AMRITA VISHWA VIDYAPEETHAM

श्रद्धावान् लभते ज्ञानम्

AMRITA SCHOOL OF MEDICINE
DEPARTMENT OF PHYSIOLOGY

PROGRAM
MD PHYSIOLOGY

(Revised with effect from 2015-2016 onwards)

Contents

GOAL

The goal of postgraduate Medical education in Physiology shall be to produce competent medical teachers who shall –

1. Perform the professional obligations ethically and in keeping with the objectives of National Health Policy.
2. Have acquired the basic skills in teaching medical and para medical students.
3. Be aware of the contemporary advances and developments in Physiology.
4. Have acquired a spirit of scientific enquiry and are oriented to the principles of research methodology.

OBJECTIVES

The candidate, upon successfully qualifying in MD Physiology examination, should be-

1. A competent Physiologist
2. Able to effectively teach medical and paramedical students the basic physiological mechanisms of human body with reference to their implications in the pathogenesis of diseases (patho physiology) and the physiological basis of their management.
3. Able to conduct such clinical/experimental research as would have significant bearing on human health and patient care and also able to publish research papers.
4. Acquire skills in conducting collaborative research in the field of Physiology and allied sciences.
5. Able to demonstrate to the students that the knowledge of physiology can be used in a variety of clinical settings to solve diagnostic and therapeutic problems.
6. Encourage students to participate in workshops/seminars/journal clubs/ demonstrations in allied departments to acquire skills for collaborative research.

PROGRAM OUTCOMES

PO1 Possess comprehensive knowledge of the normal functions of all organ systems of the body

PO2 Possess an understanding of the physiological basis of health and disease.

PO3 Understanding of the basic biophysical principles involved in functioning of body organs in normal and diseased conditions

PO4 Ability to explain the normal functioning of all organ systems in human body and its alterations in diseased state, correlating the same with classical clinical features and outline the basic principles of management.

PO5 Ability to perform detailed clinical examination of each system in a systematic manner and interpret the findings.

PO6 Ability to perform all basic haematology laboratory tests and interpret the results and outline the possible causes for the abnormal results.

PO7 Demonstrate highr level critical thinking skills and applying aquired knowledge in solving problems

PO8 Ability to ask correct research questions and design and conduct research work and publish

PROGRAM SPECIFIC OUTCOMES

PSO1 Ability to explain functional anatomy of all organs and organ systems, specific function of each and the role of homeostasis.

PSO2 Knowledge of the interactions of different organ system for well-coordinated total body functions (maintenance of mileu interior)

PSO3 Ability to outline the basic physiological responses and adaptations to changes in external and internal environment .

PSO4 Ability to record, analyze and interpret human physiology experiments like BP, ECG, Spirogram, Audiogram, Stethography, Perimetry, Physiograph and interpret basic abnormalities.

PSO5 Ability to perform technical aspects of all lab tests in hematology and principles underlying the test.

PSO6 Ability to draw and explain amphibian skeletal and cardiac muscle graph

SYLLABUS - THEORY

I. General Physiology

General and Cellular Basis of Human Physiology

Organisation of body fluids.

Functional morphology of cell

Transport across cell membrane & capillary wall

Intercellular communications

Genetics and Gene therapy

Homeostasis, Bio electric potentials

2. Haematology

Composition & functions of blood, functions of plasma proteins.

The functional basis of different formed elements of blood. Elaborate on the current concepts of hemopoiesis, abnormalities in the RBC function with the functional basis of anaemias, the abnormalities in WBC, the basis of the various types of immunological responses in the human body and the mechanisms of regulation of immune responses, abnormalities in platelet functions, haemostatic mechanisms in health and disease.

Current trends in the classification of various blood groups & physiological considerations in blood transfusion

Blood volume.

Lymph & tissue fluid.

3. Nerve Muscle Physiology

Major historical landmarks in the development of current concepts of nerve muscle physiology.

Nerve Cells- Structure, properties and function, Classification of fibre types

Bioelectric potentials, CRO

Nerve degeneration & regeneration

Mixed Nerve – properties

Synapse – properties and functions

Neuroglia

Skeletal muscle- Physiological anatomy of skeletal muscle, Molecular mechanism of muscle contraction, types of contraction, length tension relationship.

Electrical Phenomena & ionic fluxes, energy sources and metabolism

Properties of muscle in intact organism

Motor unit, effects of denervation, EMG and its applications.

