour markers
d. Host defences against cancer
e. Tumour-like lesions – hamartoma and choristoma

F. Genetic disorders –

Must know

a. Basic facts about the human genome; structure of DNA and chromosomes
b. Mutations : definition, types
c. Classification of genetic disorders
d. Single gene (Mendelian) disorders
e. Patterns of inheritance of autosomal dominant, autosomal recessive and X- linked recessive disorders.
f. At least **one** example each of autosomal dominant, autosomal recessive and X-linked recessive disorders.
g. Cytogenetic disorders
h. General features
    i) Parts of a chromosome and types of chromosomes
    ii) Numerical disorders of autosomes– Down syndrome
    iii) Numerical disorders of sex chromosomes _ Turner and Klinefelter syndromes
    iv) Structural abnormalities of chromosomes
    v) At least **one** example of a microdeletion syndrome
    vi) Indications for genetic analysis
    vii) Multifactorial disorders – at least two examples of these disorders.

Nice to know

a. Human genome project
b. Fragile X syndrome
c. Genomic imprinting disorders
d. Storage disorders: Classification ; lysosomal & glycogen storage disorders
e. Laboratory diagnosis of genetic disorders : karyotyping, fluorescence in situ hybridisation, DNA microarrays, polymerase chain reaction, RFLPs, VNTR analysis, linkage analysis, genome-wide association studies, Southern blotting, DNA sequencing.

G. Immune diseases

Must know

a. Types of immunity
b. Immune mediated injury – causes and types of hypersensitivity reactions,
c. Autoimmune disorders: mechanism and pathology of systemic lupus erythematosus.
d. HIV infection and AIDS :pathogenesis, clinical manifestations, diagnosis, and pathology including opportunistic infections , diagnostic procedures and handling of infected materials and health education.

Desirable to know

a. Cells and tissues of the immune system
b. Normal immune responses
c. Immunologic tolerance
d. Mechanisms of autoimmunity
e. Amyloidosis
f. Graft rejection

Nice to know

a. Primary immunodeficiency disorders
b. Other autoimmune disorders
c. Graft versus host disease

H. Environmental and nutritional diseases

Must Know

a. Effects of tobacco and alcohol,
b. Injury produced by ionizing radiation: morphology and effects of radiation on organs

Desirable to know

a. Vitamin deficiency syndromes including rickets and osteomalacia
b. Protein energy malnutrition
c. Other nutritional diseases
d. Obesity
e. Thermal injury
f. Electrical injury
g. Occupational (industrial and agricultural) exposure

Nice to know

a. Lead poisoning
b. Mercury poisoning
c. Diet and cancer
d. Injury due to therapeutic drugs
e. Effects of (non therapeutic) drug abuse

I. Infectious diseases:

Must know

a. Mycobacterial diseases: tuberculosis and leprosy
b. Bacterial diseases: pyogenic infections , typhoid, diptheria, bacillary dysentery, syphilis
c. Fungal and opportunistic infections
d. Parasitic diseases: malaria, filaria, amoebiasis, cysticercosis, hydatid , kala azar.

Desirable to know

a. General host factors
b. Polio, herpes, rabies, measles, rickettsial, chlamydial infections

Nice to know

a. General principles of microbial pathogenesis
b. Transmission and dissemination of disease
c. Mechanisms of microbial injury
d. Agents of bioterrorism
e. Immune evasion by microbes

J. Hematology:

Must Know

a. Haematopoiesis and microscopy of normal marrow
b. Definition and classification of anemia
c. Iron deficiency anemia : causes, pathogenesis, clinical manifestations and lab diagnosis
d. Megaloblastic anemia : causes, pathogenesis, clinical manifestations and lab diagnosis
e. Aplastic anemia : causes, pathogenesis, clinical manifestations and lab diagnosis
f. Classification of Haemolytic anemia : Clinical features, pathogenesis, pathology and laboratory diagnosis of Hereditary spherocytosis, sickle cell anemia and thalassemia,
g. Non neoplastic white cell disorders : Leukopenia, agranulocytosis, leukocytosis, leukemoid reaction and infectious mononucleosis,
h. Classification of leukemia (FAB & WHO)
i. Acute myeloid and acute lymphoblastic leukemia
j. Chronic myeloid leukemia and chronic lymphocytic leukemia,
k. Myeloma
l. Physiology of haemostasis and thrombosis
m. Disorders of haemostasis and thrombosis :
   i) Haemophilia A and B,
   ii) von Willebrand disease,
   iii) Disseminated intravascular coagulation
   iv) Idiopathic thrombocytopenic purpura

Blood groups and Blood Transfusion

a. Blood groups and their clinical significance
b. Determination of blood groups
c. Significance of reverse grouping and cross-matching
d. Blood donation, collection, preservation, tests performed
e. Indications for blood transfusion
f. Transfusion reactions and transfusion associated infections
g. Rational use of blood including component therapy

Desirable to know

a. Anemia of chronic disease
b. G6PD deficiency
c. Myelodysplastic syndromes
d. Immunophenotype and karyotype findings in acute and chronic leukemias
e. Laboratory tests of haemostasis and thrombosis

