

<b>Spiral I</b>	
<b>MODULE TITLE</b>	<b>GIT &amp; Hepatobiliary-I</b>
<b>INTRODUCTION</b>	<p>This module provides the basis for GIT &amp; Hepatobiliary-II module in year-3 and then rotations of Medicine in later years. These latter modules are mainly clinical in nature and help students develop necessary skills in diagnosing and developing management plans for common GIT related conditions.</p> <p>This module will focus on the normal structure and function of the GIT system and will help students apply this information to solve clinically relevant problems suitable for this level of students.</p>
<b>RATIONALE</b>	Gastrointestinal related disorders are extremely common in Pakistan and are a cause of great morbidity and mortality. Diseases like hepatitis and diarrhea are rampant. This module will help students learn not only the structure and functions but will introduce them to the clinical aspects of related disorders so that they can link the basics with the applied aspects.
<b>TARGET STUDENTS</b>	1 <sup>st</sup> year MBBS, 2022
<b>DURATION</b>	4 weeks
<b>MODULE OUTCOMES</b>	By the end of the module, students of 1 <sup>st</sup> year MBBS will be able to correlate the GIT related structures with functions and biochemical processes
<b>DEPARTMENTS</b>	<ul style="list-style-type: none"> <li>i. Anatomy</li> <li>ii. Biochemistry</li> <li>iii. Physiology</li> </ul>
<b>OBJECTIVES</b>	By the end of the module, the students should be able to:

**LECTURES / DEMONSTRATIONS**

**ANATOMY**

**1. Introduction & divisions of GIT + abdominal quadrants**

- Describe the divisions and parts of digestive tract
- List the abdominal quadrants & regions of GIT

**2. Esophagus (Abdominal Part), Stomach {GROSS ANATOMY}**

- Explain gross features of abdominal part of esophagus & stomach
- List their peritoneal & visceral relations
- Explain their blood supply, lymphatic drainage & nerve supply

**3. General Plan of G.I.T + Esophagus (HISTOLOGY )**

- List the divisions of digestive tract
- Describe the general histological features of GIT, specially of esophagus

**4. Development of GIT -I (derivatives of fore gut) {EMBRYOLOGY}**

- Describe the divisions of primitive gut
- Enumerate the derivatives of foregut
- Describe the development of foregut
- Describe the clinical aspect of derivatives of foregut
- Enumerate the congenital anomalies of foregut
- Discuss the features of the following congenital anomalies of foregut:
  - i. Hernias
  - ii. Esophageal atresia, esophageal stenosis, congenital hypertrophic pyloric stenosis, duodenal stenosis & atresia, anomalies of liver, extrahepatic, biliary atresia, annular pancreas, accessory pancreatic tissue, & accessory spleen

**5. Stomach {HISTOLOGY}**

- Describe the functions of the layers, component and cells in the wall of the digestive tract
- Explain how they differ in the pharynx, esophagus and stomach.

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- Describe the microscopic features of gastric glands, their constituent cells and secretory product.
- Differentiate cardiac, fundic and pyloric glands

**6. Peritoneum {GROSS ANATOMY}**

- Describe the extent of peritoneum horizontally
- Define peritoneal layers, cavity, folds/mesenteries, omentum & ligaments
- Explain the attachment and reflection of peritoneum
- Explain the attachment of peritoneum on liver
- Describe the boundaries of lesser sac

**7. Small Intestine & large intestine {GROSS ANATOMY}**

- Explain different parts of small and large intestine
- Describe the blood supply and nerve supply of intestine
- List the structural differences between small and large intestine
- Discuss the lymphatic drainage of small and large intestine
- Discuss the relevant clinical conditions like volvulus & intussusceptions etc.

**8. Development Anatomy of GIT- II (derivatives of mid and hind gut ) {EMBRYOLOGY}**

- List the development derivatives of primitive gut tube (pharynx. esophagus stomach, intestine)
- Describe the derivatives of midgut and hindgut
- Describe rotation of gut
- Describe the formation of greater, lesser omentum and omental bursae
- Describe the congenital anomalies of gut
- List the special features associated with common anomalies related to gut including Congenital omphalocele, umbilical hernia, gastroschisis, anomalies of midgut, internal hernia, stenosis, atresia of intestine, Mal-rotation of gut, Ileal diverticulum, duplication of intestine, anomalies of hindgut, Hirschsprung disease, imperforate anus, anal stenosis, rectal atresia

