JINNAH SINDH MEDICAL UNIVERSITY

STUDY GUIDE	
PROGRAM	**MBBS**
MODULE TITLE	**Respiratory system -1**
ACADEMIC YEAR	**1st year MBBS, 2026**
INTRODUCTION	The first module on Respiratory system has been planned to provide insight of basic concepts regarding the structural and functional knowledge of respiratory system. This module links with Respiratory 2 module in Spiral-II where the students appreciate and link the basics with the applied aspects.
RATIONALE	Respiratory diseases are a major cause of morbidity and mortality globally as well as in Pakistan. Hence it becomes imperative for institutions to provide detailed and clinically relevant information related to the normal structure and function of the respiratory tract to its students. This will help the students to understand the basis of respiratory system-related disorders which they will come across in their clinical postings.
OUTCOMES	By the end of this module the students will be able to describe the development, structures and functions of various parts of the respiratory system.
DEPARTMENTS INVOLVED	1. Anatomy 2. Biochemistry 3. Physiology
MODULE OBJECTIVES	By the end of the module, students will be able to:
LECTURES ANATOMY	**1. Introduction to thoracic cage, thoracic inlet, and gross anatomy of diaphragm**

	• Describe the thoracic cage and its boundaries • Describe thoracic Inlet and thoracic outlet • Discuss intercostal muscles and their neuro-vasculature • Describe supra-pleural membrane and endo-thoracic fascia • Describe the position & component of muscular & tendinous part of diaphragm • Describe the attachments of diaphragm • Describe the blood supply and nerve supply of diaphragm • Describe the opening present in the diaphragm and their respective levels • Enumerate the structures passing through the openings and piercing the diaphragm • List the functions of diaphragm **2. Thoracic vertebrae & joints of thoracic wall** • Describe general features of vertebral column • Describe spinal curvature in children and adults • Discuss general characteristics of a vertebra and general features of thoracic vertebrae • Differentiate typical and atypical vertebrae • Discuss joints formed by thoracic vertebrae, general features of intervertebral joints, and costovertebral joints • Enumerate the diseases related to vertebral column (scoliosis, lordosis, disc prolapse) • Describe the features of diseases related to thoracic vertebrae **3. Thoracic wall muscles & fascia of thoracic wall & movements** • Describe the layers of thoracic wall • Describe the attachment of muscles of thoracic wall, their actions & nerve supply • Describe the arrangement & modifications of fascia
	4. Neurovascular supply of thoracic wall

	• Describe the nerve supply of skin, fascia and muscles of thoracic wall • Describe the origin and course of arteries, and nerves supplying the thoracic wall • Explain the venous drainage of thoracic wall and its communications **5. Mediastinum, its divisions and contents of superior and anterior mediastinum** • Define mediastinum • Describe the divisions of mediastinum • Define the extent and boundaries of mediastinum • Describe the boundaries of superior mediastinum • List the contents of superior mediastinum • Describe origin, extent and termination of aorta • Describe the extent, branches and relations of Aorta within the superior mediastinum • Explain the tributaries of superior vena cava within the superior mediastinum • Discuss the nerves present in the superior mediastinum • Describe the major viscera present in superior mediastinum • Describe the boundaries and contents of anterior mediastinum **6. Posterior Mediastinum-I (Thoracic Aorta, Esophagus & Azygous System of vein)** • Describe the boundaries of posterior mediastinum • List the contents of posterior mediastinum • Describe the extent and position of thoracic aorta in posterior mediastinum
	• Enumerate the branches of thoracic aorta

	• Describe the length, extent and relations of esophagus • Describe the blood supply, nerve supply, venous drainage, & lymphatics of esophagus • Discuss the clinical significance of anatomical constrictions of esophagus • Define Azygos system of veins • Describe the formation, course, relations and tributaries of azygos, Hemi-azygos & Accessory hemi-azygos veins • Discuss variations in the origin of azygos vein • Discuss the clinical importance of Azygos system of veins **7. Posterior mediastinum-II (Thoracic sympathetic trunk, thoracic duct, Phrenic and Vagus nerve)** • Discuss the thoracic part of sympathetic chain, ganglia, and branches • Describe the origin, intrathoracic course and branches of Vagus & Phrenic nerves • Describe origin, extent, tributaries, territory of drainage &termination of thoracic duct **8. Introduction to respiratory tract (Gross anatomy of pleura)** • Enumerate the parts of respiratory tract • Describe the clinical (upper and lower respiratory tract) and anatomical (Conducting and respiratory) divisions of respiratory tracts • Describe parietal and visceral pleura and its innervation • Describe arrangement of pleura according to lines of orientation (mid sternal, mid clavicular and axillary etc) • Discuss clinical anatomy of pleura (related to effusion and pleural tap etc.)
	• Name the diseases related to pleura • Summarize the features of diseases related to pleura