Nice to Know

a. Paroxysmal nocturnal haemoglobinuria
b. Immune haemolytic anaemia
c. Pure red cell aplasia
d. Haemolytic uremic syndrome and thrombotic thrombocytopenic purpura
e. Myeloproliferative neoplasms
f. Prognostic features of leukemias
g. Other plasma cell dyscrasias
h. Heparin-induced thrombocytopenia
i. Coombs test

K. Cardiovascular Pathology

Must know

a. Atherosclerosis: Definition, risk factors, etiopathogenesis, gross and microscopic description, complications and clinical correlations.
b. Aneurysms
c. Hypertension: Relate the mechanisms of the disease to the clinical course and sequelae.
d. Cardiac failure
e. Ischaemic heart disease and myocardial infarction: Incidence, risk factors, pathogenesis, morphological changes, clinical course, complications and investigations.
f. Infective endocarditis: Pathogenesis, morphology, differential diagnosis of cardiac vegetations
g. Cardiomyopathies – Recognize the disorders as part of differential diagnosis in primary myocardial disease.
h. Pericardial Diseases: Pericarditis - Aetiology and basic morphology of different forms

Desirable to know

a. Thrombophlebitis
b. Aortic dissections
c. Superior vena cava syndrome
d. Congenital heart disease: Correlate the anatomical malformations of disorders to the clinical consequences of the disease.

e. Rheumatic heart disease: Incidence, etiopathogenesis, morbid anatomy, histopathology, lesions in other organs, clinical course and sequelae.
f. Tumours of heart: Classification & Morphology

Nice to know

a. Vasculitides : infectious and non infectious
b. Metabolism of cholesterol, HDL, LDL
c. Pathology of vascular interventions – stenting and vascular replacement
d. Myocarditis

L. Respiratory Pathology

Must know

a. Pulmonary tuberculosis
b. Pneumonias: Aetiology, classification, gross, histopathology of different forms and complications.
c. Lung Abscess and Bronchiectasis: Etiopathogenesis, morphological appearances and complications.
d. Chronic obstructive lung diseases: Chronic bronchitis and emphysema - pathogenesis, definition of chronic bronchitis, morbid anatomy and cardiac sequelae, types of emphysema,
e. Occupational lung diseases: Types, etiopathogenesis, gross anatomical differences between different forms and sequelae; names of different types of pneumoconiosis; pathology of coal worker's pneumoconiosis, asbestosis and silicosis
f. Pulmonary vascular disorders: pulmonary embolism, infarction, and edema
g. Tumours of lung: Classification, aetiology, gross appearances, histology of important forms, natural history, pattern of spread
h. Non -neoplastic lesions of pleura

Desirable to know

a. Pulmonary hyperpertension : Classification, Etiopathogenesis, morphological appearances and complications
b. Chronic interstitial (restrictive, infiltrative) lung diseases: Classification, etiopathogenesis, morphological appearances and complications; differences between obstructive and restrictive lung diseases.
c. Pneumonia in the immunocompromised host
d. Acute respiratory distress syndrome
e. Atelectasis
f. Pathology of carcinoid tumour
g. Para-neoplastic syndromes and secondary pathology.
h. Tumours of upper respiratory tract: Nasopharyngeal carcinoma,carcinoma larynx

Nice to know

a. Basic pathology of atypical pneumonia
b. Fungal pneumonias
c. Mesothelioma

M. Gastro Intestinal Pathology:

Must know

a. Oral cancer : etiopathogenesis, gross and histopathological descriptions.
b. Barrett esophagus
c. Carcinoma oesophagus: etiopathogenesis, morphological features
d. Esophageal varices
e. Gastritis and peptic ulcer : Definition of peptic ulcer, etiological factors, gross and microscopic appearances and sequelae ;etiology and types of gastritis; helicobacter pylori and chronic gastritis ; differences between benign and malignant gastric ulcers
f. Gastric tumours: Classification, morbid anatomy and histopathology
g. Ulcers of intestines: Etiology, morphological appearances of typhoid, tuberculous and amoebic ulcers and bacillary dysentery ; differential diagnosis of different forms of ulcers; differences between primary and secondary intestinal tuberculosis.
h. Causes of intestinal obstruction
i. Idiopathic inflammatory bowel disease: Enumerate similarities and differences between Crohn's disease and ulcerative colitis.
k. Appendicitis
l. Intestinal polyps
m. Carcinoma colon.
n. Hepatic failure
o. Jaundice and cholestasis
p. Viral hepatitis: Etiology, clinical source and enzymology, salient histological features and sequelae.
q. Alcoholic liver disease: Pathogenesis, morphological manifestations and correlation with clinical features
r. Liver abscess
s. Cirrhosis: Classification, etiopathogenesis, morphology and differential diagnosis and complications
t. Tumours of liver: Etiopathogenesis and pathology of hepatocellular carcinoma and metastatic carcinoma
u. Cholecystitis: Clinical features and morphology
v. Gall stones : classification , etiopathogenesis, pathology and complications

Desirable to know

a. Classification of salivary gland tumours; pathology of pleomorphic adenoma.
b. GI Lymphomas : Classification, etiological factors, gross and microscopic appearances
c. GI stromal tumours
d. Carcinoid tumours of GIT.
e. Wilson disease
f. Acute and chronic pancreatitis : etiopathogenesis and pathology; complications

Nice to know

a. Malabsorption syndromes
b. Hirschprung disease
c. G.I. infections in immunocompromised individuals
d. Neuroendocrine tumours
e. Meckel's diverticulum
f. Primary biliary cirrhosis
g. Metabolic disorders such as haemochromatosis, alpha-1 antitrypsin deficiency
h. Non-alcoholic steatohepatitis.
i. Benign tumours of liver: Haemangioma, Hepatocellular adenoma

j. Tumours of gall bladder : Cholangiocarcinoma , Gross types
k. Tumours of pancreas: Adenocarcinoma and endocrine tumours.

