Jordan University of Science and Technology
Faculty of Medicine
MD Program Curriculum

Course Title: Respiratory System.
Course Code: M252
Credit Hours: 6 credits
Calendar Description: 5 weeks/ Sem.2/ Year 2
Teaching Approaches: Integrated System Course
Course Coordinator: Dr. Mohammad Nidal Khabaz
Contact by Coordinator: medicine@just.edu.jo

A. Course Description:
Integrative respiratory system provides comprehensive and integrated coverage of anatomy, physiology, histology and embryology of the respiratory system. Microbiology, biochemistry, and pharmacology relating to the system are discussed. Pathology of the upper and lower respiratory system is presented along with clinical presentations of diagnostic and treatment modalities. Teaching methods include lectures, labs, small group discussion, and clinically oriented seminars.

B. General Objectives:
By the end of this course, students are expected:
1. To identify and describe structures of respiratory organs, as well as their development, their histology and their blood supply.
2. To describe the mechanics of pulmonary ventilation and the major mechanisms involved in the regulation of respiration.
3. To explain how the respiratory gases are exchanged and carried around the body.
4. To identify various bacteria, viruses, parasites and fungal infections, which infect the respiratory tract and to understand principles of diagnosis, treatment and prevention.
5. To identify and describe the major causes, pathogenesis, morphological changes and complications of various disease processes which affect the respiratory tract.
6. To understand the major pharmacological principles, which provide the basis for the treatment of tuberculosis, cough and bronchial asthma, as well as the pharmacology of anti-histamine drugs.
7. To identify the major risk factors which contribute to occupational diseases of the respiratory system and to understand their epidemiological pattern in the Jordanian community.

Methods of Instruction:
- Lectures
- Discussions
- Practical classes
- Multidisciplinary (Paediatrics & Medicine) lectures
### C. Specific objectives:

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<th>No.</th>
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<th>Lecture Objectives</th>
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| 1 & 2 | Introduction to Respiratory System (Multidisciplinary) | 1. Understand the general outline of the RS module.  
2. Be familiar with the modalities of teaching throughout the course.  
3. Acknowledge the important relation between normal and abnormal structure and function.  
4. Appreciate the importance of knowledge of basic medical sciences in clinical application. |
| 3 | Overview of Respiratory Anatomy (Anatomy) | 1. Describe the general structures and organs of the respiratory system.  
2. Compare and relate the structure and function of different parts of the respiratory system.  
3. Describe and understand the essentials of the respiratory system.  
4. Describe the anatomical and functional subdivisions of the RS. |
| 4&5 | Upper respiratory Tract-I&II (Anatomy) | 1. Describe the structure of nasal cavity including nasal septum.  
2. Describe the structure of lateral wall of nasal cavity including chonchae and meatuses.  
3. Locate the openings of the paranasal air sinuses and naso-lacrimal duct in the meatuses.  
4. Describe nasal innervations, blood supply, and its relation to epistaxis.  
5. Study the structure of nasopharynx and associated openings with their clinical importance.  
6. Describe the structure of various cartilages and membranes of the larynx.  
7. Describe muscles of the larynx including their action, nerve and blood supply.  
8. Describe the structure of vocal cords and the mechanism of voice production and control of air passageway. |
| 6 | Pulmonary ventilation (Physiology) | 1. Describe the mechanics of pulmonary ventilation.  
2. Define pleural pressure, alveolar pressure and transpulmonary pressure.  
3. Describe changes in lung volumes, alveolar pressure, pleural pressure, and trans-pulmonary pressure during normal breathing.  
4. Define compliance of the lungs.  
5. Draw compliance diagram of the lungs in a normal person.  
6. Describe the chemical composition and function of the surfactant. |
| 7&8 | Lower respiratory tract, Pleura, Lung and Mediastinum. (Anatomy) | 1. Describe the trachea including its relations and subdivision.  
2. Define pleura and pleural cavity, and name its parts and recesses.  
3. Discuss the pleural nerve supply.  
4. Describe the lungs with their lobes and fissures and surfaces and compare between right and left lungs.  
5. Make a list of bronchopulmonary segments.  
6. Describe innervations, blood supply and lymphatic drainage of the lungs.  
7. Identify different parts and contents of the mediastinum.  
8. Study the origin, location, course and branches of the internal thoracic artery.  
9. Define the surface markings of the trachea, lungs and pleura.  
10. Describe the typical appearance of chest X-ray and CT scan. |
| 9 | Pulmonary volumes and capacities (Physiology) | 1. Define spirometry.  
2. Describe the significance of the major volume and capacities that are recorded during normal function test.  
3. Understand algebraic interrelations among pulmonary values and capacities.  
4. Describe the techniques used to determine functional residual capacity, residual volume and the total lung capacity.  
5. Describe the closing volume.  
6. Define minute respiratory volume. |
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| 10 | Thoracic cage, wall & respiratory muscles including the diaphragm. (Anatomy) | 1. Describe the shape and outline of the thoracic cage including inlet and outlet.  
2. Describe the anatomical landmarks of the anterior chest wall.  
3. List various structures making the thoracic wall.  
4. Make a list of muscles of the thoracic wall including their nerve and blood supply and their actions.  
5. List various parts of the thoracic vertebrae and name its characteristic features.  
6. Describe the sternum with its joints.  
7. Classify ribs, name their various parts and compare them with each other.  
8. Define intercostal spaces and discuss their various components including intercostal muscles.  
9. Describe the diaphragm, its origin, insertion, function, nerve and blood supply. Study openings in the diaphragm and structures that pass through. |
| 11 | Histology of Respiratory Tract (Anatomy) | 1. Describe the microscopic structure of the upper respiratory passage including the respiratory mucosa.  
2. Correlate the structure and expected function of the different components of the nose and trachea.  
3. Study the microscopic structure of the main bronchi and their subdivisions.  
4. Study the microscopic structure of the lung parenchyma, and correlate this structure with gas exchange function. |
| 12 | Upper respiratory tract infections I: Group A β-hemolytic streptococci & Haemopkillus influenza (Microbiology) | 1. Know the anatomical differences between the upper and the lower respiratory tract.  
2. Know the normal flora and the pathogens of the respiratory tract.  
4. Know the diseases caused by this organism, epidemiology, pathogenesis, treatment and prevention.  
5. Explain why there is no vaccine for this organism.  