**9. Small intestine {HISTOLOGY}**

- Explain the different layers of small intestine
- Discuss the cells present in the small intestine

- Describe the different glands present in the small intestine
- Define and explain Payers patches
- Differentiate the parts of small intestine histologically

**10. Large intestine {HISTOLOGY}**

- Enumerate the different layers of large intestine
- Describe the cells and glands present in large intestine
- Explain the difference between small and large intestine

**11. Liver and Gall bladder {GROSS ANATOMY}**

- Describe liver with its anatomical positions
- Identify lobes and surfaces of liver and visceral relations and impression.
- Identify the segments of liver
- Discuss the different components of biliary tract

**12. Hepatic Portal System**

- Identify the venous drainage of the organs of GI tract, and veins of hepatic portal system
- Describe the venous drainage of the organs of GI tract and the veins of hepatic portal system
- Describe the clinical importance of the hepatic portal system and its connections

**13. Development of liver, Gall bladder and Pancreas {EMBRYOLOGY}**

- Describe the development of liver
- Discuss the formation of bile & hepatic cells
- Discuss the molecular regulation of liver induction
- Explain the formation of gallbladder & cystic duct
- Enumerate the anomalies of Liver & gallbladder
- Discuss the formation of pancreatic bud and islet of Langerhan
- Discuss molecular regulation of pancreas development
- Describe Pancreatic abnormalities

**14. Liver and gall bladder {HISTOLOGY}**

- Explain the histology of liver
- Explain the arrangement of liver parenchyma
- Describe the general concepts underlying classical hepatic lobule, portal lobule and hepatic acinus
- Describe the microscopic structure of gall bladder

#### **15. Pancreas {GROSS ANATOMY}**

- Discuss the gross features of different parts of pancreas
- Describe the location, relations, and morphological and secretory parts of Pancreas
- Describe the arterial supply, venous drainage and nerve supply of pancreas
- Discuss the clinical relevance of pancreas

#### **16. Pancreas {HISTOLOGY}**

- Explain the histology of Pancreas
- Explain the arrangement of Pancreatic parenchyma

#### **17. Posterior abdominal wall (boundaries, lumbar vertebrae, muscles, fascia)**

- Identify the level of vertebrae with respect to the three major orifices in the diaphragm
- Identify the location of these orifices with respect to vertebral level
- Enumerate the structures forming the posterior abdominal wall
- Identify the boundaries of posterior abdominal wall
- Discuss the general characteristics of lumbar vertebrae
- Describe the muscles and fasciae of posterior abdominal wall
- Discuss the clinical conditions associated with the posterior abdominal wall

#### **18. Anal Canal**

- Describe the Ano-rectal junction
- Describe the Nerve supply and blood supply of anal canal
- Describe Ano-rectal fistula, Polyps and diverticulum

NOTE: Anal sphincters (External and internal) will be discussed with pelvis & perineum

#### **19. Anterior Abdominal wall**



- Enumerate the structures forming anterior abdominal wall
- Identify the boundaries of anterior abdominal wall
- Describe the muscles and fasciae of anterior abdominal wall
- Discuss the clinical conditions associated with the anterior abdominal wall

#### **20. Inguinal Canal**

- Describe the boundaries and content of the inguinal canal
- Discuss clinical correlation of the inguinal canal

#### **21. Abdominal Aorta + blood supply of abdomen**

- Describe the course of abdominal aorta
- Enumerate the paired and unpaired branches of abdominal aorta
- Discuss the arteries which supply the abdominal walls

#### **22. Inferior vena cavae + venous drainage of abdomen**

- Describe the formation of inferior vena cava
- List the tributaries of inferior vena cava
- Explain the relations of inferior vena cava
- Discuss the clinical conditions associated with inferior vena cava

#### **23. Lymphatic drainage and innervation of abdomen**

- Explain the groups of lymph nodes draining the abdomen
- Describe the lymphatic trunks, cistern chyl, the thoracic duct and nerves supply of abdomen
- Discuss the sympathetic trunk, splanchnic nerves, prevertebral plexus & ganglia supplying the abdomen

#### **24. Surface anatomy of Abdomen**

- Identify the bony landmarks of the abdomen
- Discuss the abdominal regions and quadrants
- List the abdominal organs in each quadrant
- Discuss the surface anatomy of stomach and spleen in relation to anterior abdominal wall

