STATE BOARD OF ALLIED MEDICAL SCIENCES ODISHA

CERTIFIED RESPIRATORY TECHNICIAN(CRT) DURATION-1YEAR

Introduction to the course:

Respiratory Therapy is a para-medical course in allied medical specialty. This disciplinary staff concerned with the evaluation and treatment of patients who have respiratory diseases after advice of doctor or with help of doctor. Respiratory Therapists are in great demand in Speciality hospitals and hospital related organizations to provide direct patient care to those with acute and chronic respiratory problems. The field of Respiratory Therapy is growing rapidly. Diagnosis and management of respiratory disorders needing intensive care, pulmonary rehabilitation, teaching and many more research opportunities are areas that offer opportunities to the Respiratory Therapists for professional growth and personal satisfaction. Respiratory Therapist can be seen in Intensive care units, pediatric and neonatal units, and operating rooms and especially in the emergency rooms. Some respiratory therapists advance by moving into teaching positions. Some others use the knowledge gained as a respiratory therapist to work in another industry, such as developing, marketing, or selling pharmaceuticals and medical devices**.** The Duration of course will be one year.

Objectives:

The emphasis of the curriculum is to enhance and advance the student's professional career in respiratory therapy with additional education in administration, research and evaluation, and advanced critical care.

Skills:

The essential skills a Respiratory Therapist should have are Numeracy, Oral Communication and decision making. The curriculum for Respiratory Therapy emphasizes on this by developing communication skills, problem solving, documentation, critical thinking ability, job task planning and organization, continuous learning, live demonstrations, hands on training and team work.

Attitudes: Respiratory therapists must be caring and committed to helping their patients.

Duration of the course :1 year

Eligibility for application :
Pass in plus two with 50% marks in Physics, Chemistry and Biology

COURSE CURRICULUM

Sl. No.	Subject	1st Quarter		Internal Assessment	Subject	2nd Quarter		Internal Assessment	Subject	3rd Quarter		Annual Board Examination
		Th	Pract/ Demo			Th	Pract/ Demo			Th	Pract/ Demo	
1	Basic Sciences	40	60		General and Applied Pharmacology	20	20		Applied Science III	17	22	
2	Microbiology and sterilization	20	10		Applied Science I	60	23		Applied Science IV	20	12	
3	Applied Pathology	20	10		Applied Science II	45	34		Pulmonary Rehabilitation	36	10	
	Total	80	80		Total	125	77		Total	73	44	

Eligibility: +2 Science with Physics, Chemistry & Biology or equivalent degree

Examination: Examination rules will be as per guideline of Odisha State Allied Board

Plan of Classes & Examination Pattern

Total duration of each course is 1year.
Internal Assessments will be conducted at the end of each quarter
Board examination will be conducted at the end of First Year.

Distribution of classes: The total number of classes have been mentioned in the curriculum.

Attendance in Class: A Student will be eligible to appear in the semester and university examination if he/she has attended minimum 75% theory classes and 85% practical classes.

Mark Distribution: Examination will be conducted in 2 parts: Part I-Basic Sciences,:Part II Clinical Sciences. Each part carries 35 marks

Question Pattern for Board (Semester Examination):

i. Short notes of 3 marks each X 5 = 15
ii. Multiple choice question1 mark each X 10 = 10
iii. Fill in the blanks 1mark each X 10 = 10

Examination Marking System

Board Examination	**70 Marks (Only Theory)**
Internal Assessment	**30 Marks (Theory + Practical)**
Total	**100 Marks**
Pass	**50 Marks**

The student has to secure a minimum of 50% both in Internal Assessment and Board Examination to get the degree Certificate.

