PRAVARA INSTITUTE OF MEDICAL SCIENCES

(DEEMED TO BE UNIVERSITY)

Loni, Tal. Rahata, Dist. Ahmednagar 413736

NAAC Re-accrediated with 'A' Grade

SYLLABUS

UG Programme- PHYSIOLOGY

MBBS- Ist year

(Competency Based Undergraduate Curriculum will be implemented from August 2019, i.e. MBBS batch admitted for first year in 2019)

Goal:

The broad goal of the teaching of undergraduate students in Physiology aims at providing the student comprehensive knowledge of the normal functions of the organ systems of the body to facilitate an understanding of the physiological basis of health and disease.

Objectives

a. Knowledge:

At the end of the course the student will be able to:

1. Explain the normal functioning of all the organ systems and their interactions for well-coordinated total body function;
2. Assess the relative contribution of each organ system to the maintenance of the milieu interior;
3. Elucidate the physiological aspects of normal growth and development;
4. Describe the physiological response and adaptations to environmental stresses; List the physiological principles underlying pathogenesis and treatment of disease

b. Skills

At the end of the course the student will be able to:

1. Conduct experiments designed for study of physiological phenomena;
2. Interpret experimental/investigative data;
3. Conduct and interpret clinical examination in normal healthy subject;
4. Distinguish between normal abnormal data derived as a result of tests, which he/she has performed and observed in the laboratory.

c. Attitude and communication skills:

At the end of the course the student will be able to:

1. Show due respect to persons who volunteer to be examined for the

purpose of learningclinical examination.
2. communicate effectively with peers, teachers and volunteer in clinical examination
3. demonstrate the ability of teamwork

d. Integration:

At the end of the integrated teaching the student should acquire an integrated knowledge of organ structure and function and the regulatory mechanisms.

List of systems included in Physiology:

- General Physiology
- Hematology
- Nerve-Muscle Physiology
- Gastro-Intestinal Physiology
- Cardiovascular physiology
- Respiratory physiology
- Renal Physiology
- Endocrine Physiology
- Reproductive Physiology
- Neurophysiology (Central Nervous System and Special Senses)
- Integrated Physiology

Physiology Syllabus: THEORY

General Physiology (PY 1.1-1.9) (8 hrs)

Structure and functions of a mammalian cell**;** Homeostasis, Intercellular communication**;** Apoptosis; Transport mechanisms across cell membranes; Fluid compartments of the body; pH & Buffer systems in the body; Evaluation of functions of the cells and products in clinical care and research.

Hematology: (PY 2.1 - 2.13) (16 hrs)

Components of blood: formation, regulation and functions; plasma proteins – origin, types, variations and functions; Hemoglobin- synthesis, variants, functions and its breakdown & Jaundice; Blood indices; Anemia and its classification; Hemostasis: mechanism, regulation & disorders Anticoagulants; Blood groups, blood banking and transfusion; Immunity: types, mechanism & regulation; ESR; Lymph-composition, circulation and functions

Nerve & Muscle Physiology: (PY 3.1 - 3.18) (10hrs)

Neuron and neuroglia: structures, types, functions; Resting membrane potential; Action potential in nerve, skeletal & smooth muscle; Nerve fibres: classification, functions & properties; nerve injuries, degeneration and regeneration in peripheral nerve; Neuromuscular junction: structure, transmission of impulses, neuro-muscular blocking agents, Myasthenia gravis; Muscle fibres: structure, types & functions; Muscle contraction; molecular basis (skeletal, smooth), Isotonic Vs. Isometric, Energy sources and metabolism, gradation of muscle activity; muscle dystrophy, Myopathies; Strength-duration curve

Gastrointestinal Physiology: (PY 4.1 - 4.10) (10hrs)

Functional anatomy and broad functions of digestive system, enteric nervous system; GI Secretions- composition, mechanism of secretion, functions, and regulation of saliva, gastric, pancreatic, intestinal juices and bile secretion; GI movements- types, regulation, functions, reflexes; role of dietary fibres; Digestion and absorption of nutrients; GI hormones- source, regulation, functions; Gut-brain axis; structure and functions of liver and gall bladder; gastric function tests, pancreatic exocrine function tests & liver function tests, Pathophysiology - Achalasia cardia, peptic ulcer, gastro oesophageal reflux disease, vomiting, diarrhoea, constipation, Adynamic ileus, Hirschsprung's disease.