Cardiac muscle – Functional anatomy, electrical properties, mechanical properties, length tension relationship. Conducting system of heart and its electrical properties
Smooth muscle – Morphology, Types, electrical & mechanical properties, control of smooth muscle contraction, length - tension relationship, plasticity.
Neuromuscular Physiology, diseases affecting neuromuscular junction.

4. Nervous System

Importance of evolution and development
The contributions of neurophysiologists who have led to the development of the present status of neurophysiology
Various methods used for the study of neurophysiology
Organisaton of the nervous system

Sensory System	Receptors, Pathways, thalamus, cortical Sensory areas.
	Important abnormalities of pain & other somatic sensation.
Motor System	Motor functions of spinal cord and spinal cord reflexes
	Cortical and brainstem control of motor function
	Cerebellum. Basal ganglia and overall motor control
	Cerebral cortex, Motor & Sensory dysfunction at different levels.
	Vestibular apparatus and equilibrium, posture & movement
	Neurotransmitters

Autonomic Nervous System
Hypothalamus, Limbic System
Speech, Memory, Learning, Behaviour, Conditioned reflexes.
Sleep and electrical activities of brain

Cerebrospinal fluid

5. Special Senses

Olfaction, Gustation, Vision, Audition.

6. Cardiovascular System

Organisation of CVS, Origin and spread of cardiac impulse

Cardiac Cycle – Normal electrical and mechanical events & their abnormalities.

Cardiac output, Haemodynamics

Blood pressure & its regulation.

Regional circulation including lymphatic circulation, foetal circulation.

Shock, cardiopulmonary adjustments in health and disease.

Basic principles in the assessment of CVS function.

7. Respiratory System

Functional Anatomy of Respiratory System

Respiratory movements & muscles involved in it. Bronchial tone.

Mechanics of Pulmonary Ventilation - Spirometry - Lung volumes & capacities.

Pressures during the breathing cycle, elastic properties of lung, compliance of lung & chest wall, alveolar surface tension, work of breathing, airway resistance.

Ventilation & Perfusion, Pulmonary Ventilation, Alveolar ventilation, Dead space, Pulmonary blood flow, Ventilation Perfusion Ratio.

Composition of respiratory gases.

Respiratory Membrane, Physics of Diffusion.

Transport of Gases - Transport of Oxygen, Oxygen Dissociation curve and factors affecting it. Carbondioxide transport, CO_2 dissociation curve

Myoglobin& foetal haemoglobin

Regulation of respiration

Respiratory adjustments in health & disease – Including high altitude Physiology & Acclimatisation

O_2 therapy, Use of Ventilators, artificial respiration.

8. Environmental Physiology

Thermo regulatory mechanism in the body and their behaviors in acute & chronic thermal stress.

Effects of exposure to hypo & hyperbaric environment

Acclimatization process

Effects of ‘G’ forces

Mechanism related to biological rhythm & their role in normal state of body function.

Effect of different types of environmental pollutants on the body.

9. Gastro Intestinal System

Nutrition & metabolism, energy balance

Functional anatomy of GIT

Secretions of GIT and associated glands and their regulation

Movements of GIT

Digestion and Absorption

Describe the basis of evaluation of metabolic functions in health and disease with special reference to liver function tests.

Gastro intestinal hormones, disorders of gastrointestinal function.

10. Endocrinology

Synthesis & secretion, transport, metabolism, mode of action and estimation of various hormones secreted by the endocrine glands.
The neurohumoral mechanisms involved in regulation of hormonal secretions and their mechanism of action at cellular level.
Changes that occur in body as a result of hypo and hyper function of different glands and their hormonal interactions correlating with the function tests.
Bone physiology and calcium metabolism
Endocrine functions of other organs.
Growth, development and ageing.

11. Reproductive System

Development and functions of gonads

Sex differentiation and their abnormalities

Male reproductive system

Female reproductive system

Puberty, Menopause

Pregnancy, Lactation, Contraception

Infertility & its management

12. Excretory System

Functional anatomy of kidney and the basic principles involved in the secretory and excretory function of kidney.

Evaluate the role of kidney in fluid and electrolyte homeostasis & acid - base balance.

The physiological basis of evaluation of renal functions in health and disease.

Principles of dialysis.

Physiological basis of diuretic action

Renal transplantation.