6. Describe the morphology and structure of H influenza.  
7. Describe the growth and pathogenesis.  
8. Explain immunity, transmission and epidemiology.  
9. Be familiar with different types of Haemophilus influenza infections.  
10. Be familiar with the laboratory diagnosis.  
11. Be familiar with the treatment and the prevention. |
| 13 | Upper respiratory Tract.II Bordetella pertussis & Corynbacteriym diphtheria (Microbiology) | 1. Describe the structure, morphology of those organisms and their significance as virulent factors and in laboratory diagnosis.  
2. Know the epidemiology, pathogenesis, the mechanism of action of the toxins produced, and the role of lysogenic conversion in virulence.  
3. Know the laboratory diagnosis of these organisms, and the significance of the toxin identification rather than the organism itself.  
4. Describe the treatment and the antibiotics used for that, prevention and the use of vaccines, their schedule and their possible side effects, and the use of the a cellular component of the vaccine. |
| 14 | Pre- and Post-natal Development of RS (Anatomy) | 1. Describe the development of nasal cavity.  
2. Describe development of the larynx.  
3. Describe the development of lungs and bronchi.  
4. Describe the development of the diaphragm. |
| 15 | Alveolar ventilation (Physiology) | 1. Define alveolar ventilation  
2. List the factors that determine alveolar ventilation  
3. Understand differences between anatomic and physiologic dead spaces  
4. Describe the effect of dead space on alveolar ventilation  
5. Define rate of alveolar ventilation  
6. Describe the effects of alveolar ventilation on PCO₂ and PO₂ |
| 16 | Pulmonary circulation  
(Physiology) | 1. Compare the pulmonary and systemic circulations listing the main differences between them.  
2. Describe bronchial circulation and the concept of physiological shunt  
3. Characterize pressures in the pulmonary system  
4. Describe blood flow through the lungs and its distribution |
| 17 | Upper respiratory tract infections. III: Influenza virus, RSV  
(Microbiology) | 1. Identify the viruses associated with upper respiratory tract, and the significance in relationship to antibiotics abuse.  
2. Know the structure of the influenza virus, and relate this into its evasiveness and virulence.  
3. Explain the epidemiology in birds, animals and humans, why it causes pandemics, methodology used for naming.  
4. Explain the genetics, clinical presentation, pathogenesis, and the role of the immune response, ryes syndrome and significance.  
5. Be familiar with the laboratory diagnosis.  
6. Be familiar with antiviral drugs used and their mechanism of action of each.  
7. Describe the significance of vaccination, the target groups that should be vaccinated, frequency, and side effects. |
| 18 | Pulmonary capillary dynamics.  
(Physiology) | 1. Describe the dynamics of capillary exchange of fluid in the lungs and pulmonary interstitial fluid.  
2. Characterize the interrelation between interstitial fluid pressure and other pressures in the lung.  
3. Define pulmonary edema and the pathophysiological mechanisms.  
4. Define pleural effusion and the causing factors |
| 19 | Physical principles of gas exchange  
(Physiology) | 1. Appreciate the measurement of partial pressure of gases.  
2. Define the factors which affect the rate of gas diffusion  
3. Identify the respiratory membrane through which gases diffuse |
| 20 | Acid-base balance and the respiratory system as line of defense.  
(Biochemistry) | 1. Describe the bicarbonate buffer system  
2. Describe the biochemical changes in Respiratory Acidosis and Alkalosis.  
3. Describe the role of Hemoglobin in the buffer system. |
| 21 | Biochemistry of oxygen toxicity  
(Biochemistry) | 1. Describe the production of oxygen free radicals intermediates.  
2. Discuss the cellular antioxidant defenses pathways. |
| 22 | Ventilation-perfusion ratio  
(Physiology) | 1. Define the concept of ventilation – perfusion ratio.  
2. Describe the effect of ventilation – perfusion ratio on alveolar gas concentration.  
3. Define the concepts of physiologic shunt and physiologic dead space.  
4. Characterize the pathophysiology of abnormal ventilation perfusion ratio. |
| 23 | Atelectasis and Disturbances of pulmonary circulation.  
(Pathology) | 1. Define Atelectasis, identifying compression & resorption atelectasis, and microatelectasis.  
2. Be familiar with the mediastinal shift.  
4. Be familiar with the causes & effects of thromboembolism & pulmonary infection. |
| 24 | Hemoglobin  
(Biochemistry) | 1. Describe the structure and the role of the heme prosthetic group.  
2. List the major structural features of the myoglobin protein.  
3. List the major hemoglobin present in the adult and the fetus  
4. Identify the difference between normal Hb and methemoglobin  
5. Identify the site where CO (carbon monoxide) binds  
6. Compare the subunit composition of fetal and adult hemoglobin.  
7. Appreciate the functional significance of the fetal hemoglobin composition.  
Distinguish between homotropic and heterotropic effects. |
25 Oxygen-hemoglobin dissociation curve shift and its significance (Biochemistry)