Cardiovascular Physiology: (PY 5.1 - 5.16) (25hrs)

Functional anatomy of heart; Pacemaker tissue and conducting system- generation, conduction of cardiac impulse; Properties of cardiac muscle; Cardiac cycle; ECG- recording, normal ECG, uses, cardiac axis, Abnormal ECG in common arrhythmias, changes with hypertrophy & MI; Haemodynamics; Heart rate- factors affecting, regulation; Cardiac output- factors, regulation, measurement; Blood pressure- components, determinants, factors, regulation

and applied aspect, Regional circulation- autoregulation, microcirculation, lymphatic circulation, coronary, cerebral, capillary, skin, fetal, pulmonary and splanchnic circulation; Pathophysiology- shock, syncope, heart failure & coronary artery disease

Respiratory Physiology: (PY 6.1-6.10) (12hrs)

Functional anatomy of respiratory tract, dead space; Mechanics of respiration; Pressure volume changes during ventilation; Lung volume and capacities; Alveolar surface tension; Compliance; Airway resistance; alveolar ventilation, V/P ratio; Diffusion capacity of lungs; Transport of respiratory gases- Oxygen and Carbon dioxide; Neural and chemical regulation of respiration; Physiology of high altitude and deep sea diving; Principles of artificial respiration, oxygen therapy; Patho-physiology of dyspnoea, hypoxia, cyanosis, asphyxia, drowning, periodic breathing; Lung function tests & its clinical significance

Renal Physiology: (PY 7.1 - 7.9) (10hrs)

Structure and functions of kidney & juxta glomerular apparatus, role of renin-angiotensin system; Renal blood flow; Mechanism of urine formation, concentration and diluting mechanism; Concept and significance of 'clearance' tests; Renal regulation of fluid and electrolytes & acid- base balance; Structure and innervation of urinary bladder, physiology of micturition, cystometry, and its abnormalities; Artificial kidney(dialysis) and renal transplantation; Renal Function Tests

Endocrine Physiology: (PY 8.1 - 8.6) (16 hrs)

Mechanism of action of steroid, protein and amine hormones; Synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and hypothalamus; Physiology of bone and calcium metabolism; Physiology of growth; Physiology of Thymus & Pineal Gland; Hormone function tests ; Obesity & metabolic syndrome; Stress response

Reproductive Physiology: (PY 9.1 - 9.12) (10hrs)

Sex determination; sex differentiation and their abnormalities; Puberty: onset, progression, stages; early and delayed puberty; Male reproductive system: functions of testis, spermatogenesis and its regulation, Cryptorchidism ; Female reproductive system: functions of ovary and its control, menstrual cycle: Hormonal, uterine and ovarian changes; Tests for ovulation; Physiological effects of sex hormones; Contraceptive methods for male and female; Effects of removal of gonads on physiological functions; Physiology of pregnancy, fetoplacental unit, pregnancy tests, parturition & lactation; Semen analysis; Causes and principles of management of infertility; Hormonal changes and their effects during perimenopause and menopause; Psychological and psychiatric disturbances associated with reproductive physiology.

Neurophysiology: (PY 10.1 - 10.20) (37 hrs)

Organization of nervous system; Sensory system: types, functions and

properties of synapse, receptors, reflex; Somatic sensations & sensory tracts; Physiology of pain; Motor system: organization, motor tracts, mechanism of maintenance of tone, control of voluntary movements ;Posture and equilibrium & vestibular apparatus; Reticular activating system, Autonomic nervous system ; Spinal cord: functional organization and lesions ; Formation, circulation and function ofCSF; Blood brain barrier; Neurotransmitters.
Organization, connections and functions of cerebral cortex, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system and their abnormalities; Higher mental functions ;Physiology of sleep, memory, learning and speech and their disorders; EEG.
Special senses- Smell and taste sensation and their abnormalities; Functional anatomy of ear and auditory pathways & physiology of hearing, Deafness, hearing tests; Functional anatomy of eye,Image formation, Visual pathway and its lesions, Physiology of vision including acuity of vision,colour vision, field of vision, refractive errors, physiology of pupil; light reflex, accommodation reflex, dark and light adaptation; Auditory & visual evoked potentials

Integrated Physiology: (PY 11.1 - 11.14) (6 hrs)

Temperature regulation: mechanism, adaptation to altered temperature (heat and cold environment), mechanism of fever, cold injuries and heat stroke; Exercise- cardio-respiratory and metabolic adjustments during exercise (isotonic and isometric), exercise in heat and cold, physical training effects; Physiological consequences of sedentary lifestyle; Brain death; Physiology of Infancy*; Physiology of aging-free radicals and antioxidants*; Physiology of meditation*.

(* 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India").

PRACTICAL:

The following list of practical is minimum and essential. Additional exercises can be included as and when feasible and required. All the practicals have been categorized as '**Procedures to be performed'** and '**Demonstrations'.** The procedures are to be performed by the students during practical classes to acquire skills. These would be included in the practical during University examination. Those categorized as 'Demonstrations' are to be shown to students during practical classes. Questions based on these would be given in the form of data, charts, graphs, problems and case histories for interpretation by students during university examination.