	9. Neuro-vasculature of lungs, bronchial & pulmonary vessels, & lymphatics of thorax • Describe the origin, course and termination of bronchial vessels and their territory of supply/ drainage • Discuss the origin, course and termination of pulmonary vessels and their functions • Describe the nerve supply of lungs • Describe the different groups of lymph nodes in thorax • Discuss the deep as well as the superficial lymphatics of thorax • Discuss the significance of lymphatics drainage of thorax **10. Histology of respiratory epithelium and its variations** • Name the types of epithelia lining the various parts of respiratory system • Explain the histological features of various parts of respiratory system **11. Histology of trachea and lung** • Describe the histological features of different layers of trachea • Describe the divisions of bronchial tree • Discuss the structural variations in different parts of bronchial tree • Describe the structure of alveoli and intermalleolar septum • Relate the functions of different type of cells, forming the alveolar wall • Describe the structure and function of blood -air barrier
	12. Development of body cavities and diaphragm, and their anomalies • Define the intra-embryonic mesoderm and its parts • Discuss the divisions of lateral plate mesoderm into visceral and

	parietal layers enclosing intraembryonic coelom • Describe the Cephalo-caudal and transverse folding of embryonic disc • Specify the extent of intraembryonic coelom after folding and its divisions into three serous cavities • Discuss the formation of Pleuro-pericardial and Pleuro-peritoneal membranes • Define embryonic components of diaphragm (Septum Transversum etc.) • Discuss the steps of development of diaphragm from its composite embryonic derivatives • Discuss anomalies related to its development **13. Development of respiratory system and its anomalies** • Discuss the formation of Laryngo-tracheal groove & respiratory diverticulum or Lung Bud • Describe the branching of primitive bronchi • Discuss the stages of development / maturation of Lungs • Name the congenital anomalies of respiratory system (tracheoesophageal fistula etc.) • Describe the main features of the common congenital anomalies **14. Cross sectional anatomy of thorax** • Explain Thorax cross sectional anatomy • Identify mediastinal great vessels, organs and lymph nodes on cross sectional images at different levels

	• Identify the structures at T4 vertebral level or angle of Louis
BIOCHEMISTRY	**1. Phospholipids** • Classify the Phospholipids in the human body with examples

	• Discuss the synthesis and degradation of phospholipids • Discuss the functions of phospholipids in the human body • Describe the synthesis and biochemical role of surfactant • Discuss the clinical significance of Acute Respiratory Distress Syndrome **2. Regulation of acid base balance** • Explain the mechanism of acid production • List the volatile & non-volatile acids • Describe the Henderson's Hassel balch equation • Explain the mechanisms of buffer in human body • Discuss the normal regulation of pH by buffers, respiratory and renal systems • Explain the anion gap and its biochemical significance • Interpret the values of Arterial Blood Gases (ABGs) **3. Respiratory pH disturbances** • Explain the role of respiration in pH regulation • Explain the mechanism of pH regulations in respiratory disturbances • Explain how to analyze ABGs in respiratory disorders • Discuss the clinical disorder of respiratory pH disturbances and their ABGs **4. Respiratory compensation mechanism** • Describe the compensation of pH disturbances by the respiratory system • Describe compensation of pH disturbances due to respiratory diseases
	• Describe respiratory acidosis and respiratory alkalosis • Interpret the respective ABGs in various clinical disorders
PHYSIOLOGY	**1. Introduction to respiratory physiology** • Describe the functions of respiratory passages

	2. Mechanics of respiration • Explain mechanism of pulmonary ventilation with reference to thoracic cage & muscles of respiration • Define alveolar pressure, pleural pressure, and alveolar ventilation • Discuss trans-pulmonary pressure and its changes during respiration • Define dead space **3. Lung compliance** • Define lung compliance • List factors affecting lung compliance • Describe the role of surfactant in maintaining lung compliance • Differentiate compliance work, tissue resistance work & airway resistance work **4. Pulmonary volumes and capacities** • List the pulmonary volumes & capacity with their normal values & significance in pulmonary function test • Determine functional residual capacity, residual vol. & total lung capacity (helium dilution method) **5. Pulmonary circulation V/Q relationship** • Describe pressure in pulmonary circulation & blood flow zones of lung (1,2,3) • Explain pulmonary capillary dynamics • Explain mechanism of development of pulmonary edema
	• State the importance of ventilation/perfusion ratio **6. Diffusion of gases** • Define respiration unit & respiration membrane • Describe mechanics of diffusion across respiration membrane & factors effecting diffusion

- List partial pressure of respiratory gases in atmosphere, humidified, alveolar & expired air
- Briefly describe the diffusing capacity of O_2 and CO_2

7. Transport of Carbon dioxide (CO_2)

- Describe the mechanisms of CO_2 transport from tissues to the lungs, including the relative contributions of different transport forms
- .Describe the chloride shift
- Relate effect of CO_2 and O_2 transport (Haldane effect)
- Define respiratory exchange ratio

