

**ANDHRA PRADESH PARA MEDICAL  
BOARD**

**HYDERABAD**

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**(A.P. Act No.38 of 2006)**

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**Syllabus for**

**DIPLOMA IN ELECTRO CARDIO GRAPHY  
TECHNICIAN COURSE  
(TWO YEARS COURSE)**

**Secretary**

In view of representation from the Faculty the Syllabus for the 1<sup>st</sup> year in all Para medical courses is modified accordingly and kept on website.

**DIPLOMA IN E.C.G. TECHNICIAN COURSE  
(TWO YEARS COURSE)**

**Syllabus for First Year**

<b>Paper-I</b>	<p><b><u>BASIC HUMAN SCIENCES</u></b></p> <p>A) Basics of Anatomy B) Basics of Physiology C) Basics of Biochemistry D) Basics of Bio-statistics</p>
<b>Paper-II</b>	<p>A) Basics of Pathology B) Basics of Blood Banking C) Basics of Microbiology D) Basics of Central Sterilization Services.</p>
<b>Paper-III</b>	<p>A) Hospital Awareness. B) Familiarization of different tables/tubes in surgical department, Surgical Awareness, preparation of patient for surgery. C) Patient related services. D) Communication &amp; Computer Skills , Audio and Visual Aids.</p>

**DIPLOMA IN E.C.G. TECHNICIAN COURSE  
(TWO YEARS COURSE)**

**Syllabus for Second Year**

<b>Paper-I</b>	<p style="text-align: center;"><b>Basic Electro Cardio Graphy</b></p> <p>A) Electro Physiology, Operation and maintenance of E.C.G. machines, Identification of the basic defects and repair, Safety Standards of E.C.G. Machines, ECG Equipment details.</p> <p>B) Einthoven's Law, the Hexaxial System, and The 12 Lead System, Principles of AC and DC, Types of Batteries, Ohm's Law, Watt, Joule. Ampere, Multimeters, CRT Tubes.</p> <p>C) Normal E.C.G. Reading, Abnormal E.C.G.</p> <p>D) Recognition of Myocardial Infarction, Basic Arrhythmias and Conduction disturbances, Treatment of the above conditions. Basic concepts.</p>
<b>Paper-II</b>	<p>A) Cardiovascular Pathology, Anatomy, Physiology, and Biochemistry of System, Blood Pressure (BP)</p> <p>B) Clinical Pharmacology</p> <p>C) Cardiovascular disorders in general.</p> <p>D) Electro-Encephalography / Electro-Myography</p>
<b>Paper-III</b>	<p>A) Defibrillator-indications &amp; Operations, Contra indications, Precautions, Complications and treatment.</p> <p>B) Stress E.C.G. - Protocols, Procedure, Indications</p> <p>C) Holter Recording-Recording and Analysis.</p> <p>D) Instrumentation Study, Instrument Measurement &amp; Critical Care equipment.</p>

# 1<sup>st</sup> YEAR

## PAPER-I

### Basics of Anatomy & Physiology

#### **Basics of Anatomy**

1. Introduction to Human Anatomy
2. Cell- Tissues Properties, Different Tissues
3. Digestive System & Hepatobiliary System
4. Respiratory System
5. Cardio Vascular System
6. Lymphatic System
7. Bones and Joints
8. Nervous System
9. Endocrine System
10. Sense Organs
11. Excretory System
12. Reproductive System

#### **Basics of Physiology**

1. Introduction to Human Physiology
2. Blood
3. Cardio Vascular System
4. Lymphoid System
5. Digestive System
6. Respiratory System
7. Nervous System
8. Endocrine System
9. Excretory System
10. Reproductive System
11. Sense Organs

## **Basics of Bio – Chemistry**

1. Introduction to Basics of Bio-chemistry including code of ethics for Medical Lab Technicians and Medical Lab Organization.
2. Reception, Registration and bio-chemical parameters investigated.
3. Glassware and plastic ware used in a bio-chemical laboratory.
  - a. **Glassware:**
    - 1) Types of glass and composition.
    - 2) Types of glassware used, their identification, application & uses.
    - 3) Cleaning, drying, maintenance and storage of glassware.
  - b. **Plastic ware: Brief outline**
4. Instrumental methods of Bio-chemical analysis.
  - a. **Colorimetry :**

Visual and photoelectric methods, instrumentation, principle & laws involved construction, operation, care and maintenance, applications.
  - b. **Spectrophotometry**

Principle and theory, types, construction, & applications
5. Basic lab operations like
  - a. **Separation of solids from liquids**
    1. Centrifugation: Principle, Different types of centrifuges care and maintenance, applications.
    2. Filtration using funnel.
    3. Weighing : Different types of balances used, care and maintenance.
    4. Evaporation
    5. Distillation
    6. Refluxing
    7. Drying different salts and dessicotion.