Anatomy and Physiology

- Anatomy of the Upper and Lower airways
- Pleura, Lungs
- Surface marking of the lungs
- Broncho pulmonary segments
- Muscles of Respiration
- Diaphragm
- Nerve supply and Blood Supply of the respiratory system
- Transportation of gases- O2, CO2, and Dissociation curves
- O2 cascade, O2 flux, Lung volumes and Capacities
- Nervous and chemical control of Respiration. Gas exchange, Work of breathing,Resistance, compliance
- Anatomy of the heart,Pericardium
- Conducting system
- Cardiac cycle, cardiac output
- Nervous control of heart
- Cardiac rhythm, ECG
- Hemodynamics
- Blood pressure
- Auscultatory areas,Heart sounds
- Nerve supply and Blood Supply of the Cardiovascular system
- Neonatal and pediatric cardio respiratory anatomy and physiology, basic vitals and their significance.

Practical(Anatomy)

1.Demonstration of heart and its blood supply, demonstration of major arteries of upper limb and lower limb, histology of cardiac muscle and histology of vessels
2. Demonstration of location and parts of lungs, histology of trachea and lungs

Practicals (Physiology)

1. Haemoglobinometry.
2. Haemocytometry
3. Total leucocyte count.
4. Total Red blood cell count.
5. Determination of blood groups.
6. Differential WBC count.

7. Determination of clotting time, bleeding time.
8. Erythrocyte sedimentation rate (ESR). Determination of packed cell Volume, Calculation of Blood indices: CI, MCH, MCV, MCHC.
9. Blood pressure recording.
10. Spirometery, Artificial Respiration

Recommended Books

1. Understanding Human Anatomy and Physiology, William Davis (p) MC Graw Hill
2. B D Chaurasia: Regional Anatomy. Vol I, II, III
3. A.K.Jain, Human Physiology and Biochemistry for Physical Therapy and Occupational Therapy, Arya Publication.
4. Dr. Venkatesh.D and Dr. Sudhakar H.S.Basic of Medical Physiology,Wolter-Kluwer Publication.
5. Chaudhari (Sujith K) Concise Medical Physiology 6th Ed. New Central Book.

Biochemistry

- Carbohydrate, Protein, Fat – Structure, Synthesis, Metabolism and sources
- Vitamins, Minerals –Functions
- Chemistry of Respiration
- Acid base balance and Imbalance
- Enzymes and Hormones functions
- Biochemical Genetics, Inborn errors of metabolism

Practicals

1. General Reactions of Carbohydrates.
2. Color reactions of Proteins.
3. Reactions of Non Protein nitrogenous substances.
4. Demonstration of pH meter, Colorimeter and spectrophotometer.
5. Demonstration of Chromatography and Electrophoresis.

Recommended books Recent edition

1. Textbook of Biochemistry -D.M.Vasudevan
2. Biochemistry -Pankaja Naik
3. Clinical Biochemistry-Principles and Practice-Praful.B.Godkar

Microbiology and Pathology

- Classification of microorganisms, size, shape, and structure of bacteria
- Microbiology - Eukaryotic pathogens involving respiratory tract
  Prokaryotic pathogens involving respiratory tract
- Mycobacterium and common gram negative bacteria
- Methods of sterilization and disinfection
- Disinfection of respiratory equipment's
- Infection control – Meaning, methods of transmission of diseases.
- Pathology - Cellular adaptation
- Cell Injury
- Cell death
- Causes of cell injury
- Reversible and Irreversible cell injury
- Examples of cell injury and necrosis
- Acute and chronic inflammation, General features of inflammation

- Systemic pathology - blood vessels, lymphatic and veins
- Lungs – Congenital anomalies, Obstructive and Restrictive pulmonary diseases, diseases of Pleura.

