

# 1<sup>st</sup> Year B.P.T.

## **SUBJECT: HUMAN ANATOMY (Subject Code BPT- 101)**

Goal – To provide the student with the necessary Anatomical knowledge & skills to practice as a qualified Physiotherapist

<b>Subject Title &amp; Code</b>	<b>HUMAN ANATOMY (BPT- 101)</b>
<b>Duration</b>	<b>New: 210 Hours</b>
<b>Total Hours</b>	
<b>Theory</b>	<b>135</b>
<b>Practical</b>	<b>75</b>
<b>Total Hrs/week</b>	<b>8</b>
<b>Lectures</b>	<b>5hrs/week</b>
<b>Practicals</b>	<b>3hrs/week</b>
<b>Seminars</b>	
<b>Method of Assessment</b>	<b>Theory and Practical</b>

### **Objectives-**

#### **1] MUSCULO – SKELETAL**

- i) The student should be able to identify & Describe Anatomical aspects of muscle bones & joints, & to understand and Analyze movements.
- ii) To understand the Anatomical basis of various clinical conditions e.g. trauma, deformities, pertaining to limbs & spine.
- iii) To be able to localize various surface land-marks;
- iv) To understand & describe the mechanism of posture & gait the Anatomical basis of abnormal gait.

## **2] In NEURO – Anatomy –**

- i) to identify & describe various parts of C.N.S. – fore – brain, Midbrain, Hind-brain Brain stem, courses of cranial nerves; functional components, course distribution. Anatomical bases of clinical lesions:
- ii) to describe the source & course of spinal tracts;
- iii) to describe blood circulation of C.N.S. & spine;
- iv) be able to identify the components of various Trans – sections.

## **3] THORAX –** to identify & describe various components of the contents of the

Thorax – with special emphasis to tracheo-bronchial tree, & cardio – pulmonary system.

## **4] CIRCULATORY – I)** be able to identify & describe the source & course of major arterial venous & Lymphatic system, with special emphasis to extremities, Spine & Thorax

## **5] PSYCHO-MOTOR –**

- i) to be able to demonstrate the movements of various joints –
- ii) distinguish cranial & peripheral nerves
- iii) distinguish major arteries, veins & Lymphatics with special emphases to extremities, & spine.

## **Syllabus**

## **1]-GENERAL Anatomy-----**

### **-----10hours**

Including Histology – Basic tissues like epithelial, Connective, muscular, nervous, system.

## **2. Musculo Skeletal Anatomy - (General)..... (10 hrs)**

- a) Anatomical positions of body, axes, planes, common anatomical terminologies (Groove, tuberosity, trochanters etc).
- b) Connective tissue classification.
- c) Bones- Composition & functions, classification and types according to morphology and development.
- d) Joints-definition-classification, structure of fibrous, cartilaginous joints, blood supply and nerve supply of joints.
- e) Muscles – origin, insertion, nerve supply and actions

### **A. Upper Extremity : (35 hrs)**

- a. Osteology : Clavicles, Scapula, Humerus, Radius, Ulna, Carpals, Metacarpals, Phalanges.
- b. Soft parts: Breast, pectoral region, axilla, front of arm, back of arm, cubital fossa, front of fore arm, back of fore arm, palm, dorsum of hand, muscles, nerves, blood vessels and lymphatic drainage of upper extremity.
- c. Joints : Shoulder girdle, shoulder joint, elbow joints, radio ulnar joint, wrist joint and joints of the hand.
- d. Arches of hand, skin of the palm and dorsum of hand.

**B. Lower Extremity.....(25 hrs)**

- a. Osteology : Hip bone, femur, tibia, fibula, patella, tarsals, metatarsals and phalanges.
- b. Soft parts: Gluteal region, front and back of the thigh (Femoral triangle, femoral canal and inguinal canal), medial side of the thigh (Adductor canal), lateral side of the thigh, popliteal fossa, anterior and posterior compartment of leg, sole of the foot, lymphatic drainage of lower limb, venous drainage of the lower limb, arterial supply of the lower limb, arches of foot, skin of foot.
- c. Joints: Hip Joint, Knee joint, Ankle joint, joints of the foot.

**C. Trunk & Pelvis ..... (20 Hrs)**

- a. Osteology: Cervical, thoracic, lumbar, sacral and coccygeal vertebrae and ribs
- b. Soft tissue: Pre and Para vertebral muscles, intercostals muscles, anterior abdominal wall muscles, Inter-vertebral disc.
- c. Pelvic girdle and muscles of the pelvic floor

**3. Regional Anatomy ..... (80 Hrs)**

Following is region-wise distribution

Thorax:

- a) Cardio – Vascular System .....(10hrs)

Mediastinum: Divisions and contents

Pericardium: Thoracic Wall: position, shape and parts of the heart; conducting System; blood Supply and nerve supply of the heart;

names of the blood vessels and their distribution in the body – region wise.

b) Respiratory system( 15 hrs)

Outline of respiratory passages

Pleura and lungs: position, parts, relations, blood supply and nerve supply; Lungs emphasize on bronchopulmonary segments

Diaphragm: Origin, insertion, nerve supply and action, openings in the diaphragm, intercostal muscles and Accessory muscles of respiration: Origin, insertion, nerve supply and action.

Abdomen: .....(8 Hrs)

Peritoneum: Parietal peritoneum, visceral peritoneum, folds of peritoneum, functions of peritoneum. Large blood vessels of the gut Location, size, shape, features, blood supply, nerve supply and functions of the following: stomach, liver, spleen, pancreas, kidney, urinary bladder, intestines, gall bladder.

Pelvis: Position, shape, size, features, blood supply and nerve supply of the male and female reproductive system.

Endocrine glands: ..... (5hrs)

Position, shape, size, function, blood supply and nerve supply of the following glands :Hypothalamus and pituitary gland, thyroid glands, parathyroid glands, Adrenal glands, pancreatic islets, ovaries and testes, pineal glands, thymus.