- Discuss the surface anatomy of kidneys, ureters and spleen in relation to posterior abdominal wall
- Identify the surface anatomy of liver
- Discuss the surface anatomy of diaphragm

## **BIOCHEMISTRY**

### **TOPIC: DIGESTION & ABSORPTION**

#### **1. Digestion & Absorption of Carbohydrates**

- Classify dietary carbohydrates with examples
- Explain the significance of the glycemic index
- Describe the importance of dietary fiber
- List the main digestive enzymes and describe their action on carbohydrate
- Discuss the abnormalities due to digestive enzyme deficiency
- Explain the absorption of monosaccharides by the intestinal mucosal cells
- Discuss the clinical significance of abnormalities of digestion and absorption (e.g. lactose intolerance)

#### **2. Digestion & Absorption of Proteins**

- List the various sources of dietary protein
- Discuss the digestion of protein
- List and explain the functions of the proteolytic enzymes
- Explain the mechanism of absorption of amino acids
- Discuss the significance of amino acid pool
- Explain the significance of nitrogen balance.
- Discuss the clinical significance of protein allergy, celiac sprue and cystinuria

#### **3. Digestion & Absorption of Lipids**

- List the constituents of dietary lipids
- Discuss the digestion of lipids
- Explain the role of lipases in lipid digestion
- Discuss the digestion of dietary cholesterol and phospholipids
- Explain the hormonal regulation of lipid digestion

- Discuss the absorption of lipids by the intestinal mucosal cells
- Discuss the re-synthesis and secretion of lipids by the enterocytes
- Discuss the secretion of chylomicrons by the enterocytes
- Define Steatorrhoea
- List causes of Steatorrhoea
- Discuss the abnormalities of lipid digestion and absorption with especial reference to cystic fibrosis

## **TOPIC: METABOLIC PATHWAYS OF CARBOHYDRATES**

### **4. Glycolytic pathway of Carbohydrates Metabolism**

- Differentiate between aerobic and anaerobic glycolysis
- Explain the role of insulin in transport of glucose inside the cells
- List the reactions of the two stages of glycolysis viz energy investment and energy generation
- Explain the hormonal regulation of glycolysis
- Discuss the fate of pyruvate
- Explain the process of glycolysis in RBC's
- Discuss the abnormalities of glycolysis

### **5. TCA cycle of Carbohydrate metabolism**

- Discuss the significance of TCA cycle as an amphibolic pathway
- Discuss the reactions of the TCA cycle and its regulatory steps
- Describe the energy produced from TCA cycle
- Explain the disorders of TCA cycle

### **6. Metabolism of Glycogen with its disorders**

- Explain the structure and functions of glycogen
- Describe the mechanism of glycogen synthesis and its regulation
- Describe the mechanism of glycogenolysis and its regulation
- Discuss the maintenance of blood glucose level
- Explain the various form of glycogen storage diseases

### **7. Metabolic pathway of Gluconeogenesis**



- Describe the mechanism of gluconeogenesis
- List the reactions which are unique to gluconeogenesis
- Describe the regulation of gluconeogenesis
- Explain the Cori cycle

#### **8. Metabolic pathway of HMP Shunt**

- Describe the significance of hexose monophosphate shunt
- Describe the oxidative and non-oxidative stages of HMP shunt
- Discuss the enzymes of the HMP shunt and its regulation.
- Explain the abnormalities of the HMP shunt especially G6PD.
- Discuss the significance of reactive oxygen species
- Discuss the functions of NADPH and glutathione

#### **9. Metabolic pathways of Fructose, Galactose & Uronic Acid**

- List the sources of fructose
- Discuss the alternative mechanism of monosaccharide metabolism
- Discuss the important enzymes of fructose metabolism
- Explain the metabolic pathway of fructose
- Explain the disorders of fructose metabolism due to enzyme deficiencies
- Discuss the important enzymes of Galactose metabolism
- Explain the metabolic pathway of Galactose metabolism
- Explain the disorders of Galactose metabolism due to enzyme deficiencies
- Explain the uronic acid pathway and its biochemical significance.
- Describe the importance of uronic acid pathway in liver detoxification

#### **TOPIC: BIOLOGICAL OXIDATION**

#### **10. Bioenergetics & Biological Oxidation**

- List high energy and low energy phosphate
- List the oxido-reductase enzymes
- Define bioenergetics and explain the general laws of thermodynamics
- Define free energy and equilibrium constant

