

GIT/HEPATOBILLIARY/METABOLISM STUDY GUIDE

SECOND YEAR

This Study guide of the module/course outlines the key components and areas for the facilitation of the students.

Department of Medical Education

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Vision and Mission of KGMC

Khyber Medical University: Vision



Khyber Medical University will be the global leader in health sciences academics and research for efficient and compassionate health care.

Khyber Girls Medical College: Vision



“Excellence in health care, research ,teaching and training in the service of Humanity”

Khyber Girls Medical College: Mission

The mission of KGMC is to promote compassionate and professional health care leaders Who are knowledgeable, skillful, and community oriented lifelong learners serving humanity through evidence based practice

Curriculum Committee KGMC

Chair:

Professor Dr.Zahid Aman , Dean KGMC.

Co-Chair:

Dr. Sabina Aziz, Associate Dean KGMC.

Clinical Sciences:

- ✓ Dr. Mohammad Noor Wazir ,Department of Medicine KGMC/HMC
- ✓ Dr. Bushra Rauf Department of Gynae KGMC/HMC.
- ✓ Dr. Sofia Iqbal, Department of Ophthalmology KGMC/HMC.
- ✓ Dr. Said Amin Department of Medicine KGMC/HMC.
- ✓ Dr. Ghareeb Nawaz Department of ENT KGMC/HMC.
- ✓ Dr. Jamshed Alam Department of Surgery KGMC/HMC.
- ✓ Dr. Ambreen Ahmad, Department of Pediatrics KGMC/HMC.
- ✓ Dr. Ain-ul-Hadi Department of Surgery KGMC/HMC.
- ✓ Dr. Fawad Rahim Department of Medicine KGMC/HMC.

Behavioral Sciences:

- ✓ Dr. Ameer Abbas Department of Psychiatry KGMC/HMC.

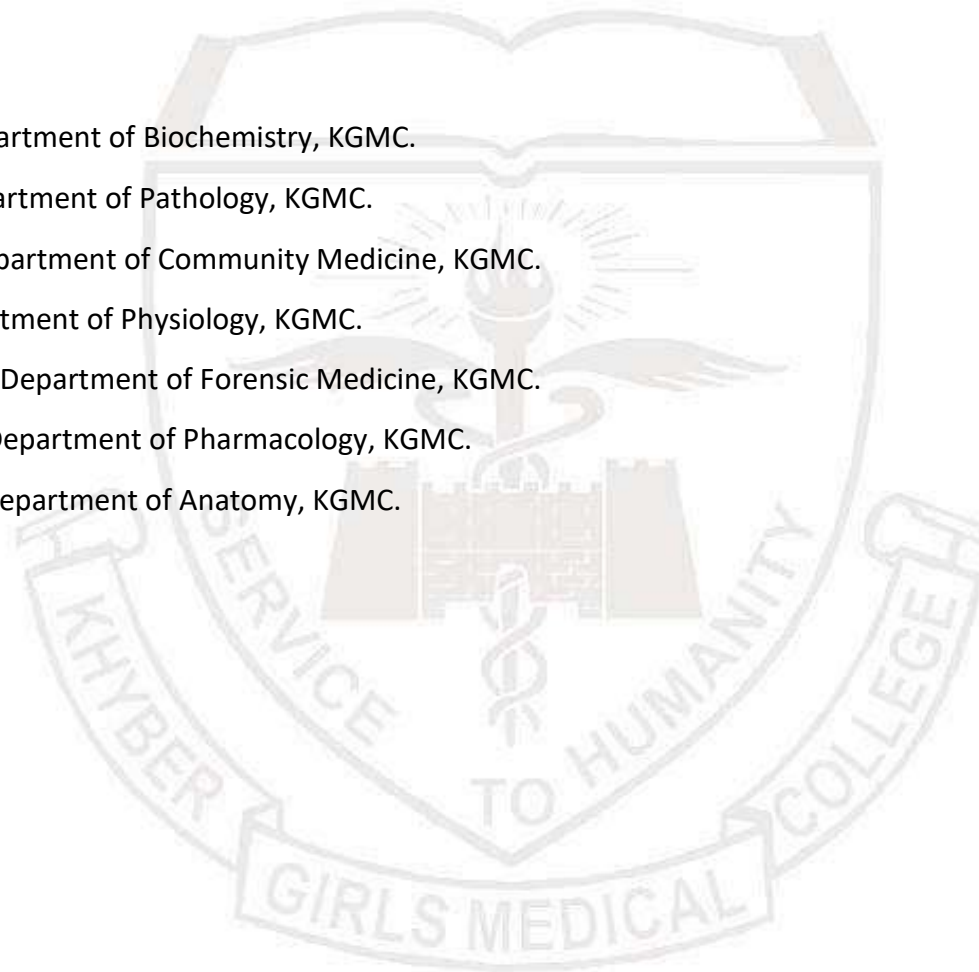
Medical Education

- ✓ Dr. Naheed Mahsood, Department of Medical Education, KGMC.

- ✓ Dr. Naveed Afzal Khan, Department of Medical Education, KGMC.
- ✓ Dr Onaiza Nasim , Department of Medical Education, KGMC

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- ✓ Dr. Khalid Javed Department of Pathology, KGMC.
- ✓ Dr. Raheela Amin Department of Community Medicine, KGMC.
- ✓ Dr. Zubia Shah Department of Physiology, KGMC.
- ✓ Dr. Naheed Siddique Department of Forensic Medicine, KGMC.
- ✓ Dr. Shams Suleman Department of Pharmacology, KGMC.
- ✓ Dr. Shahab-ud-Din, Department of Anatomy, KGMC.



Module Committee for GIT

1. Dr. Gulnaz Senior Lecturer Department of **Biochemistry**..... **Module Coordinator**
2. Dr. Naheed Mehsood Assistant Professor **DME****Module Secretary:**
3. Dr. Naveed Afzal Khan Coordinator **DME****Module Secretary**
4. Dr. Onaiza Nasim Demonstrator **DME****Member**
5. Dr. Shabnam Gul Senior Lecturer **Admin**.....**Member:**
6. Dr. Khalid Javed Professor Department of **Pathology** **Member**
7. Dr. Shahab ud Din Associate Professor Department of **Anatomy**..... **Member**
8. Dr. Ayesha Jamil Associate Professor Department of **Pharmacology**.....**Member**
9. Dr. Siddique Ahmad Associate Professor **Surgery**.....**Member**
10. Dr. Muhammad Iftikhar Assistant Professor **Surgery**.....**Member**
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13. Dr. Ameer Abbas Assistant Professor Department of **Behavioral Sciences**...**Member**
14. Dr. Adnan Assistant Professor Department of **Medicine**.....**Member**
15. Dr. Fahad Falah Lecturer Department of **Pharmacology**.....**Member**
16. Dr. Najma Attaullah Lecturer Department of **Anatomy****Member**
17. Dr. Shahnaz Lecturer Department of **Community Medicine**..... **Member**
18. Dr. Ihsanullah Lecturer Department of **Forensic Medicine**.....**Member**
19. Dr. Sarah Shahid Lecturer Department of **Physiology**.....**Member**
20. Miss. Alena Aman **Student of Final Year**.....**Member**
21. Miss. Ayesha Alam **Student of Final Year**.....**Member**

Integrated curriculum:

An integrated curriculum is all about making connections, whether to real life or across the disciplines, about skills or about knowledge. An integrated curriculum fuses subject areas, experiences, and real-life knowledge together to make a more fulfilling and tangible learning environment for students. Integrated teaching means that subjects are presented as a meaningful whole. Students will be able to have better understanding of basic sciences when they repeatedly learn in relation to clinical examples. Case based discussions, computer-based assignments, early exposure to clinics, wards, and skills acquisition in skills lab are characteristics of integrated teaching program.

Outcomes of the curriculum:

The outcomes of the curriculum of MBBS According to the PMDC are as follows

- ✓ Knowledgeable
- ✓ Skilful
- ✓ Community Health Promoter
- ✓ Problem-solver
- ✓ Professional
- ✓ Researcher
- ✓ Leader and Role Model

KNOWLEDGE

By the end of five year MBBS program the KGMC student should be able to;

1. Acquire a high level of clinical proficiency in history taking, physical examination, differential diagnosis, and the effective use of medicine's evolving diagnostic and procedural capabilities including therapeutic and palliative modalities
2. Manage the common prevalent diseases in community
3. Identify the common medical emergencies
4. Develop plan for prevention of common community diseases
5. Formulate a referral plan
6. Compose a prescription plan