Head and Neck: .....(20 hrs)

Osteology : Mandible and bones of the skull. Soft parts : Muscles of the face and neck and their nerve and blood supply-extra, ocular

muscles, triangles of the neck, Gross anatomy of eyeball, nose, ears and tongue. Facial muscles & T.M. joint

## **5. Neuro Anatomy .....(50 hrs)**

Organization of Central Nervous system - Spinal nerves and autonomic nervous system mainly pertaining to cardiovascular, respiratory and urogenital system, Cranial nerves, Peripheral nervous system, Peripheral nerve, Neuromuscular junction , Sensory end organs , Central Nervous System Spinal segments and areas, Brain Stem, Cerebellum, Inferior colliculi, Superior Colliculi, Thalamus, Hypothalamus, Corpus striatum, Cerebral hemisphere, Lateral ventricles, Blood supply to brain, Basal Ganglia, The pyramidal system, Pons, medulla, extra pyramidal systems, Anatomical integration

### **SCHEME OF EXAMINATION**

**THEORY – 80 MARKS** + Int. assessment – 20 marks Total ..... 100 Marks

Model question paper – 80 Marks

#### **Section A) Q1) M.C.Q.**

-based on Single best response ..... [20 x 1] --- 20 marks – [20 minutes]

This question should include topics covered in syllabus –

#### **Section B) S.A.Q.**

Q2) Answer any Five out of Six - ..... [ 3 x 5] -----  
15 marks

This question should include

- i] Digestive ii] /uro-genital iii] reproductive system iv] special senses – eye /ear/skin
- v] circulatory system.

Q3) Answer any 3 out of 4 ..... [ 5 x 3] -----  
15 marks

This question should include i] Thorax ii] soft parts upper limb iii] soft part lower limb

iv] soft parts Thorax /spine / neck

**Section C) L.A.Q.**

Q4) Compulsory – based Musculo Skeletal system [including Kinesiology] 15marks

Q5) should be based on Neuro-Anatomy [including cranial nerves with emphasis to V,VII, VIII, IX & XII nerves

..... 15 marks

**OR**

Q5) .....15 marks

**PRACTICAL – 80 MARKS** + Internal assessment – 20 marks = Total 100 marks

should include

**1] Spots** -----

----- 60 marks

**2] Viva** -----

----- 15 marks

Journal -----

----- 05 marks

**INTERNAL ASSESSMENT**

**THEORY:**

Two exams – Terminal and prelims of 80 marks each TOTAL 160 marks

Section A) Q1) M.C.Q.-based on Single best response – [20 x 1] --  
20marks

This question should include topics covered in syllabus-  
Section B) S.A.Q.- Q.2)-Answer any Five out of Six [3 X 5]-----  
- 15marks

This question should include  
i]-Digestive ii]-uro-genital iii]-reproductive system  
iv] - special senses-eye/ear/skin v]-circulatory system

Q.3) - Answer any 3 out of 4 [5 X 3] ----- 15 marks

This question should include

i]-Thorax  
ii]-soft parts upper limb  
iii]-soft part-lower limb  
iv]-soft parts Thorax/ spine / neck

Section C) L.A.Q-Q.4) based Musculo Skeletal system [including  
Kinesiology]--- 15 marks

Q.5) should be based on Neuro-Anatomy [including cranial nerves with  
Emphasis to V, VII, VIII, IX & XII nerves ----- 15 marks

**OR**

Q.5) ----- 15  
marks

**I.A. to be calculated out of 20 marks**

**PRACTICAL:**

Two exams – Terminal and prelims of 80 marks each TOTAL 160  
marks

1. SPOTS ----- 60 MARKS
2. Viva ----- 15 marks
3. Journal ----- 05 marks

**I.A. to be calculated out of 20**

**TEXT BOOKS**



1. Human Anatomy – by Snell
2. Anatomy by Chaurasia all 3 volumes
3. Neuro anatomy by Inderbir Singh
4. Human Anatomy by Kadasne (All three volumes)

**REFERENCE BOOKS**

1. Gray's Anatomy
2. Extremities by Quining Wasb
3. Atlas of Histology by Mariano De Fiore
4. Anatomy & Physiology by Smout and McDowell
5. Kinesiology by Katherine Wells
6. Neuroanatomy by Snell
7. Neuroanatomy by Vishram Singh

**SUBJECT: HUMAN PHYSIOLOGY (Subject Code BPT-102)**

<b>Subject Title &amp; Code</b>	<b>HUMAN PHYSIOLOGY (BPT-102)</b>
<b>Duration</b>	<b>New: 200 Hours</b>
<b>Total Hours</b>	
<b>Theory</b>	<b>150</b>
<b>Practical</b>	<b>50</b>
<b>Total Hrs/week</b>	<b>7</b>
<b>Lectures</b>	<b>5hrs/week</b>
<b>Practicals</b>	<b>2hrs/week</b>
<b>Seminars</b>	
<b>Method of Assessment</b>	<b>Theory and Practical</b>

**Objectives:** At the end of the course, the candidate will –

- 1) Acquire the knowledge of the relative contribution of each organ system in maintenance of the milieu interior (Homeostasis)
- 2) be able to describe physiological functions of various systems, with special reference to Musculo-skeletal, Neuro-motor, Cardio-respiratory, Female urogenital function, & alterations in function with aging
- 3) Analyse physiological response & adaptation to environmental stresses-with special emphasis on physical activity, temperature
- 4) acquire the skill of basic clinical examination, with special emphasis to Peripheral & Central Nervous system, Cardiovascular & Respiratory system, & Exercise tolerance / Ergography.

## Syllabus:

### 1) **GENERAL Physiology** [4Hours]

- Cell: Morphology. Organelles: their structure and functions
- Transport Mechanisms across the cell membrane
- Body fluids: Distribution, composition. Tissue fluid – formation.

### 2) **BLOOD**- -----

12hrs

Introduction: Composition and functions of blood, □Plasma: Composition, formation, functions. Plasma proteins. RBC: count and its variations. Erythropoiesis- stages, factors regulating. Reticulo-endothelial system (in brief) Haemoglobin - Anemia (in detail), types of Jaundice. Blood indices, PCV, ESR. WBC: Classification. Morphology, functions, count, its variation of each. Immunity. Platelets: Morphology, functions, count, its variations. Hemostatic mechanisms: Blood coagulation–factors, mechanisms. Their disorders. Anticoagulants. Blood Groups: Landsteiner’s law. Types, significance, determination, Erythroblastosis foetalis. Blood Transfusion: Cross matching. Indications and complications. Lymph: Composition, formation, circulation and functions.

### 3) **NERVE** Neuron AHC -----

----- 7hrs

i) Structure, classification & Properties; ii)- R.M.P. iii)- action potential;

iv) Propagation of nerve impulse; Nerve: Structure and functions of neurons. Classification, Properties and impulse transmission of nerve fibres. Nerve injury – degeneration and regeneration.