1. Contrast the tense and relaxed forms of hemoglobin.
2. Contrast the oxygen binding curves for myoglobin and hemoglobin.
3. Draw an equilibrium that shows the effect of O2 binding on the relative amounts of tense and relaxed forms.
4. Appreciate the effect of O2, PBG, CO2 and Acidity on Hemoglobin structure and oxygen saturation.
5. Appreciate how an increase in PBG helps adapt a person to high altitude.
6. List the factors that shift the oxygen-hemoglobin dissociation curve to the right or left.
7. Discuss the physiological importance of the listed factors on oxygen transport.
8. Describe the shift of oxygen-hemoglobin dissociation curve during exercise.

26 Interpretation arterial blood gases (Medicine)

1. Introduction
2. Acid-Base Status
   a. A Step-wise Approach to Interpretation
      i. Step 1: Examine the pH and compare it to the normal range
      ii. Step 2: Determine the primary process that led to the change in the pH
      iii. Step 3: Calculate the serum anion gap (SAG)
      iv. Step 4: Identify the compensatory process (if one is present)
     v. Step 5: Determine if a Mixed Acid-Base Disorder is Present
   b. Generating Differential Diagnoses
      i. Elevated Anion Gap Metabolic Acidosis
      ii. Normal Anion Gap Metabolic Acidosis (non-gap acidosis)
      iii. Metabolic Alkalosis
      iv. Respiratory Acidosis
      v. Respiratory Alkalosis
   c. Compare with Old Arterial Blood Gas Results
3. Oxygenation
   a. Assessing the Cause of Hypoxemia
   b. Assessing the Adequacy of Gas Exchange
      i. The P/F Ratio
      ii. The AaO2 Difference
   c. Special Situations To Be Aware of In Evaluating the PaO2 on an ABG

27 Lower respiratory tract infections I: Streptococcus pneumonia and other Spp. (Microbiology)

1. Name of microorganisms involved in this group.
2. Describe the classification of pneumonias, and the organisms in each group.
3. Understand the structure of S. pneumonia, and relate this to virulence, pathogenesis, clinical presentation and vaccine development.
4. Describe the laboratory diagnosis and treatment of this organism.