PSYCHOMOTOR

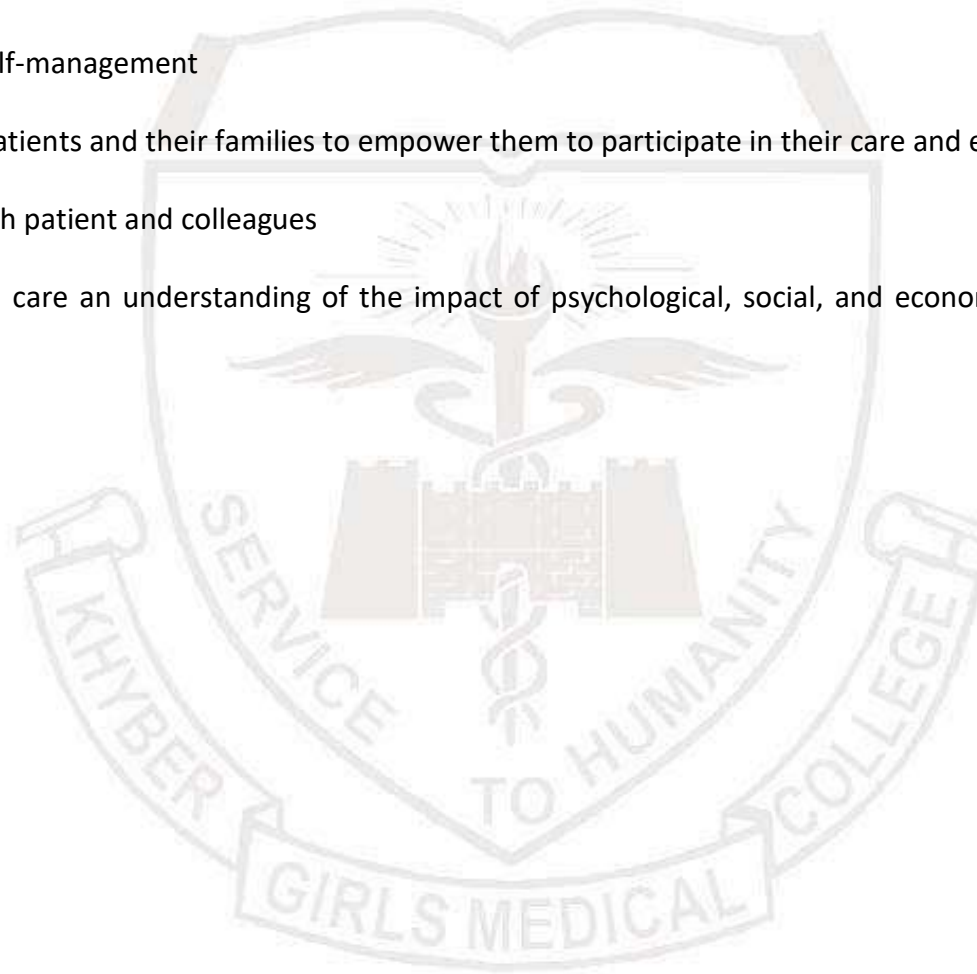
By the end of five year MBBS program the KGMC student should be able to;

1. Demonstrate the ability to perform the disease specific relevant examination
2. Respond to common medical emergencies
3. Master the skill of first aid
4. Perform BLS
5. Apply the best evidenced practices for local health problem

AFFECTIVE

By the end of five year MBBS program the KGMC student should be able to

1. Relate to patient and caregivers vulnerability
2. Demonstrate ethical self-management
3. Counsel and educate patients and their families to empower them to participate in their care and enable shared decision-making.
4. Display compassion with patient and colleagues
5. Demonstrate in clinical care an understanding of the impact of psychological, social, and economic factors on human health and disease

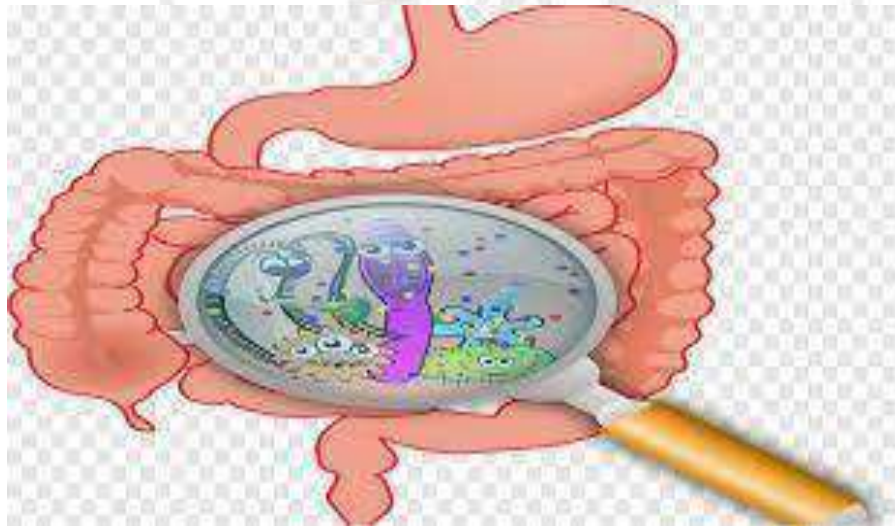


Introduction to the Gastrointestinal Tract

The **gastrointestinal tract** (**digestive tract**, **alimentary canal**, **digestion tract**, **GI tract**, **GIT**) is an **organ** system within humans and other **animals** which takes in food, **digests** it to extract and absorb energy and nutrients, and expels the remaining waste as **feces**.

The **mouth**, **esophagus**, stomach and intestines are part of the gastrointestinal tract. *Gastrointestinal* is an adjective meaning of or pertaining to the **stomach** and **intestines**. A tract is a collection of related anatomic structures or a series of connected body organs.

The structure and function can be described both as **gross anatomy** and as **microscopic anatomy** or **histology**. The tract itself is divided into upper and lower tracts, and the intestines **small** and **large** parts



General Learning Outcomes of Course

Knowledge

AT THE END OF THIS 6 WEEKS` MODULE, THE 2ND YEAR STUDENTS WILL BE ABLE TO:

- 1) DESCRIBE THE ANATOMY OF ORAL CAVITY WITH RESPECT TO GI FUNCTIONS
- 2) ELABORATE THE STRUCTURE AND FUNCTIONS OF SALIVARY GLANDS
- 3) DESCRIBE THE STRUCTURE AND DEVELOPMENT OF ESOPHAGUS, STOMACH, SMALL INTESTINE AND LARGE INTESTINE
- 4) DESCRIBE THE ANATOMY OF PERITONEUM AND MESENTERY
- 5) EXPLAIN THE MOVEMENTS, FUNCTIONS AND REGULATIONS OF GASTROINTESTINAL FUNCTIONS
- 6) DESCRIBE THE STRUCTURE, DEVELOPMENT AND FUNCTIONS OF HEPATOBILIARY SYSTEM AND PANCREAS
- 7) DISCUSS THE MECHANISMS OF DIGESTION AND ABSORPTIONS OF CARBOHYDRATES, PROTEINS, FATS AND OTHER NUTRIENTS
- 8) DESCRIBE DIFFERENT PHYSIOLOGICAL REFLEXES OCCURRING UPON STIMULATION OF GASTROINTESTINAL ORGANS
- 9) DISCUSS THE CHEMISTRY AND FUNCTIONS OF GASTROINTESTINAL HORMONES
- 10) Describe common pathological conditions like peptic ulcers, viral hepatitis, OBSTRUCTIVE JAUNDICE, CARCINOMA OF ESOPHAGUS AND COLORECTAL CANCERS

Skills

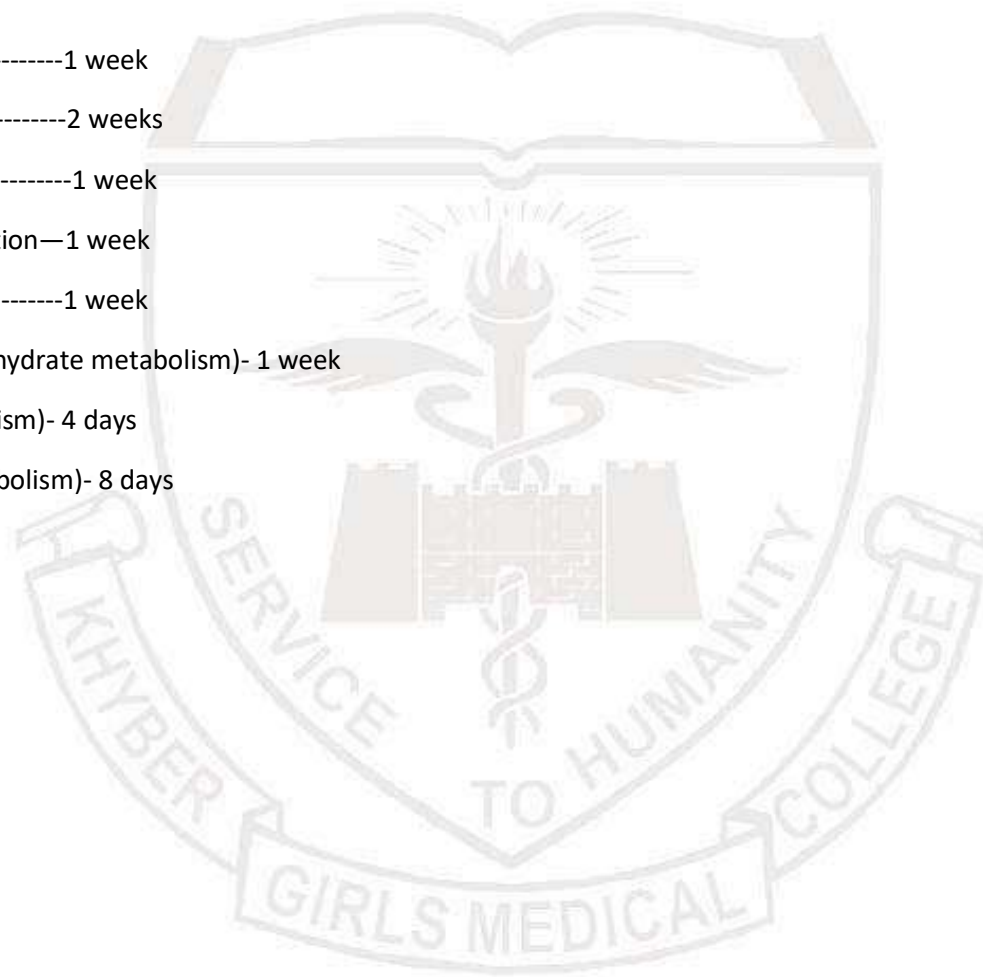
1. Identify the histological features of lips, tongue under the microscope
2. Identify the histological features of esophagus
3. Identify the histological features of stomach under the microscope
4. Identify the histological feature of duodenum under the microscope
5. Identify the histological features of liver
6. Identify the histological features of gallbladder the microscope

Attitude

1. 1. Demonstrate compassion and care for patients while performing the nervous system examination
2. 2. Demonstrate the team work while working in the hospital environment.
3. 3. Show good communication skills while performing tasks.