4) **MUSCLE** -----

----- 10hrs

- i) Structure- properties-classification-excitation/contraction coupling
- ii) Motor unit- E.M.G.- factors affecting muscle transmission)
- iii) Neuro-muscular transmission

5) **C.N.S.** -----

----- 25hrs

- i) Receptor physiology-classification & properties
- ii) Synapse- structure, properties, & transmission;
- iii) Reflexes-classification & properties;
- iv) Sensory & Motor Tracts-effect of transection (complete & incomplete) at various levels
- v) Physiology of Touch, Pain, Temperature & Proprioception;
- vi) Physiology of Muscle Tone (muscle spindle); Stretch
- vii) Vestibular Appralus mainly otolith organ Anatomy
- viii) Connection & function of Basal ganglia, Thalamus, Hypo-Thalamus, lobes of the brain, Cerebellum, Peripheral Nervous System
- ix) Sensory / motor cortex;
- x) Limbic system;
- xi) Learning, memory & condition reflex,
- xii) Physiology of Voluntary movement

6) **EXCRETARY** system -----

----- 7 hrs

□ Introduction: Physiological anatomy. Nephrons – cortical and juxtamedullary. Juxtaglomerular apparatus. Glomerular membrane. Renal blood flow and its regulation. Functions of kidneys. Mechanism of Urine Formation: Glomerular Filtration: Mechanism of glomerular filtration. GFR – normal value and factors affecting. Renal clearance. Inulin clearance. Creatinine clearance. Tubular Reabsorption: Reabsorption of Na<sup>+</sup>, glucose, HCO<sub>3</sub> urea and water. Filtered load. Renal tubular transport maximum. Glucose clearance: TmG. Renal threshold for glucose. Tubular Secretion: Secretion of H<sup>+</sup> and K<sup>+</sup>. PAH clearance. Mechanism of concentrating and diluting the Urine: Counter-current mechanism. Regulation of water excretion. Diuresis. Diuretics. Micturition: Mechanism of micturition. Cystometrogram. Atonic bladder, automatic bladder. Acid-Base balance (very brief) Artificial Kidney: Principle of haemodialysis. Skin and temperature regulation.

## 7) **TEMPERATURE REGULATION** -----

----- 2hrs

Circulation of the skin- body fluid- electrolyte balance

## 8) **ENDOCRINE** -----

----- 10hrs

Introduction: Major endocrine glands. Hormone: classification, mechanism of action. Functions of hormones Pituitary Gland: Anterior Pituitary and Posterior Pituitary hormones: Secretory cells, action on target cells, regulation of secretion of each hormone. Disorders: Gigantism, Acromegaly, Dwarfism, Diabetes insipidus. Physiology of growth and development: hormonal and other

influences. Pituitary-Hypothalamic Relationship. Thyroid Gland:Thyroid hormone and calcitonin: secretory cells, synthesis, storage, action and regulation of secretion. Disorders: Myxoedema, Cretinism, Grave's disease. Parathyroid hormones: secretory cell, action, regulation of secretion. Disorders:

Hypoparathyroidism. Hyperthyroidism.Calcium metabolism and its regulation. Adrenal Gland: Adrenal Cortex: Secretory cells, synthesis, action, regulation of secretion of Aldosterone, Cortisol, Androgens. Disorders: Addison's disease, Cushing's syndrome, Conn's syndrome, Adrenogenital syndrome. Adrenal Medulla: Secretory cells, action, regulation of secretion of adrenaline and noradrenaline. Disorders: Pheochromocytoma. Endocrine Pancreas:Secretory cells, action, regulation of secretion of insulin and glucagon. Glucose metabolism and its regulation. Disorder: Diabetes mellitus.

## 9) **REPRODUCTIVE** system -----

----- 6 hrs

Introduction: Physiological anatomy reproductive organs. Sex determination. Sex differentiation. Disorder, Male Reproductive System: Functions of testes. Pubertal changes in males. Spermatogenesis. Testosterone: action. Regulation of secretion. Semen. Female Reproductive System: Functions of ovaries and uterus. Pubertal changes in females. Oogenesis. Hormones:oestrogen and progesterone-action. regulation of secretion. Mentrual Cycle: Phases. Ovarian cycle. Uterine cycle. Hormonal basis. Menarche. Menopause. Pregnancy: Pregnancy tests. Physiological changes during pregnancy. Functions of placenta. Lactation. Contraception methods

## 10) - **SPECIAL** Senses

Eye-Errors of refraction-accommodation-reflexes-dark & light adaptation photosensitivity

Ear, Skin ----- 5hrs

11) **Gastrointestinal** system -----

----- 9 hrs

□□ Introduction: Physiological anatomy and nerve supply of alimentary canal. Enteric nervous system. Salivary Secretion: Saliva: Composition. Functions. Regulation. Mastication (in brief). Swallowing: Definition. Different stages. Functions. Stomach: Functions. Gastric juice: Gland, composition, function, regulation. Gastrin: Production, function and regulation. Peptic ulcer. Gastric motility. Gastric emptying. Vomiting. Pancreatic Secretion: Composition, production, function. Regulation, □ Liver: Functions of liver. Bile secretion: Composition, functions and regulation. Gall bladder: Functions. Intestine: Succus entericus: Composition, function and regulation of secretion. Intestinal motility and its function and regulation. Mechanism of Defaecation.

12)- **RESPIRATORY** system -----

----- 20hrs

Introduction: Physiological anatomy – Pleura, tracheo-bronchial tree, alveolus, respiratory membrane and their nerve supply. Functions of respiratory system. Respiratory muscles. Mechanics of breathing: Intrapleural and Intrapulmonary pressure changes during respiration. Chest expansion. Lung compliance: Normal value, pressure-volume curve, factors affecting compliance and its variations. Surfactant –

Composition, production, functions. RDS Spirometry: Lung volumes and capacities. Timed vital capacity and its clinical significance. Maximum ventilation volume. Respiratory minute volume. Dead Space: Types and their definition. Pulmonary Circulation. Ventilation-perfusion ratio and its importance.