N. Diseases of Kidney:

Must know

a. Nephrotic syndrome and nephritic syndrome : Integrate clinical and pathological features of this disorder.
b. Glomerulonephritis: Acute streptococcal glomerulonephritis, crescentic glomerulonephritis, chronic glomerulonephritis
c. Diabetic glomerulosclerosis
d. Renal failure: Definitions, criteria, aetiology, systemic manifestations and investigations; etiopathogenesis & morphology of acute tubular necrosis, acute and chronic renal failure,
e. Urinary tract infection : Acute pyelonephritis, chronic pyelonephritis, tuberculous pyelonephritis - etiology, pathogenesis, morphological features and clinical correlations
f. Chronic kidney disease and end-stage kidneys
g. Urinary tract obstruction : Calculi - etiopathogenesis & morphology; hydronephrosis - – etiopathogenesis & morphology
h. Renal tumours: Renal cell carcinoma, Wilms tumour : Morphology and clinical course

Desirable to know

a. Pathogenesis of glomerular disease
b. Malignant hypertension
c. Adult and infantile polycystic kidney disease
d. Urinary bladder tumours

Nice to know

a. Interstitial Nephritis
b. Lupus nephritis
c. Renal amyloidosis
d. Acute papillary necrosis: etiopathogenesis & morphology
e. Renal changes associated with hypercalcemia & hyperparathyroidism.
f. Other glomerulopathies: IgA nephropathy

O. Pathology of Male Genital Tract:

Must know

a. Penis – carcinoma and premalignant lesions
b. Testis – classification of tumours, clinical course and pathology of seminoma
c. Prostate – Benign prostatic hyperplasia
d. Hydrocoele

Desirable to know

a. Torsion of testis
b. Cryptorchidism
c. Orchitis and epididymitis
d. Genital tuberculosis
e.Adenocarcinoma prostate

Nice to know

a. Pathology of other testicular tumours

P. Pathology of Female Genital Tract:

Must know

Cervix

a. Chronic cervicitis with squamous metaplasia
b. Cervical intraepithelial neoplasia (dysplasia) and role of cytological screening.
c. Carcinoma cervix

Uterus

a. Endometrial Hyperplasia and polyps
b. Endometrial Carcinoma
c. Endometriosis
d. Adenomyosis,
e. Leiomyomas

Ovary

a. Classification of tumours
b. Mucinous and Serous tumours, Dysgerminoma, Teratoma, Krukenberg tumour

Diseases of pregnancy

a. Ectopic pregnancy
b. Hydatidiform mole
c. Choriocarcinoma

Desirable to know

a. Congenital abnormalities of uterus
b. Prolapse
c. Endometritis

Nice to know

a. Paget disease of vulva
b. Sarcoma botryoides of vagina
c. Haematocolpos / haematometra
d. Salpingitis and pelvic inflammatory disease
e. Genital infections – herpes, genital tuberculosis,
f. Dysgenetic gonads and their significance.
g. Liquid-based cytology.
h. Other ovarian tumours – Granuloasa cell tumour, Grem cell tumours, other surface epithelial tumours.

Q. Pathology of Breast:

Must know

a. Fibrocystic disease
b. Classification of breast tumours
c. Fibroadenoma,

d. Carcinoma breast: Pathology of in situ and invasive carcinoma, not otherwise specified (NOS, NST) – aetiopathogenesis and prognostic factors

Desirable to know

a. Duct papilloma and phyllodes tumour
b. Other types of carcinoma – mucinous (colloid), medullary, papillary carcinoma
c. Carcinoma male breast,

Nice to know

a. Gynaecomastia
b. Molecular subtypes in breast carcinoma – only the names
c. HER-2-neu in breast carcinoma

R. Pathology of Lymphoreticular System:

Lymph nodes

Must know

a. Tuberculous lymphadenitis, filarial lymphadenitis and non specific lymphadenitis
b. Metastatic tumours
c. Non Hodgkin lymphomas : Classification; pathology of diffuse large cell lymphoma, Burkitt lymphoma
d. Hodgkin lymphoma : Classification and morphology of all subtypes.
e. Differences between Hodgkin and non Hodgkin lymphomas.
f. Ann Arbor staging of lymphomas.