Themes

- 1) Painful swallowing-----1 week
- 2) Abdominal pain-----2 weeks
- 3) Jaundice-----1 week
- 4) Diarrhea and Constipation—1 week
- 5) Bleeding Per Rectum-----1 week
- 6) Hyperglycemia-(Carbohydrate metabolism)- 1 week
- 7) Obesity (Lipid metabolism)- 4 days
- 8) Wasting (Protein metabolism)- 8 days



Theme 1: Painful swallowing

Subject	Topic	Learning objectives	Teaching strategy	Assessment
Gross Anatomy	Oral cavity	Describe the musculature of tongue	Demo/SGD	MCQ
	Salivary glands	Describe the gross anatomy of parotid, submandibular and	Demo/SGD	MCQ
	Esophagus	Describe the extent, course, relations and gross structure of	Demo/SGD	MCQ
Embryology	Development of tongue	Describe the developmental events of tongue	LGF	MCQ
	Development of	Describe the development of	LGF	MCQ
	Development of	Describe the development of salivary glands	LGF	MCQ

Histology	Oral cavity	Describe the microscopic structure of lips	LGF	MCQ
		Describe the histological features of tooth in longitudinal and transverse section	LGF	MCQ
		Explain the histology of tongue.	LGF	MCQ
		Differentiate between the microscopic picture of anterior 2/3rds and posterior 1/3rds of the tongue	LGF	MCQ

	Esophagus	Identify the epithelium of esophagus and esophageal glands in mucosa	LGF	MCQ
		Differentiate between musculature in different parts of the esophagus	LGF	MCQ
Physiology	General principles of gastrointestinal motility	Describe electrical activity of gastrointestinal smooth muscle	LGF	MCQ
		Describe the mechanism of excitation of smooth muscle of gastrointestinal	LGF	MCQ
		Differentiate between slow wave and spike potential	LGF	MCQ
	Neural control of GIT function (Enteric Nervous system)	Differentiate between mesenteric and submucosal plexus.	LGF	MCQ

		Classify the following enteric nervous system neurotransmitters as excitatory or inhibitory: norepinephrine, acetylcholine, CCK, VIP, histamine, and somatostatin	LGF	MCQ
		Describe the role of autonomic nervous system in regulation of GIT's function	LGF	MCQ
		Differentiate between sympathetic and parasympathetic modulation of the enteric nervous system and the effector organs of the GI tract	LGF	MCQ

		Describe three types of gastrointestinal reflexes	LGF	MCQ
	Hormonal control of Gastrointestinal motility	Describe gastrointestinal hormone actions, stimuli for secretion, and site of secretion	LGF	MCQ
	Functional types of movements in the gastrointestinal tract	Describe the functional types of movements in the gastrointestinal tract	LGF	MCQ
		Describe law of gut.	LGF	MCQ
		Describe blood flow through the villus and its significance	LGF	MCQ
	Gastrointestinal blood flow— Splanchnic circulation	Describe anatomy of the gastrointestinal blood supply	LGF	MCQ

		Describe the effect of gut activity and metabolic factors on gastrointestinal blood flow	LGF	MCQ
		Describe nervous control of gastrointestinal bloodflow	LGF	MCQ
	Ingestion of food	Describe the mechanics of ingestion of food	LGF	MCQ
		Describe chewing and mastication	LGF	MCQ

		Describe different stages of swallowing.	LGF	MCQ
		Describe the effects of the pharyngeal stage of swallowing on respiration	LGF	MCQ
	General principles of alimentary tract secretion	Describe basic mechanisms of stimulation of the alimentary tract glands	LGF	MCQ
		Describe dual effect of sympathetic stimulation on alimentary tract glandular secretion	LGF	MCQ
	Role of mucus and saliva	Describe the secretion of saliva and its nervous regulation	LGF	MCQ

		Describe the plasma and saliva concentrations of Na ⁺ , Cl ⁻ , and HCO ₃ ⁻ at low secretion rates and at high secretion rates and the principal cell types involved in each secretion rate. 14	LGF	MCQ
		State the substrates and digestion products of salivary amylase (ptyalin).	LGF	MCQ
		Identify the stimuli and cell types involved in GI secretion of mucous, and identify the function of salivary mucus.	LGF	MCQ

		Describe three types of stimuli that increase salivary secretion.	LGF	MCQ
		State the components of the saliva important in oral hygiene, and identify the role of salivary secretions in eliminating heavy metals	LGF	MCQ
	Disorders of swallowing and esophagus	Describe the clinical abnormalities of swallowing mechanism	LGF	MCQ
		Describe Achalasia and Megaesophagus	LGF	MCQ
Biochemistry	Saliva	Describe the composition of salivary secretions	LGF	MCQ
		Describe the formation and characteristics of salivary secretions	LGF	MCQ
		Elaborate the functions of saliva	LGF	MCQ

Pathology	Carcinoma of Esophagus	Describe the histological types and presentation of esophageal carcinoma	LGF	MCQ
ENT	Oral ulceration	Enlist the causes of oral ulcerations	LGF	MCQ
		Describe Aphthous ulcers and its treatment	LGF	MCQ
		Describe the clinical features and drugs used to treat esophageal candidiasis	LGF	MCQ

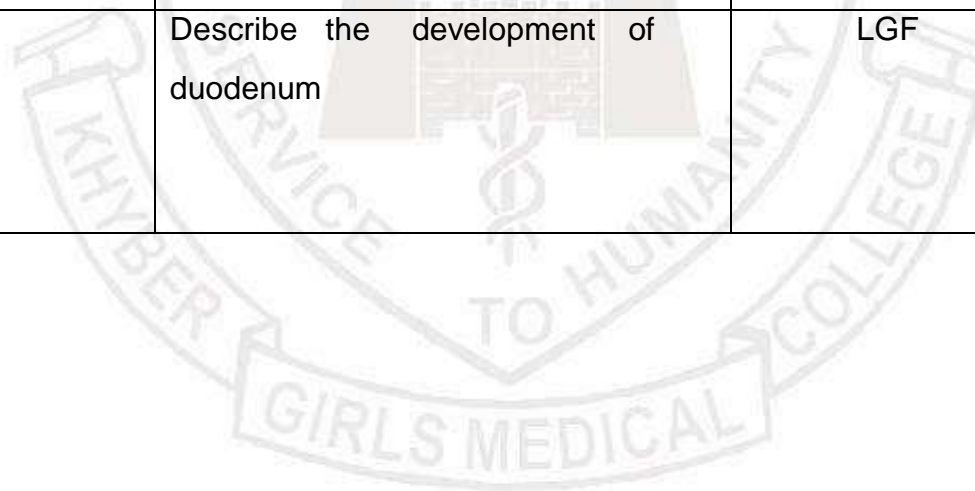
Theme 2: Pain Epigastrium

Subject	Topic	Learning objective	Teaching strategy	Assessment
Gross Anatomy	Anterior abdomen Wall	Describe the origin, insertion, nerve supply and actions of anterolateral abdominal wall muscles	Demo/SGD	MCQ
		Describe the formation of rectus sheath	Demo/SGD	MCQ
		Describe the contents of rectus sheath	Demo/SGD	MCQ
		Describe the surface anatomy of anterior abdominal wall Describe the structures related to transpyloric plane	Demo/SGD	MCQ
		Enlist various types of abdominal hernias	Demo/SGD	MCQ
	Inguinal canal	Describe the boundaries of inguinal canal	LGF	MCQ

		Enlist the contents of inguinal canal in males and females	LGF	MCQ
		Differentiate between direct and indirect inguinal hernia	LGF	MCQ
	Peritoneum	Describe greater and lesser	LGF	MCQ
		Describe the nerve supply of peritoneum	LGF	MCQ
		Describe the anatomy of lesser sac.	LGF	MCQ
		Describe the boundaries of epiploic foramen	LGF	MCQ
		Describe the various peritoneal pouches, recesses and ligaments	LGF	MCQ

	Stomach	Describe the gross structure of stomach		MCQ
		Describe the blood supply and lymphatic drainage of stomach		MCQ
		Describe the anatomy of stomach bed		MCQ
	Duodenum	Describe the gross structure and blood supply of duodenum		MCQ
		Write the relations of various parts of duodenum		MCQ
	Pancreas	Describe the gross structure of pancreas and its ductal system		MCQ
Histology	Stomach	Enumerate the different layers of the stomach wall		MCQ
		Write a note on gastric glands.		MCQ
		Differentiate between fundic and pyloric mucosa		MCQ