- Describe the coupling of endergonic & exergonic reactions by high energy intermediates (e.g. ATP)
- Describe the role of ATP as an energy carrier
- Describe biologic oxidation and redox potential

#### **11. Oxidative Phosphorylation & Electron Transport Chain**

- List the ion transporters in the inner mitochondrial membrane
- Describe the organization of the electron transport chain
- Discuss the functions of each complex of ETC
- Explain the energy currency of the body
- Explain the site and mechanism of synthesis of ATP
- Describe how proton are pumped from the matrix to the intermembrane space
- Discuss the significance of co-enzyme Q and the Q-cycle
- Discuss the inhibitors and uncouplers of ETC and their mechanism of action
- Discuss how electron transport chain releases free energy
- Discuss the generation of proton gradient
- Explain the significance of P.O. Ratio
- Explain Mitchell's chemiosmosis theory of electrochemical gradient
- Explain the glycerophosphate and malate shuttle
- List the genetic defects of oxidative phosphorylation
- Explain the clinical conditions which inhibit the electron transport chain

#### **TOPIC: BIOCHEMICAL FUNCTIONS OF LIVER**

#### **12. Metabolic role of Liver & its detoxification**

- Discuss the metabolic, synthetic, excretory, detoxification and storage functions of liver
- List the liver function tests based on the five main functions of the liver
- Explain the normal level of serum bilirubin (total, conjugated and unconjugated), urinary urobilinogen, urinary bilirubin, fecal stercobilinogen in different types of Jaundice
- Discuss the importance of serum enzymes in the differential diagnosis of Jaundice (ALT, AST, ALP, LDH, GGT, and 5'-Nucleotidase)
- Discuss the importance of albumin, total protein and prothrombin time in diagnosing liver disease

### **13. Degradation of Hemoglobin and Bilirubin Metabolism**

- List the steps of heme degradation to bilirubin
- Discuss the role of liver in bilirubin uptake and conjugation
- Discuss the secretion of bilirubin in bile
- Explain the fate of bilirubin in the intestine and its excretion in urine and stool

### **14. Jaundice and its biochemical investigations**

- Describe the disorders of bilirubin metabolism
- Explain the types of bilirubin in the blood
- Classify jaundice
- Explain the causes with examples and diagnostic investigations of pre-hepatic, hepatocellular & post-hepatic and obstructive jaundice

## **PHYSIOLOGY**

### **1. Introduction to the digestive system**

- Describe characteristics of gastrointestinal wall
- Explain functional types of movements in gastrointestinal tract
- Briefly state the gastrointestinal blood flow

### **2. Functions of the smooth muscle and their electrical properties**

- List the electrical properties of smooth muscle
- Explain the mechanism of smooth muscle contraction
- Differentiate smooth muscle from skeletal muscle
- Describe genesis of BER and its role in GI motility

### **3. Nervous and hormonal control of GIT**

- List hormones of GIT and their role in process of digestion
- Describe autonomic nervous system Explain Myenteric and Meissner's plexus
- Describe the Gastrointestinal reflexes (gastro-colic, entero-gastric, colono-ileal reflexes)

### **4. Secretion of saliva (composition, function and regulation)**

- List the salivary glands, composition and their functions
- Describe stimuli that increase salivary secretion
- Explain control of salivary secretion

**5. Mastication & Deglutition reflex**

- Describe mechanism of mastication
- Explain different phases of deglutition
- Explain lower esophageal tone and motility defects in esophagus

**6. Functions of stomach**

- Describe motor functions of stomach
- Explain regulation of stomach emptying

**7. Gastric secretion (composition, function and regulation)**

- List composition of secretions of gastric glands
- Describe role of gastric secretions in digestion
- Describe the regulation of gastric secretion

**8. Movements of small and large intestine**

- Explain the following functions: Segmentation, Peristalsis, Mass movement and Defecation reflex
- Describe the effects of autonomic system in modulating intestinal motility

**9. Secretions of small and large intestine**

- List secretion of different enzymes in small and large intestines
- Describe the regulation of small and large intestinal secretions

**10. Pancreatic secretions (composition, function and regulation)**

- Describe composition & secretions of pancreatic juice
- Explain phases of pancreatic secretion
- Describe the regulation of pancreatic secretion