Desirable to know

a. Basic concepts of immunohistochemistry of lymphoid cells – one or two markers for each type of cell.
b. Names of at least two high-grade and low-grade non Hodgkin lymphoma
c. Follicular lymphoma and mantle cell lymphoma

Nice to know

a. Current WHO Classification of lymphoid neoplasms
b. Extranodal lymphomas
c. Adult T cell leukemia/lymphoma
d. Mycosis fungoides

Spleen

Must know

a. Causes of splenomegaly
b. Pathology of chronic venous congestion,
c. Splenic infarction

Desirable to know

a. Pathology of spleen in malaria and kala azar,

Nice to know

a. Common neoplasms – lymphomas , haemangiomas, chronic myeloid leukemia
b. Rupture spleen

Thymus

Nice to know

a. Thymomas and Myasthenia gravis.
b. Invasive and non-invasive thymoma
c. Thymic hyperplasia
d. Other anterior mediastinal tumours– germ cell tumours

S. Pathology of Skin

Must know

a. Premalignant lesions
b. Tumours of skin : Basal cell carcinoma, squamous cell carcinoma, malignant melanoma.
c. Naevi – intradermal, junctional and compound naevi
d. Skin lesions in leprosy

Desirable to know

a. Molluscum contagiosum
b. Verrucae(warts)

Nice to know

a. Bullous lesions of skin– Classification and morphological features :pemphigus, pemphigoid
b. Immunofluorescence in dermatopathology
c. Chronic inflammatory dermatitis : Psoriasis, lichen planus
d. Epidermal cyst, pilar cyst, seborrheic keratosis

T. Bone & Joints and and Soft Tissue

Must Know

a. Osteomyelitis: Pyogenic osteomyelitis, pathogenesis, pathology and complications.
Tuberculous osteomyelitis and psoas abscess
b. Bone tumours: Classification; pathology of osteogenic sarcoma, chondrosarcoma, giant cell tumour, Ewing's tumour, myeloma and metastatic tumours
c. Soft tissue tumours: Classification; pathology of lipoma, fibroma, haemangioma, neurofibroma, schwannoma, leiomyoma,

Desirable to know

a. Arthritis - osteoarthritis and rheumatoid arthritis, septic arthritis, gout;
b. Chronic synovitis,
c. Other infections : Mycetoma, syphilis

Nice to know

a. Metabolic bone disorders: Brown tumour of hyperparathyroidism, rickets, osteomalacia
b. Avascular necrosis,
c. Aneurysmal bone cyst, fibrous dysplasia, Paget disease.
d. Soft tissue sarcomas: classification and histopathology

U. Central Nervous System, Peripheral Nervous System & Muscle:

Must Know

a. Pyogenic meningitis and brain abscess
b. Tuberculous meningitis and tuberculoma
c. Cysticercosis

d. Role of CSF examination in meningitis
e. Cerebral infarction: Gross and microscopic features
f. Tumours of the CNS: Pathology of meningioma, schwannoma, astrocytoma, glioblastoma, Medulloblastoma; metastatic tumours
g. Subarachoid hemorrhage, Epidural haemorrhage, Intracranial aneurysm

Desirable to know

a. Cerebral edema, herniation and hydrocephalus
b. Hypertensive encephalopathy
c. Venous sinus and cortical vein thrombosis
d. Watershed infarcts
e. Cerebral malaria – aetiological agent, basic pathology
f. Hydatid cyst
g. Alzheimer disease

Nice to know

a. Morphological features and differential diagnosis of encephalitis.
b. Amoebic meningoencephalitis – aetiological agent, basic pathology
c. Viral meningitis
d. HIV infection in the CNS
e. Molecular basis of gliomas and its impact on diagnosis and prognosis
f. Syndromes associated with brain tumors
g. Cerebral lymphomas
h. Neurodegenerative disorders
i. Diseases of myelin
j. Congenital malformations
k. Prion disease
l. Myopathies: Differential diagnosis of common muscle disorders.

V. Endocrinology

Must know

a. Diabetes mellitus: Classification, pathogenesis of system involvement, sequelae and complications.
b. Hypothyroidism and Hyperthyroidism
c. Thyroiditis, Colloid goiter, Multinodular goiter
d. Differential diagnosis of thyroid nodules and diffuse thyroid enlargement
e. Classification of tumours of thyroid; pathology of papillary carcinoma thyroid

Desirable to know

a. Graves disease
b. Other thyroid tumours
c. Parathyroid, adrenal and pituitary hypofunction and hyperfunction .
d. Tumours of parathyroid, adrenal ,including pheochromoctyoma, and pituitary

Nice to know

a. Adrenalitis – etiopathogenesis, pathology, classification and complications,
b. Multiple endocrine neoplasia syndromes- names and components

W. Perinatal and Pediatric Pathology

Must know

a. Hydrops fetalis
b. Hemolytic disease of newborn: Etiopathogenesis, pathology, and complications
c. Childhood tumours: Neuroblastoma, retinoblastoma, wilms tumour, embryonal rhabdomyosarcoma

Desirable to know

a. Perinatal infections
b. Neonatal respiratory distress syndrome and hyaline membrane disease – etiopathogenesis, pathology and complications.
c. Cystic fibrosis – etiopathogenesis, pathology, diagnosis and prognosis.