	Duodenum	Discuss histological features of duodenum and describe duodenal glands.	LGF	MCQ
	Pancreas	Describe the histology of pancreas	LGF	MCQ
		Differentiate histologically between exocrine and endocrine portions of pancreas	LGF	MCQ
Embryology	Development of foregut	Describe the development of stomach	LGF	MCQ
		Describe the development of duodenum	LGF	MCQ



		Enlist various developmental anomalies of stomach	LGF	MCQ
		Enlist various developmental anomalies of duodenum	LGF	MCQ
	Pancreas	Describe the development of pancreas	LGF	MCQ
		Enlist various anomalies of pancreas	LGF	MCQ
Physiology	Motor function of Stomach	Describe the motor function of stomach.	LGF	MCQ
		Describe basic electrical rhythm of the stomach wall	LGF	MCQ
		Describe Pyloric pump	LGF	MCQ
		Describe role of the pylorus in controlling stomach emptying	LGF	MCQ
		Describe the regulation of gastric emptying	LGF	MCQ

	Gastric secretion	Describe characteristics of the gastric secretions	LGF	MCQ
		Describe the mechanism of secretion of different gastric glands 22	LGF	MCQ
		Describe the phases and regulation of gastric secretion.	LGF	MCQ
		Enlist the hormones that inhibit and increase gastric secretions.	LGF	MCQ

		Enumerate the reflexes that inhibit and increase gastric secretions	LGF	MCQ
Biochemistry	Gastric secretions	Describe the chemical composition of gastric secretions	LGF	MCQ
		Describe the functions of HCl and other constituents of gastric secretions	LGF	MCQ
		Discuss the mechanism of synthesis and secretion of HCl from gastric mucosa	LGF	MCQ
		Discuss the mechanism of secretion and role of Intrinsic factor from gastric parietal cells	LGF	MCQ
Pathology	Peptic ulcer disease	Describe the mechanism of formation of peptic ulcers, its stages and complications	LGF	MCQ
		Describe the etiology, pathology and clinical presentation of gastric	LGF	MCQ

		Describe the mechanism of development, presentation and complications of acute pancreatitis	LGF	MCQ
Pharmacology	Drugs used in Peptic ulcer	Classify the drugs used in Peptic ulcer disease	LGF	MCQ
		Describe the mechanism of action of drugs used in Peptic ulcer	LGF	MCQ

Forensic Medicine	Poisons identification through gastric lavage	Enlist indications and contraindications for gastric lavage Describe the sampling technique of gastric lavage fluid	LGF	MCQ
Medicine	GERD and Peptic ulcer	Describe the etiology, clinical features, complications and drug treatment of GERD and peptic ulcer disease	LGF	MCQ
Surgery	Peptic ulcer	Describe the complications of long- term peptic ulcer disease and its surgical management	LGF	MCQ
	Lump in the abdomen	Describe common causes of lump in abdomen and enlist the common surgical procedures for treatment of hernia.	LGF	MCQ
	Acute pancreatitis	Describe the etiology, clinical features, complications and management of acute pancreatitis	LGF	MCQ

Theme 3: Jaundice

Subject	Topic	Learning objective	Teaching strategy	Assessment
Gross Anatomy	Liver	Describe the borders and surfaces of liver	Demo/SGD	MCQ
		Describe the visceral surface of liver	Demo/SGD	MCQ
		Describe the peritoneal reflections and associated ligaments of liver	Demo/SGD	MCQ
		Describe the lobes and segments of liver	Demo/SGD	MCQ
		Describe the blood supply of liver	LGF	MCQ
		Describe the hepato renal pouch of morrison and its clinical significance	LGF	MCQ
	Extra hepatobiliary apparatus	Describe the gross anatomy of gall bladder	Demo/SGD	MCQ
		Describe calot's triangle	LGF	MCQ

		Describe the gross anatomy of extra hepatic biliary tree	LGF	MCQ
	Spleen	Describe the gross anatomy of spleen and blood supply of spleen	LGF	MCQ
	Hepatic portal venous system	Describe the formation and tributaries / branches of hepatic portal venous system	LGF	MCQ
		Explain the clinical significance of hepatic portal system	LGF	MCQ
Embryology	Development of distal fore gut	Describe the development of liver	LGF	MCQ
		Describe the development of gall bladder and biliary tree	LGF	MCQ

		Describe the developmental anomalies of liver and biliary tree	LGF	MCQ
Histology	Liver	Discuss the histological features of liver	LGF	MCQ
		Describe liver parenchyma and general structural plan of the liver	LGF	MCQ
		Describe the histological features of the structures present in the portal triad	LGF	MCQ
	Spleen	Discuss the histological features of spleen	LGF	MCQ
		Differentiate between red pulp and white pulp	LGF	MCQ
Physiology		Describe the role of pancreatic secretions in digestion.	LGF	MCQ
	Pancreatic secretion	Describe the phases and regulation of pancreatic secretion	LGF	MCQ

	Physiology of liver	Describe Physiological Anatomy of the Liver	LGF	MCQ
		Describe blood flow through the liver	LGF	MCQ
		Describe metabolic functions of liver	LGF	MCQ
		Describe Regulation of Liver Mass— Regeneration	LGF	MCQ
		Describe Bilirubin formation and excretion	LGF	MCQ

	Secretion of bile by liver	Describe the mechanism of secretion of bile by the liver	LGF	MCQ
		Describe the function of bile salts in fat digestion and absorption	LGF	MCQ
		Describe functions of the biliary tree in digestion	LGF	MCQ
Biochemistry	Bile	Describe the constituents of bile	LGF	MCQ
		Describe the functions of bile	LGF	MCQ
		Describe the mechanism of gall stone formation	LGF	MCQ
Pathology	Acute/ chronic viral hepatitis	Describe the different viruses causing acute and chronic hepatitis	LGF	MCQ
		Describe the pathogenesis, stages and clinical presentation of liver cirrhosis	LGF	MCQ

Pharmacology	First pass hepatic metabolism of drugs	Describe the mechanism of drugs detoxification and metabolism in the liver	LGF	MCQ
	Hepatotoxic drugs	Enlist some of the commonly used hepatotoxic drugs and their ³¹	LGF	MCQ

Forensic Medicine	Hepatotoxic poisons	Enlist the poisons which cause hepatotoxicity Diagnose poisoning through routine toxicological sampling	LGF	MCQ
Community Medicine	Hepatitis B and C virus infection	Describe the epidemiology of hepatitis B and C virus infection and its control measures	LGF	MCQ
		Describe water borne hepatitis (Hepatitis A and E) viruses and its control measures	LGF	MCQ
Medicine	Liver cirrhosis	Describe the etiology, clinical features, complications and treatment options of liver cirrhosis	LGF	MCQ
Surgery	Obstructive jaundice	Describe the etiology, clinical features, biochemical investigations and treatment options of obstructive jaundice	LGF	MCQ

Theme 4: Diarrhoea and Constipation

Subject	Topic	Learning objective	Teaching strategy	Assessment
Gross Anatomy	Jejunum and ileum	Describe the gross features of jejunum and ileum	LGF	MCQ
		Tabulate differences in gross features and blood supply of jejunum and ileum	LGF	MCQ
	Mesenteries	Describe the mesentery of small intestine	LGF	MCQ
	Appendix	Describe the gross features, blood supply and mesentery of appendix	Demo/SGD	MCQ
		Describe the clinical correlates of appendix	LGF	MCQ
	Abdominal aorta	Enumerate the branches of abdominal aorta.	Demo/SGD	MCQ
		Describe the course and distribution of celiac trunk	LGF	MCQ

		Describe the course and distribution of superior mesenteric artery	LGF	MCQ
		Describe the course and distribution of inferior mesenteric artery	LGF	MCQ
	Inferior vena cava	Describe the origin, ³⁴ course, tributaries and relations of inferior vena cava	LGF	MCQ
	Lymphatic drainage	Describe the origin, course and relations of citerna chili	LGF	MCQ
		Describe the lymphatic drainage of abdominal organs	LGF	MCQ

Embryology	Development of midgut	Describe the formation and rotation of midgut loop	LGF	MCQ
		Describe the physiological herniation of midgut loop	LGF	MCQ
		Enlist the derivatives of midgut loop	LGF	MCQ
		Describe the development of mesenteries	LGF	MCQ
		Describe the various anomalies of midgut development	LGF	MCQ
Histology	Jejunum and ileum	Discuss histological features of jejunum and describe plica circulares.	LGF	MCQ
		Discuss histological features of ileum and describe Payers patches.	LGF	MCQ
		Discuss the various structural specializations meant for increasing the surface area of small intestine (plica circulares, crypts of lieburkhun, villi and microvilli)	LGF	MCQ

	Appendix	Discuss histological features of appendix.	LGF	MCQ
Physiology	Movements of the	Describe different types of movements of small 36	LGF	MCQ
		Describe the control of peristalsis by nervous and hormonal signals	LGF	MCQ
	Secretion of small	Describe secretion of mucus by Brunner's	LGF	MCQ