Transport of respiratory gases: Diffusion across the respiratory membrane. Oxygen transport – Different forms, oxygen-haemoglobin dissociation curve. Factors affecting it. P50, Haldane and Bohr effect. Carbon dioxide transport: Different forms, chloride shift. Regulation of Respiration: Neural Regulation. Hering-breuer's reflex. Voluntary control. Chemical Regulation. Hypoxia: Effects of hypoxia. Types of hypoxia. Hyperbaric oxygen therapy. Acclimatization Hypercapnoea. Asphyxia. Cyanosis – types and features. Dysbarism Disorders of Respiration: Dyspnoea. Orthopnoea. Hyperpnoea, hyperventilation, apnoea, tachypnoea. periodic breathing – types Artificial respiration Respiratory changes during exercise.

### 13)- **CARDIO – VASCULAR**-----

----- 20hrs

- i) structure & properties of cardiac muscle;
- ii) Cardiac cycle;
- iii) Heart rate regulation-factors affecting;
- vi) Peripheral resistance, venous return
- vii) Regional circulation-coronary-muscular, cerebral
- viii) normal ECG.

Introduction: Physiological anatomy and nerve supply of the heart and blood vessels. Organization of CVS. Cardiac muscles: Structure. Ionic basis of action potential and pacemaker potential. Properties.

Conducting system: Components. Impulse conduction Cardiac Cycle:



Definition. Phases of cardiac cycle. Pressure and volume curves. Heart sounds – causes, character. ECG: Definition. Different types of leads. Waves and their causes. P-R interval. Heart block. Cardiac Output: Definition. Normal value. Determinants. Stroke volume and its regulation. Heart rate and its regulation. Their variations Arterial Blood Pressure: Definition. Normal values and its variations. Determinants. Peripheral resistance. Regulation of BP. Arterial pulse. Shock – Definition. Classification–causes and features. Regional Circulation: Coronary, Cerebral and Cutaneous circulation. Cardiovascular changes during exercise

#### 14) **Exercise Physiology** -----

----- 5 hrs

i) Effects of acute & chronic exercises; ii) oxygen / CO<sub>2</sub> transport-O<sub>2</sub> debt)

effects of exercise on muscle strength, power, endurance, B.M.R.,

R.Q.-hormonal & metabolic effects-respiratory & cardiac conditioning

IV) AGING v) Training-fatigue- & recovery; vi) Fitness-related to age, gender, & body type

#### 15)- **A.N.S** -----

----- 4 hrs

Sympathetic / parasympathetic system-adrenal medulla-functions-

Neuro

Transmitters-role in the function of pelvic floor-(micturation, defecation labour)

#### 16) **Applied Physiology [10 Hours]**

More detailed study of the physiology and practical applications of the following selected topics with emphasis on aspects, which should help in understanding the nature and treatment of common clinical situations of interest in Physiotherapy. Pulmonary Functions, Properties of gases, Mechanics of respiration, Diffusion capacity, special features of pulmonary circulation and their application. Respiratory adjustments in exercises... Artificial respiration. Breath sounds. Cardio vascular Functions. Blood flow through arteries, arterioles, capillaries, veins and venuoles. Circulation of Lymph, Oedema. Factors affecting cardiac output. Circulatory adjustment in exercise and in postural and gravitational changes. Pathophysiology of fainting and heart failure. Muscles and Nervous System Functions: Peripheral nervous system, Neuromuscular transmission, Types of nerve fibres. Action potential, Strength-duration curve, ECG, EMG, VEP, NCV. Degeneration and regeneration of nerve, Reactions of denervations.. Synaptic transmission, Stretch reflex- Mechanism and factors affecting it. Posture, Balance and Equilibrium/Coordination of voluntary movement. Voluntary motor action, clonus, Rigidity, Discordination, Special senses- Vision, taste, hearing, vestibular, Olfaction. Sympathetic and Parasympathetic regulation, Thermoregulation, Blood functions Thalassemia Syndrome, Hemophilia, VWF. Anemia, Leucocytosis Bone marrow transplant Metabolic Functions: Diabetes Mellitus, Physiological basis of Peptic Ulcer, Jaundice, GIT disorders and Dietary fiber, Thyroid functions, Vitamins deficiency,

## **PRACTICAL**

I. Haematology[ 20 Hours]

To be done by the students

1. Study of Microscope and its uses
2. Determination of RBC count
3. Determination of WBC count
4. Differential leukocyte count
5. Estimation of hemoglobin
6. Calculation of blood indices
7. Determination of blood groups
8. Determination of bleeding time
9. Determination of clotting time

ii. Demonstrations only

1. Determination of ESR
2. Determination of PCV

iii. Clinical Examination [20 Hours]

1. Examination of Radial pulse.
2. Recording of blood pressure
3. Examination of CVS
4. Examination of Respiratory system
5. Examination of Sensory system
6. Examination of Motor System
7. Examination of reflexes
8. Examination of cranial nerves

III. Amphibian Experiments – Demonstration and Dry charts

Explanation. [10 Hours]

1. Instruments used for frog experiments. Kymograph, heart liver, Muscle trough, stimulator.
2. Simple muscle curve.
3. Effect of increasing the strength of the stimuli
4. Effect of temperature on muscle contraction.
5. Effect of two successive stimuli.
6. Effect of Fatigue.
7. Effect of load on muscle contraction
8. Genesis of tetanus and clonus.
9. Velocity of impulse transmission.
10. Normal cardiogram of amphibian heart.
11. Properties of Cardiac muscle
12. Effect of temperature on cardiogram.

#### **IV. Recommended Demonstrations\***

##### **1. Spirometry**

## **SCHEME OF UNIVERSITY EXAMINATION**

**THEORY-80MARKS + INT. ASSESSMENT-20MARKS=TOTAL -  
100MARKS**

### **Section-A-MCQ.**

Q-1) based on single Best answer ----- (20 x 1) -----

---- 20 marks

It must include MUST KNOWN questions

### **Section-B-SAQ.**

Q-2) Answer any Five out of Six ----- (5 x 3) -----

----- 15 marks

Should include – i)- Blood, ii)- G.I. tract iii)- Endocrine

iv)- Uro-genital v)- Metabolism vi)- special senses (eye/ear/skin)

Q-3) Answer any Three out of four ----- (3 x 5) -----

----- 15 marks

Should include i)- Cardio – vascular ii)- Respiratory iii)- Exercise

Physiology iv)- Electrolyte balance

### **Section-C-LAQ**

Q-4) based on Musculo-skeletal system ----- 15marks

(LAQ should give breakup of 15 marks)