6. Water Chemicals and related substances
  - a. Purity of chemicals
  - b. Corrosives
  - c. Hygroscopic Substances
7. Prevention, Safety and first aid in lab accidents.
8. Collection of Specimens
  - a. **Blood:** Types of Specimens, Collection, Precautions during collection processing and preservation.
  - b. **Urine:** Types of Specimens, Collection, Precautions during collection, Processing and Preservation.
9. Urine biochemical parameters.
10. Units of measurements
11. **Solutions** : Types based on solute and solvent, Types based on method of expressing concentration, calculations.
12. **Carbohydrates:** Definitions, Biological importance, Acid value, iodine value, saponification value.
13. Amino acids and Proteins Definition, Biological importance, Classification, Qualitative tests.
14. **Diagnostic tests** : Blood sugar, Glucose tolerance test, Blood urea, Serum uric acid, Serum creatinine.
15. **Vitamins and Minerals**
  - a. **Vitamins:**  
Water Soluble vitamins, Fat Soluble vitamins, Sources, Daily requirements, Deficiency diseases.
  - b. **Minerals :**  
Sources, Daily requirements, Deficiency diseases.

# Paper-II

## **Basics of Pathology**

### **Introduction to Pathology in brief**

1. Urine – Analysis – Physical Examination – specific gravity PH, reaction,

colour.

Chemical Examination – Sugar Albumin, bile salts,

bile Pigments etc.

Microscopic,

Sediment for RBC,

WBC,

Epitheleal cells,

casts,

crystals,

parasites.

Preparation of Reagents, procedure and principle of tests.

2. **Sputum Analysis** – Physical Examination, Preparation and staining smear for Microscopic Examination.
3. **Semen Analysis** – Physical Examination Microscopy – counting, motility, staining, Morphology, abnormal and normal forms.
4. **Body Fluids** – Differential count of Peritoneal, pericardial, pleural fluids and CSF, charging chamber, Identifying and counting the cells.

# **Basics of Microbiology**

## **I. Introduction to Microbiology in brief**

Definition,  
History

## **II. Microscopy**

- a) Principle working and maintenance of compound Microscope.
- b) Principle of Fluorescent microscope, Electron Microscope, Dark Ground Microscope.

### **History**

**Types of Microscope:** (a) Light Microscope, (b) DGI, (c) Fluorescent, (d) Phase contrast.

**(e) Electron Microscope :** a). Transmission, b) Scanning, Principles of operational mechanisms of various types of Microscopes.

## **III. Sterilization and disinfection – classification and Methods of sterilization.**

### **Sterilization: Definition, types and principles of sterilization methods:**

(a) Heat (dry heat, moist heat with special reference to autoclave, (b) Radiation, (c) Filtration, efficiency testing to various sterilizers.

### **Antiseptics and Disinfectants :**

Definition, types and properties, mode of action, uses of various disinfectants, precautions while using the disinfectants, qualities of a good disinfectants, testing efficiency of various disinfectants.



- 1) Principle and Methods of sterilization by heat
  - a) By Dry Heat, flaming, Red Heat, Hot air oven, incineration.
  - b) By Moist Heat-pasteurization, Inspissation, tyndalisation, autoclave.

2) Filtration Methods

- 3) Ionising Radiation – Disinfection, Mode of action and uses of important chemical disinfectants – Phenol and Phenolic compounds, alcohols, halogens, dyes and acids and alkalis.

4) Gaseous Methods of sterilization.

- IV. Cleaning, drying & Sterilization of Glassware disposal of contaminated material i.e. clinical infective material inoculated culture media. Handling and Disposal of Biomedical waste.
- V. **Biomedical waste management in a Microbiology Laboratory** : types of the waste generated, segregation, treatment, disposal.
- VI. Morphology and classification of Bacteria Sp. of cell, capsule, flagella, spore, Anaerobic Methods of cultivation of Bacteria.

## **Paper-III**

### **A. Hospital Awareness**

A brief idea of hospital as an organization management different units of a hospital effective communication skills, communication channel

Maintenance of records  
Effective leadership  
General patient care  
Medical terminologies  
Vital signs  
Unit preparation  
Transporting & Transferring patients  
Sterilization Techniques  
Control of infection  
Medication – Oral & parenteral  
Admission – Discharge procedure  
Bandages

Practicals : Posted in ward & taught clinically

### **A. Surgical Department**

Familiarization of different tubes

1. Drainage tube
2. Post Operative Exercises
3. Post OP Management of Patient
4. Shock of Management
5. Changing Surgical Dressing.