	Pancreatic enzymes	Describe the chemistry, secretion, functions and regulation of pancreatic enzymes	LGF	MCQ
	Intestinal digestive enzymes	Describe the chemistry, secretion, functions and regulation of small intestinal digestive enzymes	LGF	MCQ
		Describe secretion of intestinal digestive juices by the crypts of Lieberkühn	LGF	MCQ
	Gastrointestinal hormones	Describe the secretion, structure, functions and regulation of Gastrin, Secretin, Cholecystokinin's and other GI hormones	LGF	MCQ
	Disorders of small intestine	Describe abnormal digestion of food in the small intestine in pancreatic failure	LGF	MCQ
		Describe mal absorption by the small intestinal mucosa in Sprue	LGF	MCQ
Biochemistry	Pancreatic secretions	Describe the composition of pancreatic secretions	LGF	MCQ
		Describe the mechanism of secretion and actions of pancreatic enzymes	LGF	MCQ
		Describe the mechanism of synthesis of Bicarbonates	LGF	MCQ

	Digestion and absorption	Describe the mechanism of digestion and absorption of fats in the intestines	LGF	MCQ
	Nutritional disorders	Define Protein energy malnutrition associated clinical conditions	LGF	MCQ
Community Medicine	Food borne diseases	Describe the epidemiology of food borne diseases	LGF	MCQ
	Adipose tissue	Describe the mechanism of digestion and absorption of proteins in the intestines	LGF	MCQ
Pharmacology	Anti-diarrheal drugs	Classify anti-diarrheal drugs and their mechanism of action	LGF	MCQ
Pediatrics	Acute gastroenteritis	Describe the aetiology, clinical features and management of acute gastroenteritis	LGF	MCQ
	Chronic constipation	Classify drugs used in constipation and describe their mechanism of action	LGF	MCQ
		Describe the mechanism of absorption of Iron, Vitamin-B12 and Folate in the intestines	LGF	MCQ
	Energy requirement of human body	Discuss the daily energy requirement of a human body in health and disease	LGF	MCQ
		Define BMR	LGF	MCQ
		Enlist the causes of high and low BMR	LGF	MCQ
		Describe the daily requirements of common vitamins, Iron, Calcium, Iodine and other minerals	LGF	MCQ

Theme 5: Bleeding Per Rectum

Subject	Topic	Learning objective	Teaching strategy	Assessment
Gross Anatomy	Large intestine	Describe the gross features of cecum, ascending, transverse and descending and sigmoid colon	Demo/SGD	MCQ
		Describe the mesentery of large intestine	Demo/SGD	MCQ
		Describe the gross anatomy of rectum	Demo/SGD	MCQ
		Describe the gross anatomy of anal canal	Demo/SGD	MCQ
		Describe the blood supply of anal canal and its clinical correlates.	LGF	MCQ
		Describe the boundaries and contents of Ischiorectal (anal) fossa	LGF	MCQ
Embryology	Development of hind gut	Describe the partitioning of cloaca	LGF	MCQ

		Enlist the derivatives of hind gut	LGF	MCQ
		Enlist the developmental anomalies of hindgut	LGF	MCQ
Histology	Colon	Discuss the histological features of colon	LGF	MCQ
		Describe the characteristic features of intestinal glands	LGF	MCQ
	Rectum	Describe the histological features of Rectum	LGF	MCQ
Physiology	Movements of the Colon	Describe different types of movements of colon	LGF	MCQ
		Describe gastro-colic reflex and duodeno-colic reflexes	LGF	MCQ
		Describe the mechanism of defecation reflex	LGF	MCQ
	Secretion of Large Intestine	Describe secretion of mucus by the large intestine	LGF	MCQ

	Disorders of Large intestine	Describe constipation, megacolon	LGF	MCQ
		Explain mechanism of diarrhea and its causes.	LGF	MCQ
		Explain paralysis of defecation in spinal cord injuries	LGF	MCQ
	General Disorders of the gastrointestinal tract	Describe the mechanisms of Vomiting and Nausea	LGF	MCQ
		Describe Vomiting Act	LGF	MCQ
		Describe Gastrointestinal Obstruction	LGF	MCQ
		Describe gases in the gastrointestinal	LGF	MCQ

Metabolism

Subject	Topic	Learning objective	Teaching strategy	Assessment
Theme-6: Glucose control (Carbohydrate metabolism)				
Biochemistry	Oxidative Phosphorylation	Describe the generation of proton gradient & the resultant motive force across the inner mitochondrial membrane by transport of electrons through ETC which in turn produces ATP by oxidative phosphorylation	LGF	MCQ
		Describe the structure of ATP synthase enzyme(complex-V) & explain how it works as a rotary motor to synthesize ATP from ADP & Pi	LGF	MCQ
	Respiratory Chain Inhibitors &	Describe the control of the rate of respiration, oxidation of reducing equivalents via ETC & its tightly coupling with oxidative phosphorylation in mitochondria	LGF	MCQ
		Discuss certain common poisons which block respiration or oxidative phosphorylation & identify their site of action	LGF	MCQ
Biochemistry	Intestinal juices	Describe the composition of intestinal juices	LGF	MCQ
Pathology	Carcinoma of colon and Rectum	Describe the etiology, histological findings, clinical presentation and staging of carcinoma of colorectal carcinoma	LGF	MCQ
Surgery	Colorectal malignancies	Describe the etiology, clinical features, investigations and management of colorectal cancers	LGF	MCQ

		Explain how uncouplers act as poisons by dissociating oxidation from oxidative phosphorylation via ETC but at the same time they may have a physiological role in generating body heat	LGF	MCQ
	Glycolysis	Define Glycolysis	LGF	MCQ
		Describe the entry of glucose into different kinds of cells through various GLUT transporters	LGF	MCQ
		Describe the reactions of glycolysis	LGF	MCQ
		Describe the transportation of NADH to Mitochondria via various Shuttles	LGF	MCQ
		Describe the energetics of glycolysis	LGF	MCQ
		Describe the fates of pyruvate	LGF	MCQ
		Describe the types of glycolysis especially the anaerobic glycolysis	LGF	MCQ
		Describe the key enzymes and regulation of glycolysis	LGF	MCQ
		Discuss the glycolysis in RBC	LGF	MCQ
		Describe the biomedical Significance and clinical disorders of glycolysis	LGF	MCQ
		Discuss glycolysis in cancer cells	LGF	MCQ
	Oxidation of Pyruvate	Describe the conversion of pyruvate into acetyl CoA	LGF	MCQ

		Enumerate the enzymes & coenzymes of PDH complex	LGF	MCQ
		Describe the sequence of reactions catalyzed by PDH complex.	LGF	MCQ
		Describe the regulation of PDH complex	LGF	MCQ
		Discuss the clinical aspects of PDH complex especially the congenital lactic acidosis	LGF	MCQ
	Tricarboxylic Acid Cycle	Define citric acid cycle	LGF	MCQ
		Describe the sources of acetyl CoA in mitochondria	LGF	MCQ
		Describe the reactions of TCA	LGF	MCQ
		Discuss the energetics of TCA	LGF	MCQ
		Discuss the energy yield of one molecule of glucose when it is converted into carbon dioxide and water	LGF	MCQ
		Name the vitamins that play key role in TCA	LGF	MCQ
		Describe the amphibolic nature of TCA	LGF	MCQ
		Discuss the regulation of TCA	LGF	MCQ
	Hexose Mono Phosphate shunt	Discuss the Role of Pentose Phosphate Pathway	LGF	MCQ
		Name the tissues where Hexose Mono Phosphate shunt occurs	LGF	MCQ
		Describe the reactions of the two parts of Hexose Mono Phosphate shunt	LGF	MCQ
		Describe the Role of thiamine in Hexose Mono Phosphate shunt	LGF	MCQ



		Enumerate the Similarities & differences b/w glycolysis and HMP shunt pathway	LGF	MCQ
		Discuss the functions of NADPH (produced in Hexose Mono Phosphate shunt) in various tissues and cells	LGF	MCQ
		Discuss G6PD deficiency and its effects in various tissues and cells	LGF	MCQ
		Describe the regulation of HMP shunt pathway	LGF	MCQ
	Uric Acid Pathway	Enumerate the products of Uric acid pathway and their importance	LGF	MCQ
		Discuss why ascorbic acid is vitamin for humans	LGF	MCQ
	Galactose Metabolism	Describe the uses & requirements of galactose in the body	LGF	MCQ
		Enumerate the inhibitors of TCA and their sites of inhibition	LGF	MCQ
	Gluconeogenesis	Define Gluconeogenesis	LGF	MCQ
		Name the organs and sub cellular location where Gluconeogenesis	LGF	MCQ
		Describe the substrates or precursors of Gluconeogenesis	LGF	MCQ
		Describe the three bypass reactions	LGF	MCQ
		Describe the Gluconeogenesis from Fatty Acids	LGF	MCQ
		Discuss the Cori's cycle	LGF	MCQ
		Discuss the regulation of Gluconeogenesis	LGF	MCQ