28 & 29 Regulation of respiration: Neural and chemical control. (Physiology)

1. Locate and comment on the function of the dorsal and ventral groups of respiratory neurons, the pneumotaxic center, and the apneustic center in the brain stem.
2. List the effects on respiration that are mediated by the vagus nerves.
3. List the neural factors that affect the activity of respiratory centre
4. Describe abnormal patterns of breathing
5. Describe cough and sneezing reflexes
6. List the specific functions of the respiratory receptors in the carotid body, the aortic body, and in the ventral surface of the medulla oblongata.
7. Describe the effects of arterial PO2, PCO2 and PH on alveolar ventilation

30 Lower respiratory tract infections II: Pseudomonas, Moraxella and Bacillus Anthracis (Microbiology)

1. Describe morphology and structure of the group and relate this to virulence, antibiotics resistance, pathogenesis, clinical presentation, and laboratory diagnosis.
2. Describe their growth, classification, toxins and extracellular products.
3. Explain their pathogenesis, immunity and clinical manifestations.
4. Explain their mode of transmission and epidemiology.
5. Be familiar with related laboratory diagnosis.
Be familiar with their treatment and prevention.
| 31&32 | Obstructive lung disease 1&2  
(Pathology) | 1. Define obstructive lung disease.  
2. Discuss the pathogenesis, pathological features, and possible complications of: Asthma, Chronic bronchitis, Bronchiactasis, and Emphysema.  
3. Classify emphysema according to morphologic and etiologic patterns. |
| 33 | Lower respiratory tract infections:III Mycoplasma and Legionella  
(Microbiology) | 1. Describe the structure, morphology of the group and relate this to virulence, pathogenesis, and clinical presentation.  
2. Explain their pathogenesis, immunity and clinical disease.  
3. Explain their mode of transmission and epidemiology.  
4. Be familiar with the related laboratory diagnosis.  
5. Be familiar with their treatment and prevention. |
| 34&35 | Treatment of bronchial asthma 1&2  
(Pharmacology) | 1. Describe the pathophysiology, etiology and clinical presentations with special emphasis on factors known to provoke the attacks of bronchial asthma.  
2. Understand the aims of therapy of bronchial asthma.  
Be familiar with some examples of drugs that can be used in the treatment of bronchial asthma with their method of administration, mechanisms of action, pharmacokinetics and side effects, such as : Beta agonists, Corticosteroids, Anticholinergic agents, Theophylline, Mast – cell stabilizers, Anti-leukotriens and Others |
| 36 | Bronchial asthma treatment guidelines (Medicine) | 1. Identify the different pathophysiologic changes targeted in bronchial asthma treatment  
2. Review the different medication categories for bronchial asthma  
3. Be familiar with the concepts of step up & step down in bronchial asthma treatment  
4. Emphasis on the most recent bronchial asthma treatment guidelines in comparison with the old guidelines  
5. Overlook of possible future therapies |
| 37&38 | Restrictive lung disease 1&2  
(Pathology) | 1. Define restrictive lung disease.  
2. Be familiar with the principles, cause & mechanisms in acute restrictive lung disease identifying Acute Respiratory Distress Syndrome in adults and newborn.  
3. Discuss the pathology of idiopathic pulmonary fibrosis.  
4. List the commoner cause of pulmonary fibrosis with emphasis on the pathology of Sarcoidosis.  
5. Be familiar with causes and pathology of pneumoconiosis.  
6. Identify causes and pathology of Asbestosis & Mesothalioma.  
7. List the pulmonary hemorrhage syndromes, which may lead to pulmonary fibrosis. |
| 39 | Fungal infections  
(Microbiology) | 1. Describe the different fungi involved in the respiratory tract.  
2. Describe their structure, clinical classification, and their significance in the disease process.  
3. Explain the epidemiology, pathogenesis, clinical presentation, association with the immune status of patients.  
4. Know the laboratory diagnosis in medical mycology.  
5. Be familiar with the treatment and the antifungal drugs, their mechanism of action and toxicity.  
6. Know the preventive measures and the role of the immune system. |
| 40 | Acute Pulmonary infections  
(Pathology) | 1. Define pneumonia and pneumonitis.  
2. Clarify pneumonias according to etiology & morphological patterns.  
3. Compare & contrast bacterial & nonbacterial pneumonias.  
4. Outline the events in the resolution of the pneumonic process.  
5. List the possible complications of pneumonia.  
6. Discuss the causes, morphology and outcome of lung abscess. |
| 41 | Chronic Pulmonary infections.  
(Pathology) | 1. Define atypical pneumonia & discuss its etiology & pathology.  
2. List the types of fungal & parasitic infections of the lung.  
3. Be familiar with lung infections in the immunocompromised host. |
| 42&43 | Treatment of respiratory bacterial infections.  
(Pharmacology) | 1. Understand the pharmacokinetics, mechanism of action and adverse effects of drugs commonly used in the treatment of pulmonary bacterial infections. |
|   | Respiratory infections in children (Pediatrics) | 1. Understand different presentation of upper respiratory tract infections in children  
|   |  | 2. Identify common upper respiratory tract infections in children  
|   | Mycobacterium tuberculosis (Microbiology) | 1. Describe morphology, structure, staining and cultural characteristics of the organism.  
|   |  | 2. Relate the structure to the virulence and pathogenesis of the disease.  
|   |  | 3. Explain the range of pathogenicity, resistance, antigenic structure, virulence mechanisms and antimicrobial susceptibility.  
|   |  | 4. Be familiar with tuberculosis, routes of infections and reactivation.  
|   |  | 5. Explain the immunity, transmission and epidemiology.  
|   |  | 6. Describe relevant laboratory diagnosis.  
|   |  | 7. Be familiar with anti-tuberculosis drugs, and the multidrug resistance organism  
|   |  | 8. Define the immunoprophylaxis, and the vaccines used and their strategy.  
|   |  | 9. Know the role of the PPD testing and their significance.  
|   | Pulmonary TB and chronic pulmonary infections. (Pathology) | 1. Describe the pathology of pulmonary primary TB.  
|   |  | 2. Describe the pathology of secondary TB  
|   |  | 3. Describe the pathology of progressive TB  
|   |  | 4. Describe the pathology of chronic pulmonary infections.  
|   | Pneumonias Clinical cases (Medicine) | 1. Understand classification of pneumonias  
|   |  | 2. Appreciate the clinical presentation of pneumonias in adults  
|   | Lung Tumors 1&2 (Pathology) | 1. Describe the etiology of lung cancer.  
|   |  | 2. Distinguish between Small Cell Carcinoma & Non Small Cell Carcinoma, and know the clinical & pathologic findings of the various types, together with their prognosis.  
|   |  | 3. Be familiar with bronchial carcinoid.  
|   |  | 5. List other tumors in the lung & know the commonest metastatic tumor.  
|   |  | 6. List the diagnostic techniques used for respiratory disease.  
|   |  | 7. Be familiar with pleural effusions pneumothorax & pleural tumors.  
|   |  | 8. Identify nasal polyp, nasal papilloma & carcinoma.  
|   |  | 9. Understand the etiology & pathology of nasopharyngeal carcinoma.  
|   |  | 10. Describe laryngeal polyp, papilloma & carcinoma.  
|   | Histamine and anti-histamines 1 (Pharmacology) | 1. Review histamine synthesis, storage, release, actions and the clinical manifestations of histamine shock.  
|   |  | 2. Understand the mechanisms of actions of anti-histamine drugs.  
|   |  | 3. Be able to classify, understand the pharmacokinetics, uses and adverse effects of anti-histamine drugs.  
|   | Treatment of tuberculosis (Pharmacology) | 1. Understand the concepts of TB treatment with special emphasis on two phases of therapy.  
|   |  | 2. Understand the concepts of combination therapy particularly the advantages and disadvantages with special emphasis on TB management.  
|   |  | 3. Describe the mechanisms of action, pharmacokinetics, uses and side effects of Isoniazid, Rifampin, and Ethambetol. In addition, pyrazinamide as first line therapy of tuberculosis.  
|   | Treatment of cough (Pharmacology) | 1. Understand the pathophysiology of cough.  
|   |  | 2. Understand the sites of actions of anti-tussives given example  
|   |  | 3. Understand the mechanism of action of mucolytic agents and give examples  
|   | Occupational health of the respiratory system (Community Medicine) | 1. Enumerate types of occupational hazards that affect the respiratory system  
|   |  | 2. To familiarize the students with different diagnostic techniques used in occupational medicine  
|   |  | 3. Understand the process of investigating work related respiratory illness.  
|   |   |   