Skin & temperature regulation

SYLLABUS - PRACTICAL

1. Haematology

Haemocytometry **-** Counts of various cells in the blood i.e. RBC, WBC, eosinophils, platelets and reticulocytes.

Make, stain & report on a peripheral smear & do differential count of WBCs

Haemoglobinometry, PCV, ESR, Blood Indices.

Blood grouping – ABO & Rh typing

Determination of bleeding time & clotting time

Haemolysis & fragility tests (Demonstration only)

2. Nerve Muscle Physiology

All the laboratory exercises done by undergraduate students in nerve muscle

Physiology – Skeletal muscle, cardiac muscle & smooth muscle (Graph discussion)

Ergography

EMG & Nerve conduction studies (Demonstration only)

3. Nervous system & Special senses

Examination of higher functions

Examination of sensory system

Examination of motor system

Examination of cranial nerves

Examination of reflexes

Examination of nervous system in a patient with nervous system disorder & interpret the data obtained.

EEG (Demonstration only)

Perimetry

Tests for hearing & deafness interpretation

4.Cardiovascular system

Examination of cardiovascular system in a normal person.

Determination of arterial blood pressure & its variation with posture & exercise

Recording of arterial pulse using physiograph

Recording of normal ECG in 12 leads

Echocardiography & treadmill test (Demonstration only)

5. Respiratory system

Examination of respiratory system in a normal person.

Recording of respiratory movements – normal & after exercise, using stethograph & Spirometer & interpretation of data obtained.

Peak expiratory flow meter studies

6. Endocrinology & Reproduction (Chart discussion only)

Evaluation of a patient with endocrine disorder

Determination of ovulation time by basal body temperature chart, cervical smear & vaginal smear

Pregnancy diagnostic tests – Immunological test (Demonstration only)

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COURSES

Course I General Physiology, Haematology, Cardiovascular System (MDPY1)

CO1: Describe the structure of cell membrane with reference to ion channels. Homeostasis, Transport across cell membrane and Bioelectric potentials

CO2: Discuss the Body fluid compartments, Homeostasis, Plasma proteins, RBC, WBC, Platelets, Coagulation of Blood, Blood Group, Lymph and Tissue fluid.

CO3: Describe Functional anatomy of heart and blood vessels, Properties of Cardiac muscle, Cardiac cycle, Normal ECG, Cardiac output, .Haemodynamics. Blood pressure, Regional circulation,.Shock.

CO4: Should be able to perform common hematological tests and interpret the results

General Physiology

General and Cellular Basis of Human Physiology

Organisation of body fluids.

Functional morphology of cell

Transport across cell membrane & capillary wall

Intercellular communications

Genetics and Gene therapy

Homeostasis, Bio electric potentials

Haematology

Composition & functions of blood, functions of plasma proteins.
The functional basis of different formed elements of blood. Elaborate on the current concepts of hemopoiesis, abnormalities in the RBC function with the functional basis of anaemias, the abnormalities in WBC, the basis of the various types of immunological responses in the human body and the mechanisms of regulation of immune responses, abnormalities in platelet functions, haemostatic mechanisms in health and disease.

Current trends in the classification of various blood groups & physiological considerations in blood transfusion

Blood volume.

Fluid dynamics in blood vessels

Lymph & tissue fluid.

Cardiovascular System

Organisation of CVS, Origin and spread of cardiac impulse

Cardiac Cycle – Normal electrical and mechanical events & their abnormalities.

Cardiac output, Haemodynamics

Blood pressure and stroke volume

Blood pressure & its regulation.

Renal control of blood pressure

Regional circulation including lymphatic circulation, foetal circulation.

Shock, cardiopulmonary adjustments in health and disease.

Basic principles in the assessment of CVS function.

Course II Physiology of Respiration, Renal Physiology, Skin & Temparature Regulation, Principles of Biophysics as applied to Physiology (MDPY2)

CO1: Explain Mechanism of Breathing, surfactant.Ventilation, Pulmonary Circulation, Transport of gases, Regulation of respiration, Hypoxia, exercise, artificial respiration-

CO2: Should be able to perform common human physiology experiments and interpret the results

CO3: Should be able to draw amphibian skeletal and cardiac muscle graphs and discuss the physiological basis

Excretory System

Functional anatomy of kidney and the basic principles involved in the secretory and excretory function of kidney.

Evaluate the role of kidney in fluid and electrolyte homeostasis & acid - base balance.