Q-5) based on C.N.S./ spinal cord/Electro-Neuro-Physiology ----- 15

marks

OR

Q-6)- ----- do-----

----- 15 marks

**PRACTICAL** – 80 Marks + Internal Assessment 20 Marks – total 100  
marks

a) Spots-based on topics covered in syllabus ----- 20 marks

b) Viva-based on 1 to 8 mentioned in practical syllabus ----- 20 marks

c) Demonstration – on Clinical Physiology ----- 35 marks

d) Journal -----  
--- 05 marks

## **INTERNAL ASSESSMENT**

### **THEORY:**

Two exams – Terminal and prelims of 80 marks each TOTAL 160 marks

Section-A-MCQ.Q-1]-based on single Best answer---- [20 x 1] -----  
----- 20 marks

It must include MUST KNOW questions

Section-B- SAQ-Q-2] Answer any Five out of Six --- [5 X 3] -----  
----- 15 marks

Should include –

i]-Blood, ii]-G.I. tract iii]-Endocrine iv] - Uro-genital v]- Metabolism  
vi]-special senses [eye/ear/ skin]

Q-3]-answer any Three out of four – [3 X 5] ----- 15 marks

Should include

i] Cardio- vascular ii] Respiratory iii] Exercise Physiology iv] Electrolyte balance

Section-C-LAQ-Q-4]-based on Musculo-skeletal system-----  
----- 15 marks

Q-5]-based on C.N.S./ Spinal Cord/Electro-Neuro-physiology- 15 marks

OR

Q-6] -----do-----  
15marks

[LAQ should give break up of 15 marks]

**I.A. to be calculated out of 20 marks**

**PRACTICAL:**

Two exams – Terminal and prelims of 80 marks each TOTAL 160 marks

1. Spots: - Based on Topics covered in syllabus-----  
20 marks

2. Viva: - Based on 1-8 mentioned in practical syllabus -----  
20 marks

3. Demonstration on clinical Physiology -----  
--- 35 marks

4. Journal -----  
----- 05 marks

**I.A. to be calculated out of 20 marks**

***Recommended text books:***

1) Essentials of Medical physiology – K. Sembulingam

1. Text book of medical physiology – Guyton Arthur
2. Concise medical physiology – Chaudhuri Sujit K.
3. Human Physiology – Chatterjee C.C.
4. Text book of practical Physiology – Ranade.
5. Text of Physiology – A.K.Jain.
6. Basics of Medical physiology- Venkatesh D & Sudhakar H H
7. Manipal Manual of Physiology – Prof. C N Chandrashekar

**Reference:**

8. Review of Medical Physiology – Ganong William F.
9. Physiological basis of Medical practice – Best & Taylor

**SUBJECT: BIOCHEMISTRY (Subject Code: BPT – 103)**

<b>Subject Title &amp; Code</b>	<b>Biochemistry (BPT- 103)</b>
<b>Duration</b>	<b>New: 60 Hours Didactic</b>
<b>Total Hours</b>	
<b>Theory</b>	
<b>Total Hrs/week</b>	
<b>Lectures</b>	<b>3hrs/week</b>
<b>Method of Assessment</b>	<b>Theory</b>

**SYLLABUS**

- 1) Cell biology -----2hr
  - i) – Cell Membrane, structure, & function;

2) - Carbohydrates -----

-- 8 hrs

- i) - Chemistry-definition, classification with examples ;
  
- ii) - functions of carbohydrates with mucopolysaccharides (in details) :
- iii) - Reducing properties of sugars of clinical & diagnostic importance  
( e.g. Benedict's test, Banfood's test etc
- iv) - Metabolism-Digestion & absorption of carbohydrates – Glycolysis  
– aerobic, anaerobic, Energetics & regulation;
- v) - Kreb's cycle-its energetic & regulation-role of T.C.A. cycle;
- vi) Glycogenesis, glycogenolysis & their regulation-role of liver in muscle glycogen
- vii) - glyconeogenesis-significance of H.M.P. shunt
- viii) - hormonal regulation of blood sugar levels-Important metabolic disorders of glycogen, lactose intolerance, and Diabetes mellitus.

3) Proteins -----

---- 6 hrs

- i) - Chemistry-definition-function-classification of Amino acids- protein structure effect of temperature on proteins – denaturation-coagulation; isoelectric pH & its importance;
- ii) - Metabolism-Digestion & absorption-Decarboxylation – De-amination- Transmethylation- transamination & their importance  
– Detoxification of ammonia including urea cycle ;
- iii) - special products of amino acid e.g. tryptophan, phenylalanine, glycine, methionine



iv) - Neuro-transmitters. Those produced from amino acids eg:  
Serotonin, GABA, Dopamine, Epinephrine(Functions)

4) Lipids - -----

-- 5 hrs

i) - Chemistry-definition classification (including fatty acids with examples) – function

ii) - Metabolism-Digestion & absorption of lipids – B-oxidation – of saturated fatty acids & its energetic & regulation of fat metabolism in adipose tissue-Ketone bodies formation & utilization –cholesterol & its importance (no biosynthesis needed) – classification, sources & function of lipoproteins – lipoproteinemia atherosclerosis

5) – Nucllc Acids -----

1 hr

i) – D.N.A. / R.N.A.- definition-structure & function-types-Genetic code-catabolism of purine- gout

6)-Enzymes -----

- 3 hrs

i) – definition-Co- Enzymes-classification-factors affecting -;

ii) – general Mechanism of action (in brief);

iii) Inhibition & types of inhibitors;

iv) –Iso- Enzymes ;

v) – clinical & therapeutic use of enzymes

7) – Vitamins -----

--- 6 hrs

i) –water & Fat soluble-definition- classification;

- ii) – individual vitamins-sources- Co- Enzymes forms- function- reaction related to metabolism covered;
- iii) – RDA, absorption - & transport-deficiency & toxicity

8) – Biological Oxidation -----  
 -----1 hr  
 - Oxidative phosphorylation

9)- Minerals -----  
 ----- 2 hrs  
 i) –Phosphate, calcium, & iron (in details);  
 ii) magnesium, fluoride, Zink, Copper, Selenium Molybdenum,  
 Iodine-sources, RDA, absorption,-transport-excretion function &  
 disorder

10) – Acid – Base Balance, Water & Electrolyte -----  
 -- 2 hrs  
 i) – Body water, pH-osmolarity Extra & Intra cellular fluid;  
 ii) – Buffers – pH, buffer system in blood –  
 iii) – Role of kidneys & lungs in acid-base balance :  
 iv) – water-electrolyte balance im-balance-dehydration