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<th>Objectives</th>
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| 1      | Histology of Respiratory Tract (Anatomy)          | 1. Identify the microscopic structure of upper respiratory tract including nasal mucosa, larynx, nasopharynx and trachea.  
2. Identify the microscopic structure of lung tissues and parenchyma.  
3. Identify the microscopic structure of different parts of bronchial tree. Try to relate structure of each part to its function.                                                                                                                                                                                                                           |
| 2      | Anatomy of URT, thoracic cage, thoracic wall and respiratory muscles. (Anatomy) | 1. Identify different parts of the nose: nasal cavity, nasal septum and nasal walls including chonchae and meatuses with associated openings.  
2. Identify different parts of the laryngeal skeleton and membranes including vocal folds and cords.  
3. Identify different parts of the laryngeal cavity: inlet, ventricle, infraglottic space and rima glottidis.  
4. Identify different muscles acting on inlet of larynx (sphenicteric action) and on true vocal cords. Revise their innervations and clinical significance.  
5. Revise surface markings of larynx and site for emergency tracheotomy.  
6. Identify different parts of pharynx. Identify main structures in nasopharynx particularly opening of auditory tube and pharyngeal tonsil, and comment on their clinical significance.  
7. Revise the gross, surface and radiological anatomy of the trachea.  
8. Identify different components and joints of the thoracic cage: inlet, ribs, sternum and thoracic vertebrae.  
9. Identify principal respiratory muscles: intercostals and diaphragm (attachments, nerve supply and actions).  
10. Identify accessory muscles of respiration and revise the mechanics of ventilation and various diameters of thoracic cavity.                                                                                                                                                                                                                           |
| 3      | Pleura, Lungs & Mediastinum (Anatomy)             | 1. Identify different parts of pleura and its recesses. Revise its innervations.  
2. Identify different parts of a lung and contrast between right and left ones.  
3. Identify structures entering and leaving the hilum of the lung and structures related to hila.  
4. Identify important relations to each lung that leave impressions on them.  
5. Revise blood supply, innervations and lymphatic drainage of lungs and pleurae.  
6. Revise surface markings of lungs and pleurae.  
7. Revise different parts and contents of the mediastinum.  
8. Identify different parts of the branching bronchial tree from the trachea to alveoli.  
9. Identify and carefully examine the radiological appearance of lungs, trachea, hilum, bronchial tree and skeletal structures (plain chest x-ray, bronchogram, CT scan and MRI).                                                                                                                                                                                                                           |
| 4      | Spirometry (Physiology)                          | 1. Define the different lung volumes and capacities and determine the amounts of these measurements in a spirogram.  
2. Describe and perform the forced expiratory volume and maximum breathing capacity test and determine these measurements in a spirogram.  
3. Explain how pulmonary function tests are used in the diagnosis of restrictive and obstructive pulmonary disorders.                                                                                                                                                                                                                           |
| 5      | Throat swab (Microbiology)                        | 1. Be familiar with the selection, collection and transport of specimen for microbiological examination.  
2. Be familiar with the cultivation and isolation of viable pathogens.  
3. List types of media used for throat swab culture.  
4. Identify and describe the type of hemolysis.  
5. Explain the value of using of some biochemical reactions.                                                                                                                                                                                                                                                                   |
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<th>Procedure/Procedure</th>
<th>Description</th>
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| 6   | Sputum culture      | 1. Be familiar with the selection, collection, and transportation of sputum sample.  
                   | (Microbiology)   | 2. Be familiar with the cultivation of acid-fast and none acid-fast bacteria.  
                   |                   | 3. Be familiar with the procedure of Zeil-Neelsen stain.  
                   |                   | 4. Be able to visualize and observe mycobacterium under the microscope.  
                   |                   | 5. Be familiar with the LJ medium.  
                   |                   | 6. Prepare slides from the sputum for staining. |
| 7   | Web Path 1          | 1. Be familiar with the use of “Webpath” program in computerized pathology teaching and look up lung edema, congestion, thromboembolism, infarction, atelectasis and obstructive lung disease.  
                   | (Pathology)       | 2. Examine glass slides of pulmonary edema, congestion, atelectasis and emphysema. |
| 8   | Web Path 2          | 1. Use Webpath to look up restrictive lung disease, pneumonias granulomatous diseases and tumors.  
                   | (Pathology)       | 2. Examine glass slides showing pneumonias, tuberculosis, Hydatid cyst in the lungs, and carcinoma. |

**Summary of teaching activities in the RS module:**

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<th>Department</th>
<th>No. of Lectures</th>
<th>No. of Labs</th>
<th>No. of Discussions</th>
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**Clinical cases for small group discussions**

**Lung Cancer**

A 55-year-old man, heavy smoker (40 cig/day for 30 years) presented with cough, hemoptysis, right sided chest pain, and progressive shortness of breath for the last 3 months. Recently he noticed that he is passing large amounts of urine with increased frequency of urination day and night and he became constipated. In addition, he has pain and swelling around the wrist and ankle joints and over the last 3 months, he has poor appetite and lost 10 kg of body weight (from 60 kg to 50 kg). 20 years ago this gentleman was in Germany and worked for 5 years in ship building.