		Name the key enzymes of Gluconeogenesis	LGF	MCQ
		Discuss the various reactions with enzymes involved	LGF	MCQ
		Describe the Genetic Deficiencies of Enzymes in Galactose Metabolism and their effects	LGF	MCQ
	Fructose Metabolism	Describe the Main source of Fructose	LGF	MCQ
		Discuss the various reactions with enzymes involved	LGF	MCQ
		Discuss the various reactions with enzymes involved	LGF	MCQ
		Describe the Genetic Deficiencies of Enzymes in Galactose Metabolism and their effects	LGF	MCQ
	Glycogen Metabolism	Describe the structure and functions of the glycogen especially the significance of its polymer	LGF	MCQ
		Describe the Difference between Liver & muscle glycogen	LGF	MCQ
		Describe the synthesis of glycogen by two mechanisms with its enzymes	LGF	MCQ
		Discuss the breakdown of glycogen with its enzymes	LGF	MCQ
		Describe the Regulation of Glycogen metabolisms	LGF	MCQ
		Discuss the glycogen storage diseases with deficient enzymes and cardinal clinical features	LGF	MCQ

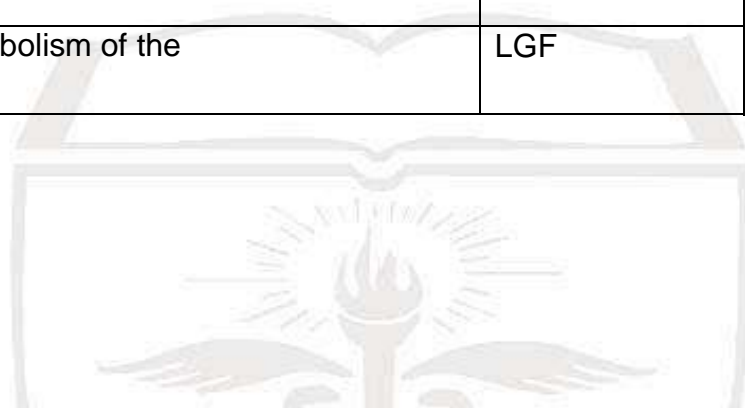
subject	Topic	Learning objectives	Teaching strategy	Assessment
Theme 7: Obesity (Fat metabolism)				
Biochemistry	Fatty acid (FA) synthesis (<i>De Novo</i>)	Enumerate the organs where fatty acid synthesis occurs with sub cellular sites	LGF	MCQ
		Discuss the source of Acetyl CoA that will be used for FA synthesis with reason	LGF	MCQ
		Discuss how acetyl CoA comes out of mitochondria for the synthesis of FA	LGF	MCQ
		Describe the steps of FA synthesis with enzymes	LGF	MCQ
		Describe the FA synthase enzyme with its structure and components	LGF	MCQ
		Describe the product of FA synthase and the subsequent fate of this product	LGF	MCQ
		Discuss the regulation of FA synthesis	LGF	MCQ
		Discuss why animals cannot convert fatty acids into glucose	LGF	MCQ
		Describe the further elongation and desaturation of FA	LGF	MCQ

		Enumerate the various methods of oxidation of FA	LGF	MCQ
		Discuss the stages of beta oxidation with its reactions	LGF	MCQ
		Calculate the no. of ATP obtained when one molecule of palmitic acid is oxidized completely	LGF	MCQ
		Describe the genetic deficiencies of FA oxidation i.e. MCAD & CAT deficiencies with their hallmarks	LGF	MCQ
		Discuss the oxidation of odd-chain FA	LGF	MCQ
		Compare the processes of FA synthesis with FA oxidation	LGF	MCQ
	Metabolism of Ketone bodies	Enumerate the ketone bodies	LGF	MCQ
		Define ketogenesis	LGF	MCQ
		Describe the steps of ketogenesis	LGF	MCQ
		Discuss the energy yield during ketogenesis in liver	LGF	MCQ
		Enumerate the conditions in which there is increased ketogenesis	LGF	MCQ
		Discuss utilization of ketone bodies	LGF	MCQ

		Discuss the energy yield in ketone bodies utilization in extra hepatic tissues	LGF	MCQ
		Describe the regulation of ketogenesis in well-fed healthy conditions, during early stages of starvation & in prolonged starvation	LGF	MCQ
		Discuss the ketoacidosis in diabetes	LGF	MCQ
	Complex Lipid metabolism	Describe the synthesis of triacylglycerol by two mechanisms	LGF	MCQ
		Describe the synthesis of phosphatidic acid	LGF	MCQ
		Enumerate the substances formed from phosphatidic acid	LGF	MCQ
		Describe the synthesis of glycerophospholipids	LGF	MCQ
		Discuss the degradation of glycerophospholipids	LGF	MCQ
		Describe the synthesis of ceramide and sphingophospholipids (shingomyelin)	LGF	MCQ
		Discuss the degradation of shingomyelin	LGF	MCQ
		Discuss Niemann-Pick disease with its cardinal clinical features	LGF	MCQ



		Discuss Farber disease with its cardinal clinical features	LGF	MCQ
		Describe the synthesis of glycosphingolipids	LGF	MCQ
		Describe the degradation of glycosphingolipids	LGF	MCQ
		Describe the abnormalities of phospholipid metabolism i.e. true demyelinating diseases and sphingolipidosis	LGF	MCQ
	Eicosanoid metabolism	Define eicosanoids and describe their two classes	LGF	MCQ
		Describe the synthesis of prostanoids by cyclo-oxygenase pathway	LGF	MCQ
		Enumerate the two isomers of cyclo-oxygenase with their inhibition	LGF	MCQ
		Discuss why low dose aspirin therapy is used in strokes and heart attacks	LGF	MCQ
		Describe biochemical reason for the adverse effects of NSAIDs & steroids	LGF	MCQ
		Describe the catabolism of the prostanoids	LGF	MCQ



		Describe the lipoxygenase pathway for synthesis of Leukotrienes and lipoxins	LGF	MCQ
		Describe the synthesis of leuktriene biosynthesis inhibition	LGF	MCQ
		Enumerate the leukotriene receptor antagonists	LGF	MCQ
	Metabolism of cholesterol	Describe the major sites of cholesterol synthesis as well as sub cellular sites	LGF	MCQ
		Describe the source of cholesterol synthesis	LGF	MCQ
		Describe the various steps of cholesterol synthesis	LGF	MCQ
		Discuss the regulation of cholesterol synthesis	LGF	MCQ
		Enumerate the inhibitors of HMG CoA reductase inhibitors	LGF	MCQ
		Describes the degradation and excretion of cholesterol with synthesis of bile acids, their conjugation, bile salt formation and micelle formation in lumen of the intestine	LGF	MCQ
		Discuss the enterohepatic circulation of bile salts	LGF	MCQ
		Discuss the role of bile acid sequestrants i.e. cholestyramine and dietary fiber	LGF	MCQ
		Discuss the regulation of bile acid synthesis	LGF	MCQ

	Metabolism of lipoproteins		Describe the structure of a typical lipoprotein particle	LGF	MCQ
			Enumerate the various classes of LP	LGF	MCQ
			Enumerate the functions of apolipoproteins	LGF	MCQ
			Describe the steps of chylomicrons' metabolism	LGF	MCQ
			Describe the metabolism of VLDL	LGF	MCQ
			Describe the metabolism of LDL	LGF	MCQ
			Describe the metabolism of HDL	LGF	MCQ
	Disturbances of Lipid metabolism		Differentiate between hyperlipidemia and dyslipidemia	LGF	MCQ
			Describe the Classification of hyperlipidemia with enzyme deficiency	LGF	MCQ
Medicine	Hyperlipidemias		Describe the epidemiology, preventive strategies and diseases associated with hyperlipidemias	LGF	MCQ

Theme 8: Wasting (Protein metabolism)

Subject	Topic	Learning objective	Teaching strategy	Assessment
Biochem	Amino acid pool & chemical processes for dissimilation of proteins	Discuss how amino acid pool is formed	LGF	MCQ
		Discuss the chemical processes responsible for dissimilation of proteins: transamination, deamination and trans deamination	LGF	MCQ
	Discuss the clinical importance of transaminases		LGF	MCQ
Ammonia transport and effects of ammonia toxicity on brain	Discuss how ammonia is formed in various tissues and transported to liver Discuss the effects of ammonia toxicity in brain		LGF	MCQ
Urea cycle & its associated inherited disorders	Describe The Krebs-Henselet Cycle of Urea Formation in Liver		LGF	MCQ
	Describe the clinical significance of various enzymes involved in urea formation		LGF	MCQ

Metabolism of aromatic amino acids	Discuss biosynthesis, fate, metabolic functions and related inherited disorders of aromatic amino acids	LGF	MCQ
Metabolism of sulphur containing amino acids	Discuss biosynthesis, fate, metabolic functions and related inherited disorders of sulphur containing amino acids	LGF	MCQ
Metabolism of individual amino acids	Discuss biosynthesis, fate, metabolic functions and related inherited disorders of branched chain amino acids	LGF	MCQ
Purine nucleotide metabolism	Enumerate purine and Pyrimidine bases serine, and alanine	LGF	MCQ
	Describe the steps of de novo synthesis of the parent purine nucleotide i.e Inosine mono phosphate (IMP)	LGF	MCQ
	Discuss the conversion of IMP to AMP & GMP	LGF	MCQ
	Describe the regulation of purine synthesis	LGF	MCQ
	Describe the salvage pathway of purine synthesis with its regulation	LGF	MCQ
	Describe Lesch-Nyhan syndrome with its cardinal clinical features	LGF	MCQ
	Discuss the anti-metabolites of purine nucleotides i.e purine analogs, amino acid analogs & folic acid analogs	LGF	MCQ
	Enumerate the synthetic inhibitors of purine synthesis with their mechanisms	LGF	MCQ
	Discuss the synthesis of deoxy ribonucleotides	LGF	MCQ
	Describe the mechanism of action of ribonucleotide reductase with its inhibitors	LGF	MCQ