Nice to know

a. Pathology of prematurity: Necrotising enterocolitis; sudden infant death syndrome
b. Terms used to describe errors in morphogenesis

X. Developments in Pathology:

Desirable to know

a. Immunohistochemistry
b. Immunoflourescence

Nice to know

a. Flow cytometry
b. Fluorescence in situ hybridisation
c. Image analysis & digital morphometry
d. Methods of molecular diagnosis
e. DNA microarray technology and sequencing

IV. PRACTICAL SYLLABUS

The Clinical Pathology teaching is to be done as [a] bed-side and / or hospital laboratory-based demonstrations and evaluation sessions. [b] Departmental practical classes of 2 hours duration each.
The Clinical Pathology classes shall be drawn from the time allotted in the first clinical year – clinical posting schedules.

The individual institutions could modify the classes and have their own schedule. These are only guidelines and suggestions

Clinical Pathology postings to be included in clinical posting schedule - 15 days.
The students to be taught theoretical aspects, demonstration of various tests and they will be introduced to the equipments and instruments in the clinical pathology laboratory

The tests which they have to perform during the examination could be included in the regular 2 hour practical classes in the afternoon, to give enough time for practice, so that the students become proficient in performing these tests.

On completion of Clinical Pathology Postings, the students need to know both theoretical aspects and practical aspects. They should have enough exposure to the various tests performed in the clinical pathology laboratory.

The procedures to be demonstrated and practiced are:

A) Clinical Pathology – Blood

1 Anticoagulants and their use – Practice
2 Drawing of blood, preparation of smears and staining of smears – Practice
3 Using the microscope – Practice
4 Differential Leucocyte Count of blood smears – Practice
5 Reporting of peripheral smear – Practice
6 Hemoglobin estimation by acid hematin method – Practice
7 Blood grouping – ABO & Rh – Practice
8 ESR by Westergren pipette – demonstration
9 Total count of WBC, RBC and Platelets by Neubauer chamber – demonstration
10 Hemoglobin estimation by Drabkin's method – demonstration
11 PCV by Wintrobe's tube – Demonstration
12 Bleeding time, clotting time, prothrombin time, APTT – Demonstration
13 Osmotic fragility test, coombs tests and sickle test – Demonstration
14 Use of automated cell counters and coagulation analysers – Demonstration
15 Reporting peripheral blood and bone marrow – typical stained slides to be provided (List appended Table2A)

B) Clinical Pathology – Urine and Body Fluids

1 Urine – assessment of the physical characters, to measure specific gravity and pH– Practice
2 Urine – chemical tests for Protein, Reducing substances, blood, bile salts, bile pigments and Ketone bodies– Practice
3 Use of different stix and their interpretation – Demonstration
4 Microscopic examination of urine – Demonstration
5 Automated Urine Analysis – Demonstration
6 CSF – Demonstration of cell types in a normal CSF sample and a case of meningitis
7 Ascitic and Pleural Fluids – Demonstration of cell types
8 Semen Analysis – Demonstration

C) Histopathology and Cytopathology

1 Preservation and Transport of Specimens – Demonstration
2 Laboratory Techniques in Histopathology – Demonstration
3 Laboratory Techniques in Cytopathology : FNAC, Pap Smears, Fluid Cytology– Demonstration
4 H & E staining and other special staining – Demonstration
5 Demonstration of Histopathology slides along with tutorial classes in general and systemic pathology – typical stained slides to be provided (see list in Appended Table 1)
6 Demonstration of Cytology slides along with tutorial classes in general and systemic pathology – typical stained slides to be provided (see list in Appended Table 2A)
7 Demonstration of Gross Specimens along with tutorial classes in general and systemic pathology – typical specimens to be provided (see list in Appended Table 2B)

D)) Histopathology and Cytopathology Exercise

1. Each students is instructed to accompany five surgical samples from operation theatre in which he is posted in the concerned hospital.with the concurrence of the surgical and allied specialities department

2. He is to ensure the tissue sample(biopsy/resected) is transported in adequate formalin along with complete details of the patient :- Name , age , unit,I.P. Number, nature of tissue,) in the sample and request form with the signature of the concerned unit assistant.

3. Specimen should be submitted to the pathology reception, there the **Pathology Number** to be noted, sample followed up in the Histopathology processing lab ,till the concerned slides are ready.

4. the slides shall be viewed along with the concerned professor and to make entries in his/her record

5. This exercise is to ensure that students are educated and oriented regarding collection, transporting, processing and diagnosis of a human tissue.

6. The students has to observe 5 FNAC procedure and familiarize himself/herself with the processing, staining, interpretation of the slide and make entries in his/her record.

Students shall be evaluated according to this exercise

LISTS OF SLIDES AND SPECIMENS FOR HISTOPATHOLOGY, CYTOLOGY, HEMATOLOGY AND GROSS SPECIMENS HAVE BEEN APPENDED HEREWITH.

These lists are only a guideline of the minimal requirements.