1. Preoperative preparation of patient
2. Preanesthetic preparation
3. Assisting in operation
4. Anaesthesia
5. CSSD
  1. Recovery room
  2. Movement of papers
  3. Scheduling of theaters
  4. Supplying of articles
  5. Specific area practices
    - a. As scrubnurse
    - b. As circulating nurse

c. **Communication and Computer Skills, Audio & Visual Aids.**

d.

e.

f. **COMMUNICATION** Process

g. Types of communication

h. Strategies for effective Communication

i. Barriers of communication

j.

k. **SOFT SKILLS** Presentation with the use  
of visual aids such as

l. power point

m. Conversation

n. Extempore speech, usage of effective language for  
communication of health work.

o. Case studies and situational analysis

p. Survey and Reporting

q.

r. **COMPUTER** Computer basic

s. MS – Office

t. MS – Word

u. MS – Excel

v. MS – Power Point

w.

x. **INTERNET CONCEPTS** Browsing

y. Down- Loading

z. Use of Slide Projector

# 2<sup>nd</sup> Year

## ANATOMY AND PHYSIOLOGY OF THE CARDIOVASCULAR SYSTEM

Know the structure and function of the heart. The anatomy of the blood vessels, and the roles of the different types of vessel in the circulatory system.

General structure and function of the heart, including:

- The role of the heart in circulation
- Valves and supporting apparatus.
- Chambers
- Main coronary arteries and veins
- Great veins and arteries
- Pericardium

Simple anatomy and function of the specialized conduction system:

- Sinus node
- Atrioventricular node
- Bundle of His
- Left and right bundle branches
- Purkinje fibres

Pathology of the Cardiovascular System

Understands common pathological terms used in description of heart disease and, where applicable, associated electrocardiographic features.

Knows the meaning of the terms:

- Atherosclerosis; atheroma
- Ischaemia
- Angina pectoris,
- Unstable angina.
- Prinzmetal's angina
- ST-elevation and non-ST elevation myocardial infarction
- Acute coronary syndrome
- Necrosis
- Hypertension.
- Atrial and ventricular septal defects.
- Cyanosis.
- Coarctation of the aorta.
- Valvular stenosis and regurgitation, Pericarditis

# Practicals

## 1. Basic Anatomy and Physiology

- a. Definition of anatomy and physiology
- b. Anatomy terminology.

## 2. Systems of the Human Body

- a. Circulatory system
- b. Respiration system
- c. Excretive system
- d. Digestive system
- e. Skeletal system (name of the bones)
- f. Nervous system (introduction)

## 3. Cardio Pulmonary Resuscitation

## 4. Cardio Vascular System

### Blood Vessels

Arteries, Veins, Capillaries, Recording & Interpretation of Blood Pressure.

### Heart

- a. Position, Structure, Blood flow and Blood supply
- b. Electrical activity of the bears
- c. Cardiac muscles
- d. Cardiac conduction
- e. Circulation: Greater, lesser and coronary circulation

- a) Medical and technical terminology applicable to the subject area.
- b) Essential anatomy and physiology of the heart and circulation as relevant to electrocardiography.
- c) The work and responsibilities of a support worker in cardiology.
- d) Problems encountered in the recording of a 12-lead resting electrocardiogram and their solutions.
- e) Features of the normal 12-lead resting electrocardiogram and the recognition of some abnormalities.

The Syllabus is in three sections:

- 1) Anatomy and physiology of the heart and circulation.
- 2) Electrocardiography.
- 3) Interpretation of the electrocardiogram in health and disease.

## **WHAT TO EXPECT FROM THE ECG**

Clinical diagnosis depends mainly on a patient's history, and to a lesser extent on the physical examination. The ECG can provide evidence to support a diagnosis, and in some cases it is crucial for patient management. It is, however, important to see the ECG as a tool, and not as an end in itself.

The ECG is essential for the diagnosis, and therefore management, of abnormal cardiac rhythms. It helps with the diagnosis of the cause of chest pain, and the proper use of thrombolysis in treating myocardial infarction depends upon it. It can help with the diagnosis of the cause of breathlessness.

With practice, interpreting the ECG is a matter of pattern recognition. However, the ECG can be analysed from first principles if a few simple rules and basic facts are remembered. This chapter is about these rules and facts.

## **THE ELECTRICITY OF THE HEART**

The contraction of any muscle is associated with electrical changes called 'depolarization', and these changes can be detected by electrodes attached to the surface of the body. Since all muscular contraction will be detected, the electrical changes associated with contraction of the heart muscle will only be clear if the patient is fully relaxed and no skeletal muscles are contracting.