Practicals:

1. Laboratory organization-
2. Reception of specimen, dispatch of reports, records keeping, coding of cases.
3. Laboratory safety guidelines.
4. SI units and conventional units in hospital laboratory.
5. Haematology techniques
6. Basic requirements for hematology laboratory
7. Glasswares for hematology
8. Equipments for haematology.
9. Anticoagulant vials
10. Complete blood counts.
11. Determination of haemoglobin.
12. RBC count and TLC by hemocytometer.
13. Differential leukocyte count.
14. Determination of platelet count
15. Determination of ESR and PCV.
16. Erythrocyte Indices - MCV, MCH, MCHC.
17. Reticulocyte count
18. Absolute eosinophilic count
19. Morphology of blood cells
20. Urinanalysis
21. Examination of cerebrospinal fluid

Recommended Books

1. Basic Pathology Robbins Saunders, an imprint of Elsevier Inc., Philadelphia, USA.
2. Text book of Pathology Harsha Mmohan Jaypee Brothers, New Delhi.
3. Practical Pathology P. Chakraborthy, Gargi Chakarborty New Central book agency, Kolkata.
4. Text book of Haematology Dr Tejinder Singh Arya Publications, Sirmour (H P)
5. Text book of Medical Laboratory Technology Praful Godkar Bhalani Publications house, Mumbai.
6. Textbook of Medical Laboratory Technology Ramanik Sood.

Practicals:

1. Compound microscope and its application in microbiology.
2. Demonstration of sterilization equipments: hot air oven, autoclave, bacterial filters. Demonstration of commonly used culture media, nutrient broth, nutrient agar, blood agar, chocolate agar, Mac conkey medium, L J media, Robertson cooked meat media, MacConkey agar with LF & NLF, Nutrient agar with staph colonies.Anaerobic culture, Methods and Antibiotic susceptibility test.
3. Demonstration of common serological tests: Widal, VDRL, ASLO, CRP, RF, Rapid tests for HIV, Hbsag and HCV.
4. Grams staining.
5. Acid fast staining.
6. Principles and practice of Biomedical waste management.
7. Stool Microscopy

Recommended Books Recent Editions.

1. Anathanarayana & Panikar: Medical Microbiology - University Press.

2. Parasitology by Chatterjee - Interpretation to Clinical Medicine.
3. Textbook of Microbiology - Baveja, Arya Publications
4. Textbook for Laboratory technicians by RamnikSood. Jaypee Publishers
5. Textbook of Parasitology by Paniker.

Pharmacology

- General information about drug administration
- Bronchodialtors and xanthines
- Expectorants, Mucolytics and antihistamines
- Corticosteroids and anti infective agents
- Diuretics and anti hypertensive agents
- Neuromuscular blocking agents
- Sedatives and analgesics
- Pharmacodynamics and pharmacokinetics

Practicals Syllabus :
1. Dosage forms
2. Solid Dosage forms
3. Liquid Dosage forms
4. Gaseous Dosage forms
5. Oral route
6. Parentral routes
7. Novel routes
8. Fixed dose combination - Amoxycillin + clavulinic acid - cotrimoxazole, Lignocaine + Adrenaline
9. Drug stations - Adrenaline, dopamine, Dobutamine)
10. Drug stations - Corticosteroids (hydrocortisone, prednisalone, inhaltional steroids)
11. Drug stations - common antibiotics (amoxycillin, ciprofloxacin, Azithromycin,
12. Metronidazole, Cephalosporins)
13. Drug stations - Insulin preparations
14. Instrument & devices (Nasogastric tube, laryngoscope, Different Cathetors, nebulizers, Inhalers, Rotahalers)

Recommended Books Recent Editions.
1. K.D. Tripathi, Essentials of Medical Pharmacology.
2. Padmaja Udaykumar -Pharmacology for Allied Sciences.
3. R.S. Satoskar, S.D. Bhandarkar, S.S. Ainapure, Pharmacology and Pharmacotherapeutics

APPLIED SCIENCE -1

1. **Patient contact techniques:** Verbal & Non-verbal communication, Patient interview and examination, Conflict and conflict resolution

2. **Medical History Taking:** Social history, categories, common errors in history taking. Maternal and perinatal / neonatal history, medication history.

3. **Physical examination of the patient:** Chest topography (identification of imaginary lines and topographical landmarks) & assessment of the chest. Sensorium, emotional state and ability to co-operate, level of pain.