NO.	DIAGNOSIS	NO.	DIAGNOSIS
1.	FATTY CHANGE LIVER	26.	INTESTINAL TUBERCULOSIS
2.	ACUTE APPENDICITIS	27.	STOMACH – CHRONIC PEPTIC ULCER
3.	GRANULATION TISSUE	28.	LIVER – HEPATOCELLULAR CARCINOMA
4.	LUNG – CVC	29.	LIVER CIRRHOSIS
5.	LIVER – CVC	30	KIDNEY – CHRONIC PYELONEPHRITIS
6.	SPLEEN – CVC	31	KIDNEY – RENAL CELL CARCINOMSA
7.	ARTERY – RECENT / ORGANISED THROMBUS	32	KIDNEY – WILMS TUMOUR
8.	KIDNEY / SPLEEN INFARCT	33	BENIGN PROSTATIC HYPERPLASIA
9.	MADURA MYCOSIS - SKIN	34	TESTIS – SEMINOMA
10.	TUBERCULOUS LYMPHADENITIS	35	UTERUS – LEIOMYOMA
11	LEPROMATOUS LEPROSY – SKIN	36	UTERUS – ADENOMYOSIS
12	TUBERCULOID LEPROSY – SKIN	37	PRODUCTS OF CONCEPTION
13.	ACTINOMYCOSIS ABSCESS	38	BREAST – FIBROADENOMA
14	LOBAR PNEUMONIA	39	BREAST – CARCINOMA
15	SKIN – PAPILLOMA	40	HODGKIN / NON HODGKIN LYMPHOMA
16	SQUAMOUS CELL CARCINOMA	41	HASHIMOTO THYROIDITIS
17	ADENOCARCINOMA COLON	42	THYROID – COLLOID GOITRE
18	LIPOMA	43	THYROID – PAPILLARY CARCINOMA
19.	SKIN – CAPILLARY HAEMANGIOMA	44	BONE – OSTEOGENIC SARCOMA
20	CAVERNOUS HAEMANGIOMA	45	BONE – CHONDROMA
21	BENIGN CYSTIC TERATOMA (DERMOID CYST)	46	BONE – OSTEOCLASTOMA
22	LYMPH NODE – METASTASIS	47	BRAIN – MENINGIOMA
23	AORTA – ATHEROSCLEROSIS	48	SOFT TISSUE – SCHWANNOMA
24	LUNG – BRONCHIECTASIS	49	SKIN – MALIGNANT MELANOMA/ NAEVUS
25.	LUNG – FIBROCASEOUS TUBERCULOSIS	50	SKIN - BASAL CELL CARCINOMA

Table 2A: HEMATOLOGY & CYTOLOGY SLIDES

NO.	DIAGNOSIS	NO.	DIAGNOSIS
1.	ACUTE MYELOID LEUKEMIA (AML) – Blood/ Bone marrow	11.	BLOOD SMEAR WITH MICROFILARIA / PLASMODIUM
2.	ACUTE LYMPHOBLASTIC LEUKEMIA (ALL) – Blood/ Bone marrow	12.	FNAC BREAST – FIBROADENOMA
3.	CHRONIC MYELOID LEUKEMIA (CML) CHRONIC PHASE – Blood/ Bone marrow	13.	FNAC BREAST – DUCTAL CARCINOMA
4.	CHRONIC LYMPHOCYTIC LEUKEMIA (CLL) – Blood	14.	FNAC LYMPH NODE – GRANULOMATOUS LYMPHADENITIS
5.	PLASMA CELL MYELOMA – Bone marrow	15.	FNAC LYMPH NODE –METASTATIC DEPOSIT
6.	NEUTROPHILIA – Blood	16.	FNAC THYROID – COLLOID GOITRE
7.	EOSINOPHILIA – Blood	17.	FNAC THYROID – PAPILLARY CARCINOMA
8.	LYMPHOCYTOSIS – Blood	18.	PAP SMEAR WITH HSIL/ SQUAMOUS CELL CARCINOMA
9.	IRON DEFICIENCY ANAEMIA – Blood	19.	ASCITIC FLUID – POSITIVE FOR MALIGNANCY (ADENOCARCINOMA)
10.	MACROCYTIC ANAEMIA – Blood		