Physical examination showed a thin, emaciated patient who looks in pain. His respiratory rate was 26/minute. He has clubbing in his fingers and toes with painful swelling around both wrists and ankles. Examination of the chest showed decreased movement of the right side in comparison with the left side, the trachea was shifted to the right side; there was a dull percussion note over the right upper zone interiorly with absent breath sounds.

Investigations showed hemoglobin of 10 gm/ dl. Blood sugar, renal function, and liver function tests were normal. Serum calcium was 2.8 mmo1/1.

Chest x-ray showed collapse consolidation in the right upper lobe, and x-ray of the wrists and ankles showed periostial elevation with new bone formation.

Bronchoscopy showed a tumor obstructing the right upper lobe bronchus, biopsy was taken and histopathology revealed squamous cell carcinoma.
**Topics for discussion:**

1. Explain the reasons behind each of the following physical sign and/or symptom:
   - Hemoptysis, chest pain, shortness of breath, passing large amounts of urine, constipation, swelling of joints, clubbing of fingers, tracheal shifting to the right, dull percussion note over upper chest, X-ray findings of wrist and ankle joints (new bone formation)
2. Epidemiology of lung cancer
3. Risk factors and preventive measures of lung cancer
4. Pathology and diagnosis of lung cancer
5. Effects of lung cancer
6. Describe the lymphatic drainage of the lungs
7. Staging of lung cancer
8. Modalities of treatment in lung cancer
9. Genetics of lung cancer

**Chronic Obstructive Pulmonary Disease**

**History:**
Mr. Sabri is a 60-year-old man currently employed at a factory as a machinist. He was seen in the pulmonary clinic for the first time with a complaint of dyspnea (fighting for breath) on exertion and a cough productive of thick, yellow sputum. He states that he has had this cough for several years, but it usually "isn’t a problem". His cough is usually productive of clear to white sputum. Recently, he had been coughing up yellow sputum, was more short of breath and now is even dyspneic at rest. Mr. Sabri has admitted to feeling warm at times lately, but he had not taken his own temperature with a thermometer. He also denied history of chest pain, hemoptysis, sinusitis, weight loss, allergies, night sweats or chills. Mr. Sabri admitted to smoking 30 cigarettes a day for the last 40 years. He stated that he had attempted to quit several times but was never successful for longer than 3 to 4 months. This machinist job had exposed him to many toxic fumes. His family history is positive for lung disease, his father died of emphysema at age 70, which was 15 years ago. His mother is alive and well at age 78. He also has 2 sisters, healthy at ages 48, 50 and a brother (55 year old) with diabetes.

**Questions:**
1. What medical problems suggested by the information obtained in the history?
2. What is the most likely diagnosis and what are the key indicators for this diagnosis?
3. What is Mr. Sabri smoking history in pack-years?
4. How would you exclude the possibility of asthma from the history?
5. What is the significance of his sputum color?
6. What is the significance of his family and occupational history?

**Physical Examination:**

**General:**
Alert and oriented, but in moderate respiratory distress, uses 3 word sentences because of dyspnea and coughing, which produces thick, yellow sputum.

**Vitals:**
- Temp: 38.1°C
- Heart Rate: 120/min
- BP: 140/88mmHg
- Respiratory Rate: 30/min

**Head:**
- Tongue and mucous membranes slightly cyanotic
- Pupils Equal Reactive to Light Accommodation (PERLA)

**Neck:**
- Trachea midline and mobile; transmitted wheezes present, but no stridor. Carotids ++ bilaterally with no bruises.
- JVD noted with head of bed elevated to 45 degrees.
- Accessory muscles in neck tense with each inspiratory effort.

**Chest:**
- A-P diameter large, limited expansion of chest wall, generalized hyperresonance but decreased resonance over RLZ noted on chest percussion; bilateral expiratory polyphonic wheezes, louder on right side, noted on auscultation; course crackles and bronchial breath sounds heard over RLZ.