4. **Examination of the respiratory and cardiovascular system.**

5. **Lung sounds**(including demonstration)

6. **Heart sounds**(including demonstration)

7. **Assessment of other body systems:** Abdominal organs, neurological status, skin and its extremities, temperature, digestive and renal system, reproductive system.

8. **Techniques of percussion & palpation**

9. **Nutritional status:** Types of diets, caloric needs
10. **Vital signs**

11. **Symptoms of respiratory disorders:**
    Cough & pharmacotherapy of cough
    Haemoptysis- causes and emergency management
    Dyspnea – types and causes
    Cyanosis- acute and chronic causes
    Nasal flaring and jaw breathing, paradoxical breathing
    Causes for the use of accessory muscles for respiration

12. **Inspection of the chest**

13. **Symptoms of cardiovascular disease**

14. **Universal precautions**

15. **Bedside assessment of the patient**

16. **Principles of infection control:**
    Infection control strategies in the hospital setting.
    Importance of best infection control practices in Respiratory care
17. **Bronchial hygiene therapy (BHT)**
    Physiology of airway clearance, goals and indications

18. **Lung expansion therapy (LET)** Causes and types of atelectasis, clinical sign of atelectasis, Consolidation of lung

19. **Chest physical therapy (CPT)** Indications, ideal patient for therapy, preparing the patient for the procedure, techniques, classification of exercises, physiologic response to exercises, monitoring during the procedure

20. **Breathing exercises:** different deep breathing exercises, design a programme- intensity, frequency, duration and mode

21. **Postural drainage therapy**

22. **Airway clearance techniques:** suctioning, suction catheters

23. **Basic life support (BLS) adult**

24. **Foreign body airway obstruction and management**

25. Acute sinusitis, Acute pharyngitis, Laryngo tracheitis &Epiglotitis

26. Bronchitis & bronchiectasis

27. Pulmonary embolism

28. Lung cancer & Lung abscess

29. Pneumonia (community acquired), Pneumonia (hospital acquired)

30. COPD

31. Pneumothorax

32. Pleural diseases & pleural effusion

33. Pulmonary edema and management
34. ALI/ARDS/Severe acute respiratory distress syndrome (SARS)

35. Toxic inhalation & smoke inhalational injury

36. Acute respiratory failure

37. Viral and fungal lower respiratory tract infections

38. Occupational lung disease

39. Sleep disorders

40. Asthma

41. Pulmonary hypertension

42. Flail chest, diseases of the mediastinum and the chest wall

43. Dyspnea and management

44. Restrictive lung disorders

45. Discussion on O2 & CO2 transport- Regulation of respiration

Demonstration & Practical

1. Practicum on physical examination
2. Practicum on medical history taking and record keeping
3. Assessment of the patient with respiratory failure
4. Lung sounds and heart sounds Simulator based demonstration
5. Dyspnea- clinical presentation
6. Pneumothorax – diagnosis, management.
7. Pleural effusion- clinical presentation
8. Neuromuscular diseases- long term respiratory care
9. Measurement of O2 delivery, oxygenation
10. BLS Demonstration with manikin

Recommended Books

1. Egan's Fundaments of Respiratory Care
2. Hutchison's Clinical Methods
3. Mosby's Respiratory care equipment
5. Respiratory Physiology, The Essentials - John B West
6. Pulmonary Pathophysiology The Essentials - John B West

APPLIED SCIENCE-2

1. Gas Physics: States of matter and gas laws, change of state, Gas behavior under changing conditions, Pressure measurement, Gas flows and diffusion, Gas laws, Miscellaneous concepts such as Density and Specific Gravity

2. Gas analyzers

3. Medical gas supply & storage: Compressed gas cylinders, Colour coding, Cylinders and cylinder valves, Cylinder storage, Diameter index safety system, Medical gas pipeline system, Air compressors, Oxygen concentrators, properties of He and NO, Alarms, Safety devices, portable liquid oxygen systems

4. Gas administration devices: Reducing valves, flowmetersand regulation of gas pressure and flow, central piping system, selection of device to regulate pressure or flow.