Although the heart has four chambers, from the electrical point of view it can be thought of as having only two, because the two atria contract together and then the two ventricles contract together.

## **THE ECG - ELECTRICAL PICTURES**

The word 'lead' sometimes causes confusion. Sometimes it is used to mean the pieces of wire that connect the patient to the ECG recorder. Properly, a lead is an electrical picture of the heart.

The electrical signal from the heart is detected at the surface of the body through electrodes, which are joined to the ECG recorder by wires. One electrode is attached to each limb, and six to the front of the chest.

The ECG recorder compares the electrical activity detected in the different electrodes, and the electrical picture so obtained is called a 'lead'. The different comparisons 'look at' the heart from different directions. For example, when the recorder is set to 'lead I' it is comparing the electrical events detected by the electrodes attached to the right and left arms. Each lead gives a different view of the electrical activity of the heart, and so a different ECG pattern. Strictly, each ECG pattern should be called 'lead ...', but often the word 'lead' is omitted.

The ECG is made up of 12 characteristic views of the heart, six obtained from the limb leads and six from the chest leads.

### **HOW TO REPORT AN ECG**

Many ECG recorders automatically provide a report, and in these reports the heart rate and the conducting intervals are usually accurately measured. However, the description of the rhythm and of the QRS and T patterns should be regarded with suspicion. The recorders tend to 'over-report', and to describe abnormalities where none exist: it is much better to be confident in your own reporting.

#### **Instrumentation**

Understands instrumentation and the basic principles of lead theory needed for the effective and safe practice of electrocardiography.

Understands the function of the controls of the E.C.G machine

- Paper speed
- Gain
- Filters
- Lead selector
- Manual/automatic operation

Understands care of the equipment

- Care of recording paper
- Battery maintenance
- Care of leads and cables

## Understands electrodes

- Application of and connection to electrodes
- Care of electrodes
- Electrode positions

## Understands lead systems

- Unipolar and bipolar leads
- Einthoven's theory and its application.
- Wilson's Central terminal.

Practical electrocardiography is able to record the electrocardiogram accurately from all types of patient using both manual and automatic mode.

- Choice of appropriate leads for a particular patient category.
- Setting of controls as appropriate for the specific recording to be undertaken.
- Preparation of electrode sites to give optimum electrode contact and to minimize artefacts.
- Connection of electrodes to patient.
- Electrode positions: correct application and positioning of limb and precordial electrodes, in accordance with the Society for cardiological Science and Technology guidelines.
- Recording of the resting electrocardiogram from a patient who:
  - a) Is unconscious,
  - b) Has language or communication difficulty,
  - c) Is infectious or is in isolation,
  - d) Has a physical disability ( including amputation),
  - e) Is visually impaired.
- Evaluation of the recording to assess the need for re-recording.
- Re-recording as appropriate
- Recognition and elimination or reduction of artefacts
- Labelling of completed recordings as appropriate
- Cleaning, preparation and storage of equipment ready for subsequent recordings, including correct sterilization and disposal procedures.



## INTERPRETATION OF THE ELECTROGRAM IN HEALTH AND DISEASE

**Recognizes the features of the electrocardiogram and makes appropriate measurements.**

- Relationship of the electrocardiogram to the electrical events of the heart.
- Relationship of the electrical events to the mechanical events of the cardiac cycle.
- Waveform components (P, Q, R, S, T and U)
- Definitions and normal ranges of PR interval and QRS duration.
- Measurement of QT interval and calculation of corrected QU interval (QTc) by Bazett's formula.
- Calculation of the heart rate from the electrocardiogram
- The appearance of the normal resting electrocardiogram.

Recognises the normal variations of the electrocardiogram in relation to:

- Age
- State of activity
- Body build
- Ethnic origin

Recognises the normal electrocardiogram and some common abnormalities:

Rhythms arising from the sinus node:

- Normal sinus rhythm
- Sinus arrhythmia
- Sinus tachycardia
- Sinus bradycardia
- Sinus arrest

Supraventricular tachyarrhythmias :

- Atrial premature contractions (ectopics).
- Atrial tachycardia.
- Atrial flutter.
- Atrial fibrillation
- Supraventricular tachycardia
- Accelerated AV node (junctional rhythm)

Conduction abnormalities:

- Ventricular pre-excitation
- Left and right bundle branch block
- 1<sup>st</sup> degree AV block
- 2<sup>nd</sup> degree AV block: Mobitz I ( Wenckebach), II and 2:1 block
- 3<sup>rd</sup> degree (complete) AV block.