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DIAGNOSIS	DIAGNOSIS	DIAGNOSIS
GP: INFARCT KIDNEY	PLEOMORPHIC ADENOMA SALIVARY GLAND	GUT: RENAL CELL CARCINOMA
GP: FATTY CHANGE LIVER	CARCIN OMA LARYNX	THYROID – ADENOMA
GP: DRY GANGRENE FOOT	GIT: AMOEBIC COLITIS	HASHIMOTO'S THYROIDITIS
GP: WET GANGRENE	GIT: POLYPS	MULTINODULAR GOITRE
GP: INFARCT INTESTINE	GIT: ADENOCARCINOMA – COLON	PAPILLARY CARCINOMA
GP: CASEOUS NECROSIS	GIT: ILEUM TYPHOID ULCER	MEDULLARY CARCINOMA
GP: CVC LUNG/SPLEEN	GIT: AMOEBIC LIVER ABSCESS	BONE: OSTEOGENIC SARCOMA
GP: ACUTE APPENDICITIS	GIT: LIVER – CIRRHOSIS	BONE: EWING SARCOMA
GP: ABSCESS KIDNEY / LIVER /LUNG	GIT: HEPATOCELLULAR CARCINOMA	BONE: CHRONIC OSTEOMYELITIS
GP: MYCETOMA FOOT	GIT: LIVER METASTASIS	BONE: OSTEOCLASTOMA
GP: LIVER – CVC	GIT: OESOPHAGUS CARCINOMA	CNS: MENINGIOMA / GLIOMA
CVS: AORTA – ATHEROMA	GIT: CHRONIC GASTRIC ULCER	CNS: HAEMORRHAGE / CVA
CVS: THROMBUS ARTERY / VEIN	GIT: STOMACH – CARCINOMA	L/RET: TB LYMPHADENITIS
CVS: VENTRICULAR HYPERTROPHY	GIT: INTESTINE ULCER - TB*	L/RET: LYMPHOMA
CVS: HEART HEALED INFARCT	GIT: STRICTURE INTESTINE	SKIN – MALIGNANT MELANOMA
CVS: RHEUMATIC CARDITIS*	GUT: WILMS TUMOUR	SST: PAPILLOMA SKIN
CVS: MITRAL STENOSIS *	GUT: CARCINOMA URINARY BLADDER	SST: SQUAMOUS CELL CA
CVS: AORTIC STENOSIS *	GUT: SCC PENIS	SST: LIPOMA
CVS: BACTERIAL ENDOCARDITIS *	GUT: SEMINOMA TESTIS	BREAST FIBROADENOMA
CVS: PERICARDITIS *	GUT: TERATOMA TESTIS	BREAST – DUCTAL CARCINOMA
RS: LUNG MILIARY TB	GUT: UTERUS LEIOMYOMA	BREAST – PHYLLODES TUMOUR
RS: FIBROCASEOUS TB	GUT: ADENOMYOSIS	
RS: LOBAR / BRONCHOPNEUMONIA	GUT: ENDOMETRIAL POLYP	*OPTIONAL,IF AVAILABLE
RS: BRONCHOGENIC CARCINOMA	GUT: CERVICAL POLYP	
RS: LUNG – ABSCESS	GUT: CARCINOMA CERVIX	
RS: FIBROCASEOUS TB	GUT: CYSTADENOCARCINOMA OVARY	
RS: LUNG CVC	GUT: SHRUNKEN GRANULAR KIDNEY	
RS: METASTASIS LUNG	GUT: KIDNEY STONES	

V. REFERENCES

Text Books:

a) Robbins Pathological Basis of Disease – Kumar, Abbas & Fausto VIII Ed
b) Oxford text book of Pathology Vol. I, II & III
c) Pathology by Rubin and Farber
d) Pathology Illustrated by Reid, Roberts and Macduff

VI. THEORY AND PRACTICAL EXAMINATION

Theory – Pathology - Total 40 Marks
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Theory EXAMINATION

Exam. Category	No. of Questions	Marks
1. Essay	1 x 10 marks	10
2. Brief answers	6 x 4 marks	24
3. Very Short answers	6 x 1 marks	6
	Total	40

The above pattern is to be implemented from 2018 February Exam session onwards

Practicals – Pathology - Total 40 Marks

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Peripheral Smear		- 5 marks
Urine Examination		- 5 marks
Spotters : Hematology		-2 marks (2 slides)
	Cytology	- 2 marks (2 slides)
	Histopathology	- 6 marks (6 slides)
OSPE :	Chart (one)	- 1 marks
	Gross (2 specimen)	- 2 marks
	Blood Grouping/Hemoglobin	- 2 marks
	Total:	25 Marks
VIVA VOCE (Includes instruments)		15 Marks

OSPE chart could be prepared based on guidelines given below for problem based learning.

Guidelines to prepare Modules for Problem Based Learning

a. A brief history with clinical findings, reports of investigations done and imaging if required for that
particular case .

b. Questions on the diagnosis / differential diagnosis

c. Etiopathogenesis of the relevant lesion and / or classifications.

d. Macroscopic / morphological changes in the relevant organ systems.

e. Microscopic features: FNAC / peripheral blood smear / bone marrow / histopathology / immunohistochemistry.

f. Other laboratory investigations including molecular testing as relevant: principles and methodology of performing the tests. Differential diagnosis of the interpretations.

g. Mention the complications.

h. Prognostic factors as relevant (eg., for malignant neoplasms)

i. Significance of diagnosis and its therapeutic relevance.

Some examples are given below:

PBL – CYTOLOGY

a. A 25-year-old female presented with a thick curdy white discharge per vaginum and itching. Speculum examination showed thick discharge and congested vagina.

b. What test needs to be done to evaluate this patient.
PAP smear kit
c. What are the kits/instruments used to do the test.
– Pap smear kit
- Endocervical brush
-Ayres spatula

- Slides
- Fixatives

d. How are the smears transported
- In a Coplin jar with alcohol fixatives / spray fixatives.

f. What are the latest methods in evaluating these smears.
- Liquid-based cytology
- Thin prep

g. Place pictures of the smear from the patient with description and diagnosis: Smear shows a mixture of superficial squamous cell, intermediate cells, endocervical cells in an inflammatory background of polymorphs. Psuedohyphal forms and hyphal forms of candida are seen.

h. What are the stains used to demonstrate the organisms
– Pap stains H & E
- MGG
- Pap

i. Name a special stain which can be used to confirm the diagnosis
- PAS

j. Name two predisposing factors
- Diabetus mellitus
- Pregnancy
- OCP

k. What are the other infections that can be indentified in a cervical smear
- Trichomonas vaginalis
- Gardnerella vaginalis
- TB

l. What are clue cells
- They are seen in bacterial vaginosis and are vaginal squamous epithelial cells covered by gram negative bacilli such as Gardnerella

m. What are tadpole cells and where do you see them
- Squamous cell carcinoma cervix

n. What is the Bethesda system and its classification.
It is used to report Pap smears from the cervix or vagina. It ensures that everyone who reports these smears uses the same terminology. For example, it uses the following terms to classify abnormal squamous cells : low-grade or high-grade squamous intra-epithelial lesions (LSIL or HSIL) ; atypical squamous cells of undetermined significance (ASC-US) ; carcinoma. Terminology has also been described for other cells in the smear.