5. Medical gas therapy:
Oxygen therapy- goals, clinical practice guidelines, hazards and precautions, O2 delivery systems, protocol based O2 therapy approach. Hyperbaric oxygen therapy, Oxygen toxicity.
Nitric oxygen therapy, helium oxygen therapy.

6. Humidity therapy:
Physiologic control of heat and moisture exchange, Indications for humidification. Humidity producing equipment, types and methods to achieve proper conditioning of gas.

7. Bland aerosol therapy:
Aerosol generators, airway appliances for bland aerosol administration.

8. Aerosol drug therapy: Aerosol generators, Factors influencing aerosol deposition in the lungs, Particle deposition, Assessment based aerosol therapy protocols, Infection control.

9. Nebulizers, Metered dose inhalers and DPI's.

10. Artificial airways Part- 1
.Oro-nasopharyngeal airways, Nasal airways, LMA, Combitubes

11. Care of the artificial airway: Long term management, infection control practices, suctioning, cuff management

12. Manual Resuscitators & breathing circuit

13. Infection Control: Universal precautions, hand washing, isolation procedures, assure cleanliness of the equipments by selecting or determining appropriate, agent and technique for disinfections or sterilization and monitoring, assure proper handling of biohazardous materials, incorporated ventilator associated pneumonia prevention, protocol, implementing infectious disease protocol eg.SARS, transmission – prevention

14. Diagnostic Techniques

15. Electrical conduction system of the heart

16. normal ECG & standardization of conventional lead positions of 12 lead ECG

17. Cardiac arrhythmias: Sinus arrhythmia, sinus bradycardia, sinus tachycardia, atrial flutter and atrial fibrillation., Premature atrial contractions, junctional rhythms, ventricular arrhythmias, MI, ventricular fibrillation

18. Bedside assessment of pulmonary function: Spirometry, V-T studies, V-F studies, P-V studies.

19. Imaging studies: Values and limitations of chest X-ray
Conventional and special radiological views, Chest X-Ray Interpretation.
Review of clinical findings and history.
Preparation of viewing film.
Normal anatomy on chest x-ray.
Technical evaluation of chest x-ray. Method of chest x-ray evaluation.

20. Introduction to Pulmonary Diseases and Chest Radiographs: Atelectasis, Pneumothorax, Pneumonia, Pulmonary tuberculosis, Occupational lung diseases, Pulmonary edema, COPD, Restrictive lung diseases etc.

21. Blood gas analysis: Interpretation of ABG reports- Status of oxygenation, ventilation, and acid base status.
Interpretation of venous blood samples

22. Introduction to PFT lab: Spirometry & history of spirometer, instrumentation, calibration and quality control, infection control, dead space, terms and symbols, volume at ATPS and BTPS.

23. Pulmonary function studies: Spirogram, normal volumes and capacities, lung volume measurement, flow rate measurement, flow volume measurement, closing volume measurement, gas distribution measurement, exercise testing, bronchodilator effectiveness measurement.

24. Interpretation of PFT Data

Demonstraion and Practical

1.Practicum on assessment of CVS/ vital signs/insertion of invasive lines, sampling maintenance of lines

2.Practicum on clinical laboratory data interpretation/blood gas

3.Practicum and clinical demonstration of suctioning and other airway clearance techniques.

4.Practicum and clinical demonstration of deep breathing exercises

5.Clinical demonstration of BLS (Manikin)

6.Demonstration on O2 delivery devices, oxygen therapy

7.Demonstration of regulators and flow meters

8.Demonstration of various humidification systems

9.Demonstration of different aerosol delivery devices

10.Nebulizers, p-MDIs, DPIs, Mesh nebulizers, Ultrasonic nebulizers

11.Transcutaneous monitoring, pulse oxymeter, capnography

12.Demonstration of manual resuscitators & breathing circuits

Clinical Postings:

Intensive care units
Post operative intensive care units

High dependency intensive care units
Outpatient departments
Laboratories

Reference Books:
Davidson's Principles and Practice of Medicine - Elsevier Publications

APPLIED SCIENCE- 3

Cardiopulmonary Intensive Care Management

1. Shock: Hypovolaemic shock, cardiogenic shock, septic shock, ionotropes, vasopressors and diuretics in shock.

2. Intercostal drainage tubes: Technique of placement, complications, underwater seal systems and its management.

3. Chest trauma: Management of RTA in ICU

4. ACLS: CPR, advanced airway management techniques, diagnosis and management of life threatening arrhythmias, ventilation and electrolyte balance during resuscitation, drugs used in resuscitation, Post resuscitation support

5. Major adult cardiac disorders Concepts in ventilator management, ICU respiratory care**.**Post operative respiratory care of post cardiac surgical patients.

6. Neurological disorders
Concepts in ventilator management, ICU respiratory care.,Post operative respiratory care of post cardiac surgical patients.

7. Stroke

8. Respiratory defense mechanisms

9. Prone ventilation

10. Bronchoscopy Part 1

11. Ventilator associated pneumonia

APPLIED SCIENCE 4

1. Principles of blood gas analysis

2. Basic physical and physiological principles

3. Hydrogen ion regulation in body fluids

4. Oxygen & transport in the blood, oxygen content measurement

5. Acid base balance, Clinical approach to acid base problems, acid excretion, acid base disturbances
Correction factors in blood gas

Non-invasive Ventilation

1. Equipments for NIV, ventilators, interfaces, accessories

2. Modes of non invasive support

3. Fine tuning of the patient on NIV & synchronization

4. Quality control practices in NIV

5. Pediatric NIV- CPAP, Bubble CPAP etc

6. Disease specific application of non invasive ventilation: COPD, Asthma, OHA, acute respiratory failure, as a weaning tool, CHF, ILD, NMD and quadriplegia.

7. NIV in ICU and HDU, Critical care ventilator vs conventional NIV machines.

8. Care of the patient on NIV- humidification, preventing pressure sores, airway clearance, physiotherapy, weaning from NIV.

9. Home ventilation- Invasive and non-invasive methods

10. Assessment of the home care patient & patient selection criteria

11. Monitoring and complications of NIV

12. Ethical and medico legal aspects of assisted ventilation

PULMONARY REHABILITATION

- Historical perspective of pulmonary rehabilitation
- Basic concepts of pulmonary rehabilitation
- PR – definition and characteristics
- Selection and assessment of chronic respiratory disease patients
- Therapeutic interventions in PR: Ventilatory muscle training, Nutritional assessment, Preventive aspects for the patient with chronic lung disease, exercise in the rehabilitation of patients with respiratory disease.
- Tobacco dependence- pathophysiology and management, tobacco cessation program learning objectives.
- Sleep disorders in pulmonary patients.
- Educating the patient and family in health management
- Rehabilitation in the pediatric patients with pulmonary disease.
- Rehabilitation in non - COPD lung disease
- Rehabilitation for long term Tracheostomised patient.
- Assessment of the patient with respiratory disorder and interpretation of pulmonary function studies
- Pre-operative pulmonary function studies/ bedside assessments
- Spirometry- Interpretation of lung volumes
- Measurement of DLCO
- Spirometry and body plethysmography.
- Setting sleep lab
- Technological advances in the sleep study and its management

Practical:

1. Selection of device and methods of therapy after assessing the need for airway

clearance therapy, lung expansion therapy and breathing exercises.
2. Demonstration of chest physical therapy, exercise testing and rehabilitation methods
3. Assessment of patient and Preparation of care plan for pulmonary rehabilitation.
4. Recognition of contraindications for the chest physical therapy procedures

Recommended Books:

1. Chest Physical Therapy and Pulmonary Rehabilitation, An Interdisciplinary
2. Approach - Donna L. Frownfelter
3. Handbook of Practical Chest Physiotherapy – Mitra