The physiological basis of evaluation of renal functions in health and disease.

Principles of dialysis.

Physiological basis of diuretic action

Renal transplantation.

Skin & temperature regulation

Respiratory System

Functional Anatomy of Respiratory System

Respiratory movements & muscles involved in it. Bronchial tone.

Mechanics of Pulmonary Ventilation - Spirometry - Lung volumes & capacities.

Pressures during the breathing cycle, elastic properties of lung, compliance of lung & chest wall, alveolar surface tension, work of breathing, airway resistance.

Ventilation & Perfusion, Pulmonary Ventilation, Alveolar ventilation, Dead space, Pulmonary blood flow, Ventilation Perfusion Ratio.

Low VQ ratio and its clinical importance

Composition of respiratory gases.

Respiratory Membrane, Physics of Diffusion.

Transport of Gases - Transport of Oxygen, Oxygen Dissociation curve and factors affecting it. Carbondioxide transport, CO_2 dissociation curve

Surface tension and surfactants

Myoglobin& foetal haemoglobin

Regulation of respiration

Respiratory adjustments in health & disease – Including high altitude Physiology & Acclimatisation

Pathophysiology of Bend

O_2 therapy, Use of Ventilators, artificial respiration.

Course III Nervous System, Special Senses, Muscle & Nerve Physiology (MD-PY3)

CO1: Discuss the classification of muscles-Morphology of skeletal muscle, Mechanisms of muscle contraction

CO2: Explain the Morphology and properties of a neuron. Neuroglia, Action potential, Nerve injuries.

CO3: Discuss organisation of nervous system and functions. Synapse, Reflex action. Sensory system, Motor System, and higher functions of brain

CO4: Describe the physiology of vision, audition, smell and taste

Nerve Muscle Physiology

Major historical landmarks in the development of current concepts of nerve muscle physiology.

Nerve Cells- Structure, properties and function, Classification of fibre types

Bioelectric potentials, CRO

Nerve degeneration & regeneration

Mixed Nerve – properties

Synapse – properties and functions

Neuroglia

Skeletal muscle- Physiological anatomy of skeletal muscle, Molecular mechanism of muscle contraction, types of contraction, length tension relationship.

Electrical Phenomena & ionic fluxes, energy sources and metabolism

Properties of muscle in intact organism

Motor unit, effects of denervation, EMG and its applications.

Cardiac muscle – Functional anatomy, electrical properties, mechanical properties, length tension relationship. Conducting system of heart and its electrical properties
Smooth muscle – Morphology, Types, electrical & mechanical properties, control of smooth muscle contraction, length - tension relationship, plasticity.
Neuromuscular Physiology, diseases affecting neuromuscular junction.

Nervous System

Importance of evolution and development
The contributions of neurophysiologists who have led to the development of the present status of neurophysiology
Various methods used for the study of neurophysiology
Organisaton of the nervous system

Sensory System	Receptors, Pathways, thalamus, cortical Sensory areas.
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Motor System	Motor functions of spinal cord and spinal cord reflexes
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	Cerebellum. Basal ganglia and overall motor control
	Cerebral cortex, Motor & Sensory dysfunction at different levels.
	Vestibular apparatus and equilibrium, posture & movement
	Neurotransmitters

Autonomic Nervous System
Hypothalamus, Limbic System
Speech, Memory, Learning, Behaviour, Conditioned reflexes.
Sleep and electrical activities of brain
Cerebrospinal fluid

Special Senses

Olfaction, Gustation, Vision, Audition.

Course IV Gastro Intestinal System, Endocrine System, Reproductive System, Recent Advances in Physiology (MDPY4)

CO1: Discuss the secretory and motor functions of gastrointestinal tract

CO2: Explain the role of kidney in formation of urine, regulation of pH and body fluid volume and also clinical implications

CO3: Describe the mechanism of action, functions and abnormalities in secretion of endocrine glands

CO4: Should be able to perform clinical examination of various systems

CO5: Discribe the development of male and female charecterestics, hormonal changes, menstrual cycle, fertilization, pregnancy and contraceptive methods.

Gastro Intestinal System

Nutrition & metabolism, energy balance

Functional anatomy of GIT

Secretions of GIT and associated glands and their regulation

Movements of GIT

Digestion and Absorption

Describe the basis of evaluation of metabolic functions in health and disease with special reference to liver function tests.

Gastro intestinal hormones, disorders of gastrointestinal function.