Rhythms arising from the ventricles:

- Ventricular escape beats
- Ventricular premature beats (ectopics).
- Ventricular tachycardia.
- Ventricular flutter.
- Ventricular fibrillation.
- Ventricular standstill (asystole)

The electrocardiogram associated with an artificial cardiac pacemaker.

- Identification of pacemaker stimulus on the electrocardiogram
- Differentiation between atrial and ventricular pacing.

Interpretation of changes in the electrocardiogram arising from abnormal cardiac conditions

- Myocardial ischaemia
- Myocardial infarction
- Left ventricular hypertrophy
- Pericarditis
- Dextrocardia

Essential ECG Interpretation

This section will comprise of three 12- lead ECG's taken from the following list:-

- Complete heart block
- Left bundle branch block
- Right bundle branch block
- Ventricular fibrillation
- Atrial fibrillation
- Ventricular tachycardia
- Narrow complex tachycardia
- Acute ST elevation myocardial infarct

Candidates will be required to identify which of these findings is demonstrated in each of the three ECT's.

# **Electro Encephalo Graphy (EEG) and Electro Myo Graphy (EMG)**

## **Introduction**

The human brain consists of billions of neurons which are responsive cells that transmit messages from one part of the body to another. Neurons in the brain impact the completion of motor activities, mental thought, memories, and dreams. An electroencephalogram (EEG) is used to record the electrical activity of the brain. The EEG will be used to record the action potentials and the postsynaptic potentials of the neurons in the cerebral cortex. Furthermore, an EEG records the summation of the action and synaptic potentials produced by the firing of many neurons.<sup>1</sup> The potentials of these neurons will vary due to the emotional, mental, or physiological state of the person. EEGs are often used to measure brain activity during different exercises, diagnose neurological disorders, and monitor the patient's level of consciousness during surgeries.

Any movement within the body relies on the coordination of various muscles. The contraction of muscles is under a voluntary control in which electrical impulses from the autonomic nervous system cause the muscle to contract. The mechanism responsible for muscle contraction is action potential. An electro myogram (EMG) can be used to measure the summation of different action potentials in a muscle at a specific time. EMGs are often used to gather information about neuromuscular disorders and how muscles coordinate with each other.

Electromyography (EMG) is the study of muscle function through analysis of the electrical signals emanated during muscular contractions. Electromyography is often abused and misused by many clinicians and researchers. Many times even experienced electro Myographers fail to provide enough information and detail on the protocols, recording equipment and procedures used to allow other researchers to consistently replicate their studies.

Electromyography is measuring the electrical signal associated with the activation of the muscle. This may be voluntary or involuntary muscle contraction. The EMG activity of voluntary muscle contractions is related to tension. The functional unit of the muscle contraction is a motor unit, which is comprised of a single alpha motor neuron and all the fibers it innervates. This muscle fiber contracts when the action potentials (impulse) of the motor nerve which supplies it reaches a depolarization threshold. The depolarization generates an electromagnetic field and the potential is measured as a voltage. The depolarization, which spreads along the membrane of the muscle, is a muscle action potential. The motor unit action potential is the spatio and temporal summation of the individual muscle action potentials for all the fibers of a single motor unit. Therefore, the EMG signal is the algebraic summation of the motor unit action potentials within the pick-up area of the electrode being used. The pick-up area of an electrode will almost always include more than one motor unit because muscle fibers of different motor units are intermingled throughout the entire muscle. Any portion of the muscle may contain fibers belonging to as many as 20-50 motor units.

# Practicals

## 1. Electro Cardio Gram Leads

- a. E.C.G. definition, invention
- b. Bipolar lead (Enthovan triangle)
- c. Unipolar lead
- d. Chest lead
- e. Placement of electrodes on the chest
- f. ECG taking procedure
- g. Basic wave forms
- h. Definition of waves
- i. Electrical of waves
- j. ECG grid
- k. Instrument handling instruction
- l. The fundamental of ECG and electricity
- m. Safety measures

## 2. Reading an E.C.G.

- a. Rate
- b. Rhythm
- c. Voltage
- d. P,Q,R,S,T, and U waves
- e. ST segment and MI
- f. Risk factors for MI and heart diseases
- g. Important cardiac diseases and its pattern
- h. ECHO
- i. TMT
- j. Computerized monitoring arrangement in ICCU and ICU  
To achieve technical competencies in recording and interpretation of electrocardiogram and patient communication skills.

## 3. Operation, calibration, and servicing of E.C.G. machines.

E.C.G. Recording – in Adult & Pediatric Patients.

Stress E.C.G. Recording.

Holter Recording.