PBL NEOPLASM

A 20- year-old female presented with a solitary nodule in the left lobe of the thyroid. Imaging indentified a 1 cm cold nodule with specks of calcification. Patient later underwent total thyroidectomy with neck node dissection.

1. What is the probable diagnosis/differential diagnosis?
Hyperplastic nodule in a goitre, adenoma, papillary carcinoma

2. What are tests used to confirm the diagnosis?
FNAC, Histopathology.

3. What are the indications for FNAC thyroid?
Solitary nodule / multinodular goiter / Hashimoto thyroiditis / neoplasms

4. What is the size of the bore of the needle used for FNA of the thyroid?
23 G

5. How do you position the patient?
Patient lies down on his /her back with neck hyperextended by using a pillow beneath the neck

6. How do you fix the smears?
If H & E – alcohol
If MGG – no fixation ; air dried

7. How are the smears transported?
In Coplin jars with fixative for H & E.

8. What do you use to write the hospital / laboratory number on the slide with smear?
Diamond pencil

9. What does the FNA of a nodule with papillary carcinoma show?
- Papillary clusters with anatomical borders
- Ground-glass nuclei intranuclear inclusions.
- Psammoma bodies
- Chewing gum colloid.

10. Name 2 other conditions which show intranuclear inclusions.
- Hyalinizing trabecular adenoma
- Medullary carcinoma.

11. Where else do you see psammoma bodies?
Meningioma
Papillary serous cystadenocarcinoma of the ovary

12. What is a psammoma body?
Rounded, concentrically lamellated masses due to dystrophic calcification. Provides evidence of
papillary carcinoma thyroid.

13. What does the histopathology of the lesion disclose?
Papillary structures lined by cuboidal epithelium with crowded, overlapping nuclei showing nuclear grooves and intra nuclear inclusions. The papillae enclose fibrovascular cores.

14. Why is neck dissection done?

Papillary carcinoma spreads via lymphatics to the cervical nodes

15. What are the different modes of metastasis in other neoplasms Lymphatic / Blood/ Transcoelomic

16. Mention the molecular changes associated with this tumour RET /PTC rearrangements.

VII. INTERNAL ASSESSMENT (40 Marks)

Theory	– 20 Marks
Practical	– 15 Marks
Record	– 5 Marks
Total	- 40 Marks

The above sub-clause VII has been substituted in terms of syllabus and the same is as under:

VII. INTERNAL ASSESSMENT (30 Marks)

Theory	– 15 Marks
Practical	– 10 Marks
Record	– 5 Marks
Total	- 30 Marks

The following are guidelines. The topics to be assessed are as follows.

General Pathology and Haematology:

1. Inflammation and repair
2. Haemodynamic disorders
3. Infectious diseases
4. Neoplasia
5. Genetics, Immunologic disorders
6. Environmental and nutritional disorders, diseases of infancy and childhood
7. Diseases of blood, lymph nodes, spleen,thymus

Systemic Pathology:

1. Respiratory system, Cardiovascular system
2. Gastrointestinal system, Hepatobiliary system
3. Urinary system
4. Male and female genital system
5. Endocrine system
6. Musculoskeletal system and skin
7. Nervous system.

6 tests may be conducted for theory during first week of December, February, April, June, August, October followed by model exam – 2 in No. Paper I & II in December. For Practical 3 tests may be conducted in February, June, October followed by Model exam in December.

VIII MEDICAL ETHICS AND CRRI ORIENTATION

Medical ethics is included in the curriculum as part of both theory and practical syllabus.
Students to be taught basic medical ethics, create awareness and sensitized to the ethical issues involved.

CRRI orientation to be done with the following guidelines.

1. Should know the correct method of writing request for specific laboratory tests.
2. Should be trained in sample collection of blood, urine, body fluids, CSF – method of collection, anticoagulants and preservatives to be used, proper transportation to the laboratory.
3. Should know proper labelling and method of transportation of biopsy specimens with proper fixatives.
4. To be sensitized about inadequate and unsatisfactory samples for laboratory investigation and rejection criteria of such samples.

XI INTEGRATED TEACHING

From the integrated teaching of other basic sciences, student shall be able to describe the regulation and integration of the functions of the organs and systems in the body and interpret the anatomical basis of disease processes.

Topic for Integration

1. Tuberculosis - Horizontal Integration with Microbiology and Pharmacology
2. Leprosy - Horizontal Integration with Microbiology and Pharmacology
3. Diabetes Mellitus - Vertical integration with Anatomy, Physiology, Microbiology, Pharmacology, Medicine
4. Myocardial Infarction - Vertical Integration with Anatomy, Physiology, Pharmacology, Medicine

Note: The above are examples and suggestions. Other topics may be included by individual institutions

RECORD

Record should be followed as recommended by the University