Endocrinology

Synthesis & secretion, transport, metabolism, mode of action and estimation of various hormones secreted by the endocrine glands.
The neurohumoral mechanisms involved in regulation of hormonal secretions and their mechanism of action at cellular level.
Changes that occur in body as a result of hypo and hyper function of different glands and their hormonal interactions correlating with the function tests.
Bone physiology and calcium metabolism
Endocrine functions of other organs.
Growth, development and ageing.

Reproductive System

Development and functions of gonads

Sex differentiation and their abnormalities

Male reproductive system

Female reproductive system

Puberty, Menopause

Pregnancy, Lactation, Contraception

Infertility & its management

Course V Soft Skills (MDPY5) - Elective

CO1 Awareness about different study designs, sample size calculation, different methods of hypothesis testing and clinical trials. Proficiency in conducting a research.

CO2 Proficiency in different aspcects of medical ethics and ettiquette. Awareness about the responsibilities of being a part of a team/department.

CO3 Proficiency in teaching and the use of vareous teaching aids.

CO4: Ability to work as the member of a team.

TEXTBOOKS RECOMMENDED

1. Prescribed Books -

1. Text Book of Medical Physiology: Arthur. C. Guyton- W.B. Saunders.
2. Review of Medical Physiology: W.B. Ganong. Lange Medical Book.
3. Understanding Medical Physiology: R.L. Bijalani- Jaypee Brothers
4. Text Book of Human Physiology: Madhavankutty, Sarada Subramanium & H.D. Sing S. Chand and company.
5. Text book of Practical Physiology: Ghai
6. Text book of Practical Physiology: G.K.Pal

2. Reference Books –

1. Best and Taylor's Physiological Basis of Medical Practice: J.B. West (Ed) William & Walkins.
2. Physiology: Berne & Levy
3. Text book of Medical Physiology: Indu Khurana - Elsevier
4. Concise Medical Physiology: S.K. Chaudhuri – New Medical Book Agency, Calcutta.
5. Williams Text book of Endocrinology
6. Clinical Haematology: Wintrobe's
7. De Gruchy's Clinical Haematology in Medical Practice

8. Text Book of Biochemistry: Dr. D.M.Vasudevan & Dr.Sreekumari
9. Harper's Text Book of Biochemistry
10. Hutchinson's Clinical methods

RESEARCH

Each candidate has to work on a particular topic for thesis, submission of which shall be as per University regulations. The thesis should be brief, clear and focus on the relevance of the topic & should be under the following sub-headings

1.Title
2.Introduction
3.Review of literature
4.Materials & methods
5.Observations
6.Discussion
7.Summary & conclusion
8.Bibliography
9.Appendix – tools used for data collection like questionnaire etc

It should be submitted to the University at least 3 months before commencement of final University examination.

LOG BOOK & RECORD BOOK–

Candidate has to maintain a journal, duly certified by the teacher, in which all the practicals done by him/her are recorded

Candidate will also maintain work diary/log book & record his/her participation in all day to day training programs conducted by the department. Attendance in CME's, conferences, seminars & other academic programs are to be entered in this.

The journal & logbook must be scrutinized & certified by the Head of the department.

TEACHING OF UG STUDENTS –

During training period, the candidate should actively involve themselves in teaching programs for undergraduates, both theory & practicals

ADMINISTRATION –

They should be able to organise the laboratories for the conduction of various practicals.

Handle and order equipment for the stores, draw up lists of equipments required to equip any section of physiology.

TEACHING-LEARNING METHODOLOGY –

Group Discussions

Attending Lectures/Demonstration

Conducting / Attending seminars & Journal clubs

Conducting / Attending Practical demonstrations for UG students and Paramedicals

Practical exercises

Microteaching sessions

EXAMINATION PATTERN

Theory - **4 papers – 100 marks each Total** - **400 marks**

Topic distribution for theory -

Paper I - General Physiology, Haematology, Cardiovascular system

Paper II - Physiology of Respiration, Renal Physiology, Skin & temperature Regulation, Principles of Biophysics as applied to Physiology

Paper III - Nervous system, Special senses, Muscle & nerve Physiology

Paper IV– Gastro intestinal Physiology, Endocrine system, Reproductive system, Recent advances in Physiology

Question paper pattern -

Each paper - 3 Hours duration

Essay	2 x 20 = 40marks
Short Essays	5 X 10 = 50 marks
Short notes	2 X 5 = 10 marks
Total	100 marks

Practical exam –

Day 1	**Marks**
OSPE	50
Clinical Examination of subject provided	40
Hematology	50
Human Physiology	20
Graph Discussion (Amphibian & Mammalian)	20
Chart discussion (Clinical Cases, Interpretation of data, ,Charts etc)	20
Day 2	
Micro Teaching	20
Theory Viva	100

A candidate securing separate minimum of 50 % in theory and practical Is eligible to pass the examination. Those securing 75% and above are eligible for distinction.