		Describe the degradation of purine nucleotides	LGF	MCQ
		Describe the fate of adenine	LGF	MCQ
		Describe why the average serum level of uric acid in humans is close to the solubility limit	LGF	MCQ
		Discuss the diseases associated with purine degradation i.e. gout	LGF	MCQ
		Describe the types of gout	LGF	MCQ
		Discuss why allopurinol is used in the treatment of gout	LGF	MCQ
		Discuss adenosine deaminase deficiency	LGF	MCQ
	Pyrimidine nucleotide metabolism	Discuss the steps of de novo Pyrimidine synthesis	LGF	MCQ
		Discuss the synthesis of thymidine mono phosphate from deoxy uridine mono phosphate with its inhibition	LGF	MCQ
		Describe the salvage pathway of pyrimidines	LGF	MCQ
		Describe the degradation of Pyrimidine nucleotides	LGF	MCQ
		Discuss the abnormalities of Pyrimidine metabolism	LGF	MCQ
		Discuss Orotic aciduria	LGF	MCQ

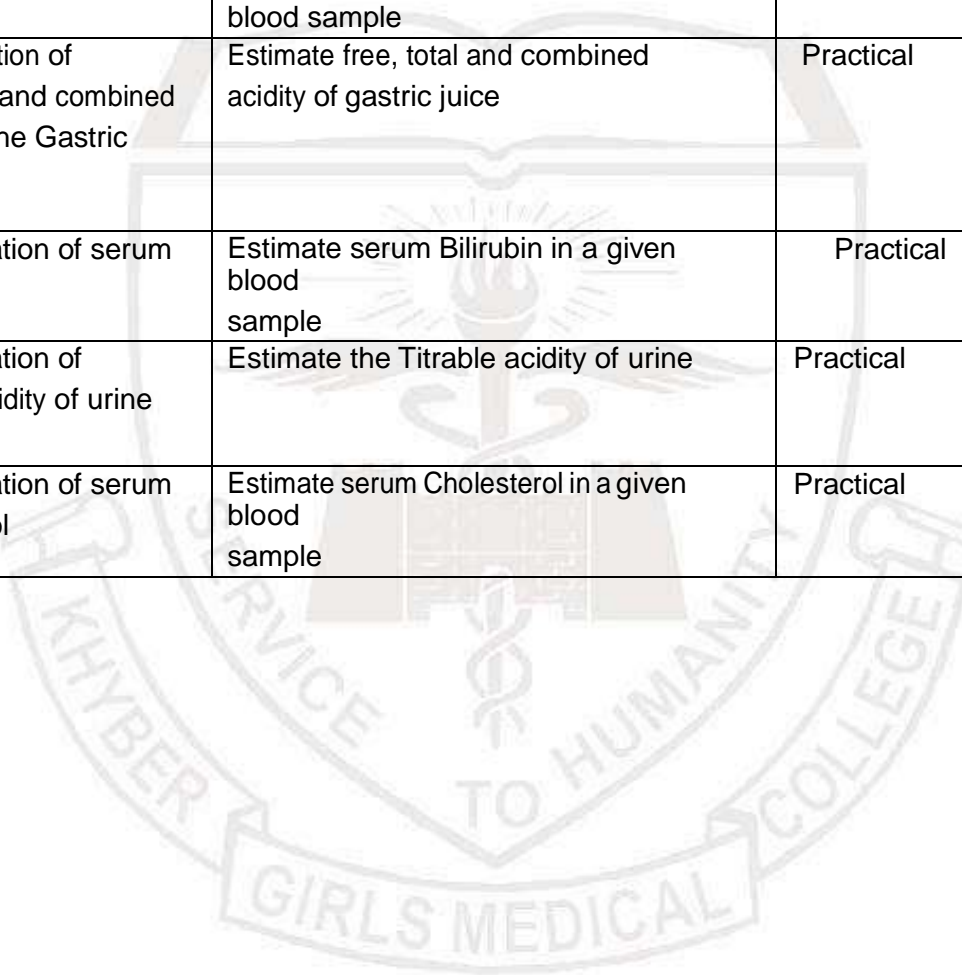
		Discuss the regulation of Pyrimidine metabolism	LGF	MCQ
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List of practical works

Subject	Topic	Learning objectives	Teaching strategy	Assessment
Histology	Lips and tongue	Identify the histological features of lips and tongue under the microscope	Practical	MCQ
	Esophagus	Identify the histological features of esophagus under the microscope	Practical	MCQ
	Stomach	Identify the histological features of stomach under the microscope	Practical	MCQ
	Duodenum	Identify the histological features of duodenum under the microscope	Practical	MCQ
	Liver	Identify the histological features of liver under the microscope	Practical	MCQ
	Gall bladder	Identify the histological features of gall bladder under the microscope	Practical	MCQ
	Jejunum and Ileum	Identify the histological features of Jejunum and Ileum under the microscope	Practical	MCQ
	Appendix	Identify the histological features of Appendix under the microscope	Practical	MCQ
	Colon and Rectum	Identify the histological features of Colon and Rectum under the microscope	Practical	MCQ

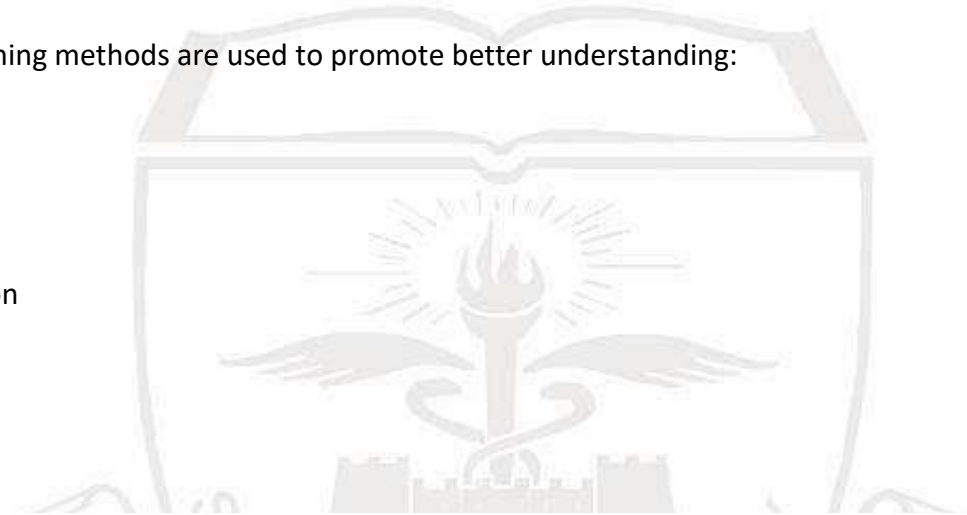
Physiology	Examination of abdomen	Examine a standardized patient`s abdomen	Practical	OSPE
Biochemistry	Determination of plasma proteins	Estimate the plasma proteins in a given blood sample	Practical	OSPE
	Determination of free, total and combined acidity of the Gastric juice	Estimate free, total and combined acidity of gastric juice	Practical	OSPE
	Determination of serum Bilirubin	Estimate serum Bilirubin in a given blood sample	Practical	OSPE
	Determination of Titrable acidity of urine	Estimate the Titrable acidity of urine	Practical	OSPE
	Determination of serum cholesterol	Estimate serum Cholesterol in a given blood sample	Practical	OSPE



Teaching and learning strategies:

The following teaching / learning methods are used to promote better understanding:

- Interactive Lectures
- Hospital / Clinic visits
- Small Group Discussion
- Skills session
- Self-Directed Study



Interactive lectures:

An interactive lecture is an easy way for instructors to intellectually engage and involve students as active participants in a lecture-based class of any size. Interactive lectures are classes in which the instructor breaks the lecture at least once per class to have students participate in an activity that lets them work directly with the material.

- The instructor might begin the interactive segment with an engagement trigger that captures and maintains student attention.
- Then the instructor incorporates an activity that allows students to apply what they have learned or give them a context for upcoming lecture material.

As the instructor feels more comfortable using interactive techniques he or she might begin to call upon a blend of various interactive techniques all in one class period.

Hospital / Clinic visits:

In small groups, students observe patients with signs and symptoms in hospital or clinical settings. This helps students to relate knowledge of basic and clinical sciences of the relevant module.