**Heart:**
- Regular rhythm with a rate of 120/min, no murmurs or rubs detected; S3 gallop and loud P2 noted on auscultation of the lungs; systolic heave noted at left sternal border; point of maximal impulse located at the fifth intercostals space at midclavicular line on the left

**Abdomen:**
- Soft and non-tender; hepatomegaly present; no evidence of paradoxical respiratory movement.

**Extremities:**
- No evidence of cyanosis or clubbing; pedal edema present and 2+ bilaterally in the lower extremities up to knee level; extremities dry and warm to touch
Questions:
1. How do you interpret the vitals?
2. What is indicated by the findings of cyanosis in the tongue and mucous membranes?
3. What are the possible causes of the bilateral wheezing and bronchial breath sounds heard over the RLZ?
4. What is suggested by a loud P2?
5. What pathology could be causing the JVD, hepatomegaly and pedal edema?
6. What is the most useful test to confirm the diagnosis of COPD?

Laboratory Evaluation:

Arterial blood Gases (ABGs): PH / PaCo2 / PaO2 / HCo3
7.33 / 50 / 45 / 30
O2 saturation 83%

Complete Blood Count:

<table>
<thead>
<tr>
<th></th>
<th>Observed</th>
<th>Normal</th>
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<tbody>
<tr>
<td>RBCs</td>
<td>5.7 million/mm³</td>
<td>4.4-5.5 million/mm³</td>
</tr>
<tr>
<td>Hb</td>
<td>17.5</td>
<td>14-16.5</td>
</tr>
<tr>
<td>HCT</td>
<td>56%</td>
<td>37-50%</td>
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<tr>
<td>WBC</td>
<td>16000/mm³</td>
<td>5000-10000/mm³</td>
</tr>
<tr>
<td>Segs</td>
<td>77%</td>
<td>38-79%</td>
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<tr>
<td>Bands</td>
<td>10%</td>
<td>0-7%</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>10%</td>
<td>12-51%</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>1%</td>
<td>0-8%</td>
</tr>
<tr>
<td>Monocytes</td>
<td>1%</td>
<td>0-10%</td>
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</tbody>
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Chemistry: All within normal limits except for the CO2(32meg/liter)

Chest Radiography (See attached images)
Hype inflated chest manifested by flattened diaphragm and barrel shaped chest consistent with COPD.
There is consolidation involving the right lower lobe and seen posteriorly in the lateral chest radiograph consistent with right lower lobe pneumonia

Questions:
1. How would you interpret the ABGs?
2. How would you interpret the CBC? What could be causing the elevated WBCs? What is the likely cause of the elevated RBC?
3. How important is the chest x-ray in determining the cause of Mr. Sabri symptoms? What does it show to be the underlying condition of the patient respiratory system?
4. What other tests/procedures should be ordered at this point?
5. What therapy should the physician order for Mr. Sabri?

Management of COPD:
The patient was admitted to the pulmonary care unit. The physician ordered the following:
- O2 by nasal canula 2LPM, wean > 90%
- Nebulizer with salbutamol and Ipratropium (Antrovent®)
- Methylprednisolone (solu-medrol®) 125 mg IV every 6 hours and then 60 mg orally.
- Ceftriaxone 2 gm Q24 hours + clarithromycin 500 mg PO Q12
- Sputum xray, culture, and sensitivity
- Blood culture
Questions:
1. What is the goal of the oxygen therapy in this case? How should it be evaluated?
2. What type of bronchodilators is Mr. Sabri receiving? What are the possible side effects?
3. How should the overall effectiveness of the bronchodilators be evaluated?
4. What is the rate of steroid therapy? How long should this medication be maintained?
5. What should the respiratory technician do to improve the chances of obtaining an appropriate sputum sample?
6. What is the significance of sputum and blood culture?
7. What advice would you give Mr. Sabri in regard to his long-term respiratory health?
8. What methods of smoking cessation do you know?

Conclusion:
Over the next several hours, Mr. Sabri steadily improved. His ABG on 2LPM revealed a PaO2 of 66mHg. By the third day, his dyspnea improved to the point where he could walk around the unit without difficulty. On the fifth, he was discharged on a regimen of oral antibiotics and oxygen. The consultant pulmonologist requested a follow-up in the pulmonary clinic in one week.

Recommended Text Books and Atlases:

Anatomy:
- Grants Atlas of Anatomy or any other reasonable colored atlas of Human Anatomy.
- Basic Histology, by L.Carlos Junqueira, 10th Edition 2004/or functional histology by Wheater (latest edition)
- Supplementary Departmental Handouts.

Biochemistry:
- Supplementary Departmental Handouts.

Physiology:

Microbiology:

Pathology:
- Supplementary Departmental Handouts.

Pharmacology:

Community Medicine:
- Occupational Health Practice Harrington, Grill, Aw.
- Supplementary Departmental handouts.