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MD Physiology examination

Model Question Paper

Paper I

General Physiology, Haematology & Cardiovascular system

Max marks 100

Draw neatly labeled diagrams wherever necessary. Leave first page blank for mark distribution

I. Describe the blood supply of heart. Give an account of the pathophysiology of ischaemic heart disease

(10+10=20marks)

II. Discuss the indications for transfusion of blood and blood products. Explain the signs and symptoms of mismatched blood transfusion, giving their physiological basis.

(10+10=20marks)

III. Discuss the following -

A. Compensatory mechanisms during hypovolemic shock

B. Clinical applications of bioelectric potentials

C. Active transport across cell membrane & their inhibitors

D. Role of lymphocytes in immune mechanism

E. Regulation of heart rate

(10 marks X5=50 marks)

IV. Write briefly on -

A. Osmosis

B. Functions of platelets

(5 marks X2=10 marks)

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MD Physiology examination

Model Question Paper

Paper II

Max marks 100

Draw neatly labeled diagrams wherever necessary. Leave first page blank for mark distribution

I. Explain the mechanism of oxygen transport to tissues. Explain the various causes of hypoxia. What is oxygen toxicity ?

(10 + 6 + 4 =20 marks)

II. Describe the mechanism and significance of renal H^+ ion secretion and buffer systems in renal tubular fluid.

(20 marks)

III. Discuss the following -

A. Renal function tests & their clinical significance

B. Role of skin in body temperature regulation

C. Acclimatization to high altitude

D. La Place's law as applied to pulmonary and renal function

E. Ventilatory responses to PO_2, PCO_2 & pH changes & their interrelationship

(10 marks X5=50 marks)

IV. Write briefly on -

A. Physiological applications of Donnan's membrane equilibrium

B. Ventilation perfusion ratio & its significance

(5 marks X2=10 marks)

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MD Physiology examination

Model Question Paper

Paper III

Max marks 100

Draw neatly labeled diagrams wherever necessary. Leave first page blank for mark distribution

I. Describe the physiology of maintenance of muscle tone and its alterations in Pyramidal & extra pyramidal diseases. (10+10=20 marks)

II. Describe the mechanism of secretion, circulation and re absorption of aqueous humor. How is normal intra ocular pressure maintained? What is glaucoma? (10+5+5=20 marks)

III. Discuss the following

A. Drugs acting on neuro-muscular junction and the mechanism of action of each

B. Synaptic plasticity

C. Role of internal ear in detection and differentiation of sound

D. Formation, circulation, absorption and functions of cerebrospinal fluid

E. Features of hemisection of spinal cord and their physiological basis

(10 marks x5=50 marks)

IV. Write briefly on

A. Mechanism of contraction of smooth muscle

B. Signal transduction in taste buds

(5marksx2=10marks)

MD Physiology examination

Model Question Paper

Paper IV

Endocrinology, Reproduction, GIT & Recent advances

Max marks 100

Time 3 hours

Draw neatly labeled diagrams wherever necessary. Leave first page blank for mark distribution

I Discuss the physiological role of hormones secreted by adrenal cortex. Write a note on diagnosis & management of Addison's disease

(15+5=20marks)

II Describe the endocrine & exocrine functions of pancreas. What are the effects of dysfunction of pancreas?

(10+10=20 marks)

III **Discuss the following –**

A Describe the physiological processes leading to ovulation. Add a note on tests for ovulation & their significance

B Outline the events occurring during digestion and absorption of fat in GIT

C Discuss the systemic actions and regulation of secretion of thyroid hormones

D Describe gametogenesis in male & its regulation

E Explain the physiology of deglutition. Outline the causes of dysphagia

(10 marks eachx5=50)

IV **Write briefly on –**

A In Vitro fertilization (IVF)

B Prostaglandins (5 marks eachx2=10)

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