Small group discussion (SGD):

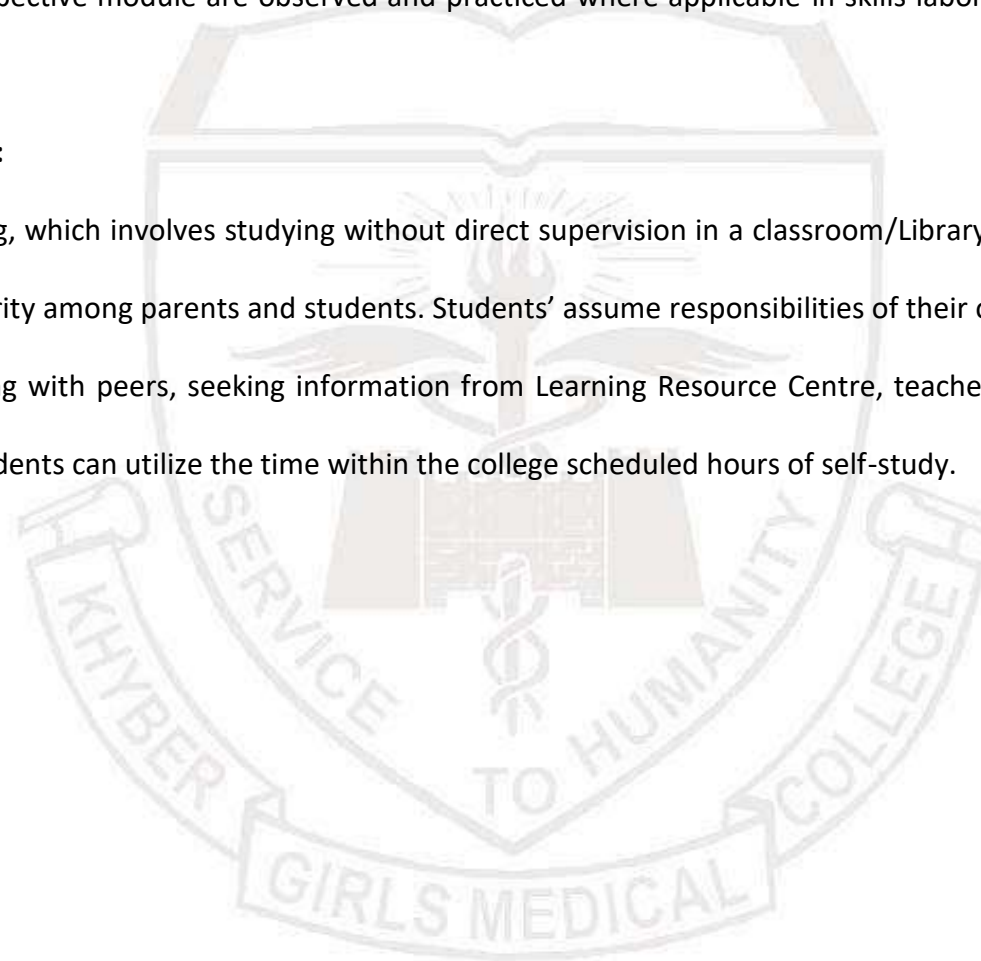
The shy and less articulate are more able to contribute. Students learn from each other. Everyone gets more practice at expressing their ideas. A two way discussion is almost always more creative than individual thoughts. Social skills are practiced in a 'safe' environment e.g. tolerance, cooperation. This format helps students to clarify concepts acquire skills or attitudes. Students exchange opinions and apply knowledge gained from lectures, tutorials and self-study. The facilitator role is to ask probing questions, summarize, or rephrase to help clarify concepts.

Skills/Practical session:

Skills relevant to respective module are observed and practiced where applicable in skills laboratory or Laboratories of various departments.

Self-Directed learning (SDL):

Self-directed learning, which involves studying without direct supervision in a classroom/Library, is a valuable way to learn and is quickly growing in popularity among parents and students. Students' assume responsibilities of their own learning through individual study, sharing and discussing with peers, seeking information from Learning Resource Centre, teachers and resource persons within and outside the college. Students can utilize the time within the college scheduled hours of self-study.



Time tables:

The timetables for the module will be shared via Edmodo and the notice boards in advance.

Assessment tools:

Theoretical knowledge is tested by a written examination system constituted by multiple choice questions (MCQs). The assessment of practical knowledge involves oral, spot, or objective structured practical examinations (OSPE).

Multiple Choice Questions (MCQs):

- Multiple choice questions (MCQs) are a form of assessment for which students are asked to select the best choice from a list of answers.
- MCQ consists of a stem and a set of options. The stem is usually the first part of the assessment that presents the question as a problem to be solved; the question can be an incomplete statement which requires to be completed and can include a graph, a picture or any other relevant information. The options are the possible answers that the student can choose from, with the correct answer called the key and the incorrect answers called distractors.
- Correct answer carries one mark, and incorrect 'zero mark'. There is NO negative marking.

- ✓ Students mark their responses on specified computer-based sheet designed for the college.
- ✓ The block exam will comprise of 120 MCQs and will be compiled according to the shared blueprint.

Objective Structured Practical Examination (OSPE)

- ✓ The content may assess application of knowledge, or practical skills.
- ✓ Student will complete task in define time at one given station.
- ✓ All the students are assessed on the same content by the same examiner in the same allocated time.
- ✓ A structured examination will have observed, unobserved, interactive and rest stations.
- ✓ Observed and interactive stations will be assessed by internal or external examiners.
- ✓ Unobserved will be static stations in which students will have to answer the questions related to the given pictures, models or specimens the provided response sheet.
- ✓ Rest station is a station where there is no task given, and in this time student can organize his/her thoughts.
- ✓ The Block OSPE will be comprise of 18 examined station and 7 rest stations. The stations will be assigned according to the shred blueprint.

Internal Evaluation:

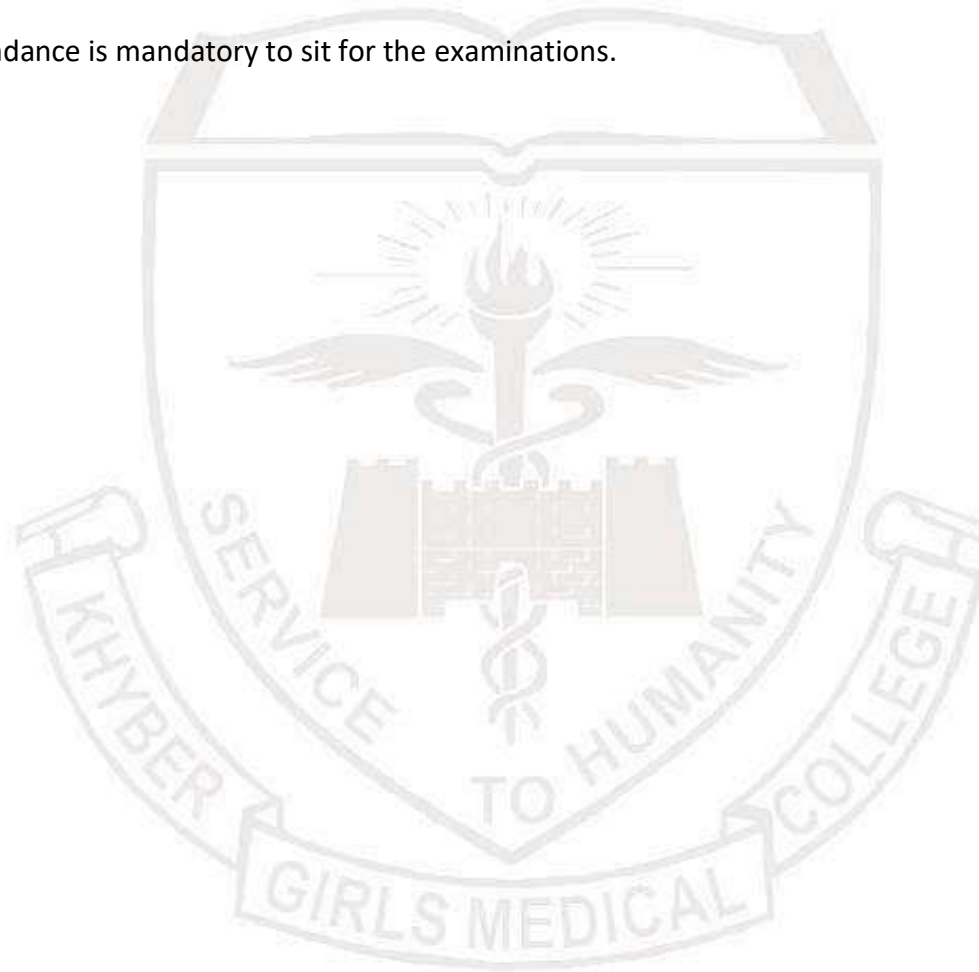
Internal evaluation is a process of quality review undertaken within an institution for its own ends. 10% marks of internal evaluation will be added to final marks. This 10% will be based on

Distribution of 13 Marks for block E paper	
Marks obtained	Average of Percentage in Block exam and Pre Professional exam.

Distribution of 10 Marks for Block E OSPE/OSPE	
Marks obtained	Average of percentage in Block OSPE Exam and Block Pre Prof OSPE
	Practical copies

Attendance Requirement:

More than 75% attendance is mandatory to sit for the examinations.



Learning resources for students

Anatomy

- Snell Neuroanatomy
- B.D Churasia
- Nelter Atlas
- Langman embryology

Physiology

- ✓ Guyton and Hall physiology
- ✓ Ganong physiology
- ✓ Human Physiology from cells to system by lauree sherwood
- ✓ BRS Physiology
- ✓ Neuroscience by Dale Purves

Biochemistry

Chatterjee text book of Biochemistry
Harpers Biochemistry
Lippincotts Biochemistry
Satya Narayan biochemistry
Keithmore embryology
Laiq Hassain Basic Histology
Difore Atlas Histology

Apart from these resource learning ,students can consult books available in library or recommended by the specialty expert