11) – Hormones -----  
 ----- 4 hrs  
 i) –Definition-classification-mechanism & action –  
 ii) – second messenger (Ca, cAMP, inositol phosphate,  
 iii) – metabolic effects of a) – Insulin, b) Glucagon, c)  
 Catecholamines,  
 d) – Thyroxine e) – Mineralo-corticoids, f) – gluco corticoids

12) –Muscle Contraction -----

----- 1 hr

- i) – Contractile elements;
- ii) –Biochemical events during contraction ;
- iii) – energy metabolism in skeletal & muscle

13) - Connective Tissue -----

1 hr

Biochemistry of connective tissue-collagen-Glyco-protein-  
proteoglycans

14) – Nutrition -----

--- 5 hrs

- i) – Importance of nutrition-Calorimetry-energy value-calorimeter-  
respiratory quotient & its significance ;
- ii) – Basal metabolic rate-definition-normal values-factors affecting  
BMR;
- iii) – energy requirement-with-age/sex/thermogenesis/-specific  
dynamic action of food,-energy expenditure for various activities
- iv) – Composition of food, balanced Diet dietary recommendations  
nutritional supplementation nutritional value of  
carbohydrates/proteins/fats & Fibers,
- v) Nitrogen balance & its significance – Protein energy malnutrition-  
Kwashiorkor & Marasmus

15) – Clinical Biochemistry -----

3 hrs

- i) –Liver function test & Renal function test;
- ii) –Relevance of blood levels of glucose, urea, and Ca-Phosphate - &  
uric acid;

- iv) –Lipid profile-Tri-glyceride,cholesterol/HDL/LDL/ALDL etc;
- v) –Protein & Aggression i)-Glycosuria

## **SCHEME OF EXAMINATION**

### **Section A-MCQ**Section

A- Q1) MCQ – Single best answer [10 x 1] ----- 10 marks

Section B-Q2) SAQ – To attempt any FIVE out of Six answers [5x3] ---  
--- 15marks

Section C-Q3) LAQ To attempt any THREE out of Four answers [3 x5] -----  
- 15marks

### **INTERNAL ASSESEMENT** 10 marks

Two exams – Terminal and prelim examination of 40 marks each

TOTAL 80 marks

Section-A- Q 1) MCQ - Single best answer - [10 x 1] ----- 10 marks

Section-B- Q 2) SAQ-To attempt any FIVE out of Six answers-[5 x 3] -  
-----15 marks

Section-C-Q3) SAQ - To attempt any THREE out of Four answers-[3 x  
5] ---15 marks

### **I.A. to be calculated out of 10 marks**

## **TEXT BOOKS**

- 1) Biochemistry – by Dr. Deb Jyoti Das,
- 2) Biochemistry – by Dr. Satyanarayan
- 3) Text book of Biochemistry for Medical students by – Dr. Vasudevan / Shri Kumar

## **REFERENCE BOOKS**

Review of Biochemistry (24<sup>th</sup> edition) by Harpar

# **SUBJECT: FUNDAMENTALS OF EXERCISE THERAPY**

**(Subject Code BPT- 104)**

<b>Subject Title &amp; Code</b>	<b>FUNDAMENTALS OF EXERCISE THERAPY (BPT- 104)</b>
<b>Duration</b>	<b>New: 250 Hours</b>
<b>Total Hours</b>	
<b>Theory</b>	<b>100</b>
<b>Practical</b>	<b>150</b>
<b>Total Hrs/week</b>	<b>9</b>
<b>Lectures</b>	<b>3hrs/week</b>
<b>Practicals</b>	<b>6hrs/week</b>
<b>Seminars</b>	
<b>Method of Assessment</b>	<b>Theory and Practical</b>

**Objective:** At the end of the course, the candidate will be able –

- 1] To define the various terms used in mechanics, Biomechanics & Kinesiology
- 2] Recall the basic principles of Physics related to mechanics of movement / motion & will be able to understand the application of such principles to the simple equipment designs, & their efficacy in therapeutic gymnasium, & various starting position used in therapeutics.
- 3] to describe & also acquire the skill of use of various tools of the Therapeutic

gymnasium

4] to demonstrate passive movements in terms of various Anatomical planes

5] to demonstrate various starting & derived positions

6] Acquire the skill of application of various massage manipulations & describe the Physiological effects, therapeutic use, merits / demerits of the same.

7] acquire a skill of assessment of sensations, superficial & deep reflexes, pulse rate/ Blood pressure, Chest expansion / respiratory rate, & limb length / girth measurement on Models

8] to demonstrate & also acquire the skill of relaxation.

9] to describe the skill & usefulness of group & recreational activities & will be able to demonstrate general fitness exercises used in Physical Training.

10] be able to define Yoga & its types, its physiological & Psycho-somatic effects & will be able to demonstrate standard yoga postures used by the beginners.

11] be able to describe Physiological principles of aerobic exercise conditioning

related to general fitness & demonstrate skill of General Fitness exercises & shall gain fitness for self.

## **Syllabus:**

1] Bio-mechanics i) Axes / planes, laws of inertia & motion, mechanics of Forces,

levers, pendulum, equilibrium, Torque ii) Types of muscle work angle of pull –

Mechanical advantage – applied mechanics in the Therapeutic Gymnasium.

1. Basic Concepts in Biomechanics: Kinematics and Kinetics [10 Hours]

a) Types of Motion, b) Location of Motion, c) Direction of Motion, d) Magnitude of Motion, e) Definition of Forces, f) Force of Gravity, g) Reaction forces, h) Equilibrium, i) Objects in Motion, j) Force of friction, k) Concurrent force systems, l) Parallel force systems, m) Work, n) Moment arm of force, o) Force components, p) Equilibrium of levers

2. Joint structure and Function [ 6 Hours]

a) Joint design, b) Materials used in human joints, c) General properties of connective tissues, d) Human joint design, e) Joint function, f) Joint motion  
g) General effects of disease, injury and immobilization.