**11. Bile secretion (composition, function and regulation)**

- List the composition of bile and factors for its release
- Explain the mechanism of conjugation and secretion of bile salts
- Describe role of bile acids and emulsification of fats
- Describe enterohepatic circulation of bile salts

**12. Vomiting & Defecation reflexes**

- Explain vomiting reflex & its causes
- Explain defecation reflex & its regulation

**13. Disorders of gastro-intestinal tract**

- Discuss the common disorders of GIT and its related glands

**TUTORIALS**

**ANATOMY**

**1. Radiological Anatomy**

- Identify various parts of normal GIT on a plain X ray

**BIOCHEMISTRY**

**TOPIC: DIGESTION & ABSORPTION**

**1. Abnormalities of digestion & absorption**

- Discuss the clinical importance of abnormalities of digestion & absorption (e.g. Lactose Intolerance)
- Correlate the interpretation of laboratory investigations with relevant clinical conditions

**TOPIC: METABOLIC PATHWAYS OF CARBOHYDRATES**

**2. Disturbances in Carbohydrate Metabolism**

- Discuss the clinical importance of disturbances in carbohydrate metabolism (e.g. G6PD deficiency)



- Correlate the interpretation of laboratory investigations with relevant clinical conditions

#### **TOPIC: ELECTRON TRANSPORT CHAIN**

##### **3. Disturbances of Electron Transport Chain**

- Discuss the clinical importance of disturbances of electron transport chain (e.g. Carbon monoxide poisoning)
- Correlate the interpretation of laboratory investigations with relevant clinical conditions

#### **TOPIC: JAUNDICE**

##### **4. Jaundice and its biochemical investigations**

- Classify Jaundice
- List the causes of each type
- Correlate the interpretation of laboratory investigations with relevant clinical condition

### **PRACTICALS**

### **ANATOMY**

#### **1. Esophagus + stomach**

- Identify the slides of esophagus and stomach under microscope
- Discuss the structure of the gastrointestinal tract, Histological features of layers of GIT
- Describe the microscopic features of esophagus
- Discuss the histological structure of each layer of esophagus
- Discuss the distribution of esophageal glands and muscles
- Elaborate the different regions of stomach, grossly and histologically
- Discuss the various layers of the wall of stomach
- Discuss the different glands and the various kind of cells present in esophagus and stomach

#### **2. Large Intestine**

- Identify large intestine under microscope
- Describe the important histological features of large intestine.

- Identify the appendix on the basis of its distinguished features
- Identify the histological features of anorectal region
- Differentiate between basic histological features of small and large intestines

## **BIOCHEMISTRY**

### **TOPIC: DIGESTION & ABSORPTION**

#### **1. Serum Glucose Estimation**

- List and explain the biochemical investigations done for Diabetes Mellitus
- Outline the method for serum glucose estimation by spectrophotometer
- Estimate the serum glucose levels and give its interpretation
- Correlate the interpretation of laboratory investigations with relevant clinical conditions

### **TOPIC: JAUNDICE**

#### **2. Serum LFT's (Liver function test) profile**

- List and explain the Liver function tests
- Identify the chemical tests and bio-techniques used to perform Liver function tests
- Interpret the serum Liver function test
- Correlate the interpretation of laboratory investigations with relevant clinical condition

#### **3. Serum Aminotransferase (ALT)**

- Identify the chemical tests and bio-techniques used to perform serum Aminotransferase
- Estimate the serum Aminotransferase level (ALT)
- Interpret the serum Aminotransferase level (ALT)
- Correlate the interpretation of laboratory investigations with relevant clinical condition

#### **4. Serum Bilirubin**

- Explain the method used to perform Serum Bilirubin by Spectrophotometer
- Estimate serum Bilirubin level (Total, Direct & Indirect Bilirubin)
- Interpret serum Bilirubin level
- Correlate the interpretation of laboratory investigations with relevant clinical condition

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<b>INTERNAL ASSESSMENT</b>	<ul style="list-style-type: none"><li>• Continuous monitoring of attendance and practical assessment in short groups.</li><li>• It will be in the form of MCQs, assignments, stages/sub-stages, projects, quiz or OSPE.</li><li>• Internal evaluation carries 20% weightage in summative semester examination.</li></ul>
<b>FINAL EXAM</b>	Final Annual exam will consist of MCQs ( One Correct & One Best ) and OSPE (observed + unobserved stations)