8. Oxygen (O_2) transport and O_2Hb curve

- Explain transport of O_2 from lungs to body tissues
- Briefly describe the role of Hb in O_2 transport
- Explain the factors shifting the O_2Hb dissociation curve.
- Define Bohr effect

9. Respiratory adjustments to exercise

- Describe the effects of exercise on respiratory system

10. Aviation, high altitude, and space physiology

- Discuss the mechanism of acclimatization of the body to low O2
- Explain the process of natural acclimatization in natives of High altitude
- Describe the physiological changes in aviation and space

11. Respiratory adjustments to deep sea diving & hyperbaric conditions

- Discuss the effects of high partial pressures of individual gases on organs and systems of the body.

12. Hypoxia and its types

- Define hypoxia and its types
- Describe coughing & sneezing reflexes

13. Regulation of respiration-I

- List the respiratory centers & their functions in the regulation of respiration

	• Describe the neural and chemical control of respiration • **14. Regulation of respiration-II** • Discuss the Role of central and peripheral and chemoreceptors in regulation of breathing. **15 Pulmonary causes of Dyspnea** • Describe the Pulmonary causes of Dyspnea: Asthma, Emphysema, Pneumonia, Atelectasis and Tuberculosis • 16**. Respiratory Failure (Type 1 & 2**) • Differentiate between Type 1 and Type 2 respiratory failure, including their causes, effects, and key distinctions. • Evaluate the benefits and potential toxicity of artificial oxygen administration.
DEMONSTRATIONS **ANATOMY**	**1. Sternum & Ribs [muscle attachment, typical and atypical ribs]** • Describe the borders and surfaces of sternum • Summarize the locations of the muscles attached on sternum • Enumerate the type of joints formed at sternum • Relate the type of joint with its functions (clinical significance) • Classify ribs • Discuss the features of ribs • Differentiate typical from atypical ribs • Describe the attachments (muscles and ligaments) on ribs • Discuss joints formed by the ribs • Describe the clinical features of cervical rib and rib fracture • Describe the functional significance of sternum **2. Gross anatomy of lung** • Describe apex, base, surfaces and borders of lungs. • Describe Hilum /root of the lungs. • Discuss Fissures and lobes of the lungs. • Describe the relations/impressions on medial surface of lungs.

	• Describe the divisions of bronchial tree. • Describe the bronchopulmonary segmentation and their importance. **3. Surface anatomy of thoracic wall, lungs & pleura**

	• Describe surface marking of ribs and intercostal spaces • Mark the anatomical landmarks of important thoracic arteries and veins • Identify the surface anatomy of trachea and main bronchi • Identify the important anatomical landmarks of lungs • Mark the surface anatomy of pleura
PRACTICALS **HISTOLOGY**	**1. Respiratory epithelium and its variations** • Identify the various epithelial tissue and its variations in different parts of conducting system, as shown in the slides of respiratory tract **2. Histology of trachea and lung** • Describe the histological characteristics of different layers of trachea based on light microscope findings • Identify different components of bronchial tree • Identify alveolar duct, alveolar sac and alveoli
BIOCHEMISTRY	**1. pH meter** • Name the chemical tests and bio-techniques to detect pH of solutions • Outline the methods for detection of pH of solutions in a sample • Determine the pH of different solutions using pH meter and litmus paper • Interpret clinical conditions correlated with their laboratory investigations **2. Arterial Blood Gases (ABGs)**

	• State the normal values of Arterial Blood Gases (ABGs) • Interpret the ABGs in various clinical disorders • Discuss the ABGs in compensated Acid base Disorders
PHYSIOLOGY	**1. Lung volume and capacities** • Determine lung volumes and capacities (Spirogram) **2. Lung function tests (Spirometry)** • Identify different parts of power lab with respect to respiration and recording of normal respiratory rate • Perform respiratory function tests • Interpret results of respiratory function tests
TUTORIAL **PHYSIOLOGY**	**1. Obstructive vs Restrictive lung disease with respect to spirometry** • Define obstructive lung disease and classify them • Define restrictive lung disease and classify them • Differentiate between obstructive and restrictive lung diseases • Discuss the importance of FVC/FEV1 in diagnosis of COPD and restrictive lung disease
CASE BASED LECTURE	**1. Ventilation-Perfusion (V/Q) Mismatch & Pulmonary Embolism** • Explain V/Q mismatch and its clinical implications. **2. Pneumothorax & Pleural Effusion** • Compare spontaneous pneumothorax with pleural effusion.
ANNUAL EXAMINATION	• MCQs and OSPE (observed + unobserved stations)
MODULE EVALUATION	• Module evaluation will be obtained through a feedback form which will be posted on the JSMU website