3. Muscle structure and function [ 6 Hours]

a) Mobility and stability functions of muscles, b) Elements of muscle structure, c) Muscle function, d) Effects of immobilization, injury and aging

2] Starting & derived positions, stability, base of support .....(8 hrs)

3] Classification of movements, (active, passive, assisted, resisted) / (8 hrs)

4] Limb length (only lower limb – apparent, true, Supratrochantric) & girth

Measurements.....(5 hrs)

- 5] Assessment of Sensations / Reflex testing....(5hrs)
- 6] Assessment of Blood pressure / pulse rate / chest expansion & Respiratory rate.... 6 hrs
- 7] Relaxation – all methods.... 3 hrs
- 8] Massage manipulations – principles effects / merits / demerits – skills on  
 extremities / scalp/ spine / abdomen / face..... 12 hrs
- 9] Therapeutic Gymnasium suspension therapy, use of accessories such as pulleys, springs, shoulder wheel, axillary crutches, finger ladder, therapeutic balls parallel, bars etc applied Biomechanical principles..... 6 hrs
- 10] Physiological & Biophysical principles of Stretching, Strengthening and aerobic conditioning for general fitness exercise, Group & recreational activities – Warm up – stretching mobility strengthening – cool down..... 12 hrs
- 12] Basic principles of General fitness – warming up exercises, aerobics – cooling down exercises.... 3 hrs
- 13] Hydrotherapy – physics – application – effects – merits / demerits... 5 hrs
14. Active Movements  
 Types of active movements, Free exercise: Classification, principles, techniques, indications, contraindications, effects and uses  
 Active Assisted Exercise: principles, techniques, indications, contraindications, effects and uses
15. Goniometry : Techniques, uses, types. Measurement of Ranges of motion of various joints using Goniometer.



16. Passive Movements [ 4 Hours]

Causes of immobility, Classification of Passive movements, Specific definitions related to passive movements, Principles of giving passive movements, Indications, contraindications, effects of uses , Techniques of giving passive movements.

**PRACTICAL (150 Hrs)**

**Skills included in all topics listed in sr. no. 2 to 13 above to be practiced on self & models**

**SCHEME OF EXAMINATION**

**THEORY – UNI. EXAM – 80 MARKS + INT. ASSESSMENT – 20 MARKS**

**Section -A-MCQ**

Q1] based on Single best answer [20 x 1] -----

20 marks (20Min)

[to cover the must KNOW area of the subject]

**Section B-SAQ**

Q2] Answer any FIVE out of Six – [5 x 3] ----- 15 marks

Q3] Answer any THREE out of Four [3 x 5] ----- 15 marks

**Section C- LAQ**

Q4] [compulsory] based on Bio-mechanics ----- 15 marks

#Q5] based on any other topic -----  
15 marks

**OR**

# Q6] based on any other topic -----  
- 15 marks

**PRACTICAL-80 MARKS + INT.ASSESSMENT-20 MARKS = TOTAL -  
100 MARKS**

**1** Long case – based on Massage / Goniometry ----- 35  
marks

i] Cognitive – Bio-physics / Biomechanical principles / indications –  
contra indication

Documentation of findings etc -----  
20 marks

ii] Psychomotor & affective – skills -----  
--- 15 marks

**2 a)** Short Case :- any one of the following -----  
- 20 marks

Short case Based on passive movts / Relaxation / Limb / Ength – girth  
/

Sensation / Reflex testing / / Aerobics / group exercise / warm ups /  
BP/ & Pulse / Chest Expansion / Respirate / Starting / Derived position  
etc.

b) Spots – Four spots based on therapeutics gymnasium etc. 5 minute  
per spots

(4x5) = 20 marks

**3** Journal -----  
----- 5 marks

**INTERNAL ASSESSMENT**

**THEORY** (20 marks)

Two exams –Terminal and prelim examination of 80 marks each  
TOTAL -160 marks

Section-A-MCQ-Q-1]-based on -Single best answer [20 x 1] ----  
20marks(20 Min.)

[to cover the must KNOW area of the subject ]

Section-B-SAQ- Q-2]-Answer any FIVE out of Six—[5 x 3] -----  
15 marks

Q-3]-Answer any THREE out of Four-[3 x 5] ----- 15 marks

Section-C-LAQ-Q-4]-[compulsory]—based on Biomechanics-----  
15 marks

# Q-5]-based on any other topic----- 15 marks

OR

# Q-6]-based on any other topic----- 15 marks

**I.A. to be calculated out of 20 marks**

## **PRACTICAL**

Two exams –Terminal and prelim examination of 80 marks each  
TOTAL -160 marks

**1.** Long Case:-Massage/ Goniometry -----  
35Marks

i) Cognitive – Biophysics / Biomechanical principles / indications /  
contraindications.

Documentation of findings etc. ----- 20  
marks

ii) Psychomotor and affective skills -----  
- 15 marks

**2.** a) Short Case:- any one of the following.-----  
-- 20 Marks

Short case Based on passive movts /Relaxation/Limb/ Length -girth/

Sensation/Reflex testing/ Yoga posture/Aerobics/group exercise/warm ups /BP & Pulse/Chest Expansion/Respiratory Rate/Starting & Derived position etc.

b) Spots - Four spots based on therapeutics gymnasium etc. 5 minute per spots

----- (4X5 = 20 Marks)

**3. Journal -----**

----- 5 Marks

**I.A. to be calculated out of 20 marks**

**TEXT BOOKS**

- 1] Principles of Exercise Therapy – Dena Gardiner
- 2] Massage, manipulation & traction – Sydney Litch
- 3] Therapeutic Exercise ----- do -----
- 4] Massage – Holly
- 5] Suspension Therapy in Rehabilitation – Margaret Hollis
- 6] Bio mechanics –Cynthia Norkin
- 8] Measurement of physical function – Cynthia Norkins.
- 1] Therapeutic Exercise – Carolyn Kisner

**REFERENCE BOOKS**

- 2] Physiotherapy in Orthopedic conditions – by Jayant Joshi

**SUBJECT: FUNDAMENTALS OF ELECTRO  
THERAPY (Subject Code BPT-105)**

<b>Subject Title &amp; Code</b>	<b>FUNDAMENTALS OF ELECTRO THERAPY (BPT-105)</b>
<b>Duration</b>	<b>New: 200 Hours</b>
<b>Total Hours</b>	
<b>Theory</b>	<b>95</b>
<b>Practical</b>	<b>105</b>
<b>Total Hrs/week</b>	<b>8</b>
<b>Lectures</b>	<b>2hrs/week</b>
<b>Practicals</b>	<b>4hrs/week</b>
<b>Seminars</b>	
<b>Method of Assessment</b>	<b>Theory and Practical</b>

Objectives – At the end of the course the candidate will be able to –

- 1] Recall the physics principles & Laws of Electricity, Electro – magnetic spectrum, & ultra sound
- 2] Describe effects of environmental & man made electro magnetic field at the cellular level & risk factors on prolonged exposure.
- 3] Describe the main electrical supply, Electric shock –precautions :-
- 4] Enumerate types & production of various Therapeutic electrical currents Describe the panel diagrams of the machines.

5] Describe in brief, certain common electrical components such as transistors, valves, capacitors, transformers etc & the simple instruments used to test / calibrate these components [ such as potentiometer, oscilloscope etc] of the circuitry, ; & will be able to identify such components.

6] Describe & identify various types of electrodes used in therapeutics, describe electrical skin resistance & significance of various media used to reduce skin resistance.

7] Acquire knowledge of various superficial thermal agents such as Paraffin wax bath, Cryotherapy, home made remedies, etc; their physiological & therapeutic effects, Merits / demerits; & also acquire the skill of application.

### **Syllabus:**

1] Fundamentals of Low frequency currents ..... 16 hrs

i] production of electricity, mains supply,

ii] A.C. currents & Faradic type current

iii] D.C. currents – Types – fundamentals of electrical charges, static electricity- physic of direct currents Ohm's law Conductors-Capacitors-Rheostats-Potentiometers-ammeters-oscilloscopes,

iv] types of electrodes galvanic skin resistance – electrode –gels- types significance

- 2] Fundamentals of High frequency currents ..... 16 hrs
- i] Magnetism, E.M.F. Conduction – Lenz’s Law- transformers -types,  
 ii] Thermonic valves,  
 iii] Semi – conductors – types -Transistors  
 iv] Electronic circuits –oscillators,, - pulse generators
- 3] E.M. spectrum – Laws of transmission reflection – refraction –  
 absorption –  
 attenuation. .... 4 hrs
- 4] Cellular Bio-physics – reception & emission of E.M.F. signals..... 4  
 hrs
- 5] Environmental currents & fields risk factors on prolonged exposure  
 to E.M. field..... 3 hrs
- 6] Production, Physical principles, Panel diagram, Testing of apparatus  
 – S.W.D.  
 Ultra sound, U.V.R., I.F.T. / Beat frequency currents, I.R. LASER (no  
 panel  
 diagram)..... 18 hrs
- 7] Therapeutic continuous / interrupted Direct currents & their various  
 wave forms,A.C. current..... 14 hrs
- 8] Bio-physics of Superficial heat & cold – Physiological effects –  
 Therapeutic effects/ uses – Merits / demerits, Indications / contra-  
 indications-skills of applicationi]Home remedies, ii] Paraffin wax bath  
 iii] whirl pool, iv] contrast bath  
 v] Hydro-collator hot packs / cold packs, vi] Cryo therapy..... 16 hrs
- 9) Medical Electricals / Physiology of Gen indication & contra indication  
 Therapeutic effects pain relief, Neuro & muscle etc..... 6 hrs
- 10) Basic Skills – in electro OPD & precaution..... 2 hrs

### **PRACTICALS (105 Hrs)**

- 1] Panel diagrams – Identification of components – Testing the mains supply & Machines
- 2] Skills of application of thermal agents

**SCHEME OF EXAMINATION**

**Theory – 80 marks. I.A. – 20 Marks;**

Theory – model question paper – [80 marks]

**Section A-MCQQ-**

1] based on Single best answer [ 20 x 1] -----  
-- 20 marks

**Section B-SAQ**

Q-2] to answer any FIVE out of six --- [ 5 x 3] -----  
----- 15 marks

Q-3] to answer any THREE out of Four [ 3 x 5] -----  
-- 15 marks

**Section C-LAQ**

Q-4 ] based on superficial Thermal agents -----  
---- 15 marks

\* Q-5] -----  
----- 15 marks

OR

\* Q-6] -----  
----- 15 marks



**PRACTICAL - PRACTICAL – 80 MARKS +, I.A. – 20 MARKS TOTAL  
= 100 MARKS**

1] Long case based on Superficial thermal agent -----

-- 35 marks

[Cognitive – Medical electronic area/ Physiological –Biophysical  
principles /

therapeutic effects / Indications – contraindications] -----

--- [20 marks]

+ [Psychomotor + Affective skills] -----

-----[15 marks]

2] Spots

A] Identification of Electronic component & give one use with example  
OR panel

Diagram ---FOUR spots [ 5 minutes per spot] (4 x 5 ) -----

----- [ 20 marks]

B] testing of equipment TWO spot (10 x2) [10 minutes] -----

----- [ 20

marks]

Journal -----

----- [05 marks]

**INTERNAL ASSESSMENT ----- 20 MARKS**

**THEORY (20 marks)**

Two exams – Terminal and prelim examination of 80 marks each

TOTAL -160 marks

Section-A-MCQ-Q-1] - based on Single best answer –[20x 1]-----

----- 20 marks

Section-B-SAQ -Q-2] - to answer any FIVE out of six—[5 x3] -----

----- 15 marks

Q-3] - to answer any THREE out of Four-[3 x 5] -----15 marks

Section-C-LAQ- Q-4] - based on superficial Thermal agents-----  
----- 15 marks

\* Q-5] ----- 15  
marks

OR

\* Q-6] ----- 15  
marks

**I.A. to be calculated out of 20 marks**

**PRACTICAL**

Two exams – Terminal and prelim examination of 80 marks each

TOTAL -160 marks

1. Long Case: - Superficial thermal agents----- 35 Marks

(Cognitive – medical electronic area / physiological – Biophysical  
principles/therapeutic effects /

Indications / contraindications) -----

20 marks

(Psychomotor + affective skills) ----- 15

marks

2. Spots -----

40 marks

a) Identification of electronic component and give 1 use with example  
or panel

diagram(4 spots, 5 min per spots) (4 x 5 = 20 marks)

b) Testing of equipment – 2 spots (10 minutes) (2 x 10 = 20 marks)

3. Journal -----

5Marks

**I.A. to be calculated out of 20 marks**

**INTERNAL ASSESSMENT IN PRACTICAL -----**

----- 20 marks

**TEXT BOOKS**

1. Clayton 1s Electro therapy – 3<sup>rd</sup> & 10<sup>th</sup> ed,
2. Electro therapy explained – by Low & Read
3. Electro Therapy – by Kahn
4. Basics of Electrotherapy – Dr. Subhash Khatri

**REFERENCE BOOK –**

Clinical Electro Therapy – by Nelson & Currier.