I. Procedures to be performed by the students:

a. Haematology:

1. RBC count
2. WBC Count
3. Differential Leucocyte Count
4. Estimation of haemoglobin
5. Blood grouping

6. Bleeding time
7. Clotting time
8. Calculate RBC indices - MCV, MCH, MCHC.

b. Procedures to be performed on human subjects:

1. Mosso's ergography.
2. Recording of Blood Pressure, pulse rate at rest and effect of posture.
3. Effect of mild and moderate exercise on blood pressure, pulse rate and respiratory rateusing Harvard step test.
4. Record and interpret Lead II ECG. Given a normal ECG, determine cardiac axis.
5. Spirometry – Lung volumes and capacities, MVV, Timed vital capacity.
6. Peak Expiratory Flow Rate
7. Demonstrate Basic Life Support in a simulated environment
8. Visual field by Perimetry

c. Clinical Examination:

1. Components of history taking and general physical examination
2. Examination of radial pulse
3. Examination of Cardiovascular system
4. Examination of Respiratory system
5. Examination of abdomen
6. Examination of Higher mental functions
7. Examination of Sensory system
8. Examination of Motor system including reflexes.
9. Examination of Cranial Nerves

II. <u>Demonstrations:</u>

I. Haematology:
   i. Erythrocyte sedimentation rate
   ii. Haematocrit
   iii. Reticulocyte count
   iv. Platelet count
II. Osmotic fragility Record Arterial pulse tracing using finger plethysmography*
III. Stethography
IV. Tests of cardiovascular autonomic functions*

(* 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India")

III. Interpretation- charts: clinical case histories, graphs, charts, problems

Chart also includes - Interpret growth chart*, Interpret anthropometric assessment of infants*: (*these two charts are 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India")

IV. Computer assisted learning:

(i) Amphibian nerve - muscle experiments and interpretation of graphs

List of graphs on nerve-muscle experiments:

- Simple muscle twitch
- Effect of various strengths of stimuli on Simple muscle twitch
- Effect of changes in temperature on Simple muscle twitch
- Effect of two successive stimuli on muscle contraction
- Effect of multiple successive stimuli (treppe, clonus, tetanus)
- Study of fatigue in skeletal muscle
- Velocity of nerve conduction
- Effect of load on muscle
- Measurement of isometric contractions using nerve muscle preparation

(ii) Amphibian cardiac experiments and interpretation of graphs

List of graphs on cardiac experiments:

- Normal cardiogram
- Effect of temperature on frog heart
- Effect of Stannius ligatures
- Properties of cardiac muscle – all or none law, staircase effect, refractory period in a beating heart (extrasystole and compensatory pause), refractory period in a quiescent heart
- Effect of vagus on frog's heart
- Action of drugs on vagus (nicotine and atropine)
- Perfusion of isolated heart and effect of ions (NaCl, KCl, $CaCl_2$)
- Perfusion of isolated heart and effect of drugs (adrenaline, acetyl choline, atropine followed by Ach) SKILL CERTIFICATION:

The list of certifiable skills is given below. The general instructions, blank template, samples of certification checklist suggested for skill certification will be are provided.

List and number of sessions for skill certification as prescribed by MCI:

	Topics	Number required to certify as per MCI
PY5.12	Record blood pressure & pulse at rest and in different grades of exercise and postures in a volunteer or simulated environment	1 each x 3
PY6.9	Demonstrate the correct clinical examination of the respiratory system in a normal volunteer or simulated environment	1
PY 10.11	Demonstrate the correct clinical examination of the nervous system: Higher functions, sensory system, motor system, reflexes, cranial nerves in a normal volunteer or simulated environment	1 each (total 5)
PY 10.20	Demonstrate (i) Testing of visual acuity, colour and field of vision and (ii) hearing (iii) Testing for smell and (iv) taste sensation in volunteer / simulated environment	1 each (total 4)

SUGGESTED AREAS FOR INTEGRATION:

As per the "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India"

EARLY CLINICAL EXPOSURE:

- **Clinical visits: 12 hours which could be a part of the practical record book**, **Suggested hospital visits: (can include more than the below suggestions)**
  Anemia, Jaundice, Visit to blood bank, Computerized lung function tests, acid peptic disease, endoscopy procedure, dialysis unit, hemiplegia, etc.
- **Basic science correlations: 18 hours**
  Discussion based on case vignettes, graphs, clinical videos, patient in classroom setting, etc linked to various systems in physiology.

SELF-DIRECTED LEARNING:

Twenty-five hours of dedicated time for self-directed learning is provided for physiology.

AETCOM MODULES TO BE COVERED UNDER PHYSIOLOGY:

AETCOM module number(as per MCI document) *	**Topic**
1.2	**What does it mean to be a patient?**
1.3	**The doctor-patient relationship**

*** https://www.mciindia.org/CMS/wp-content/uploads/2019/01/AETCOM_book.pdf**

This could be a part of the practical record book.

LOG BOOK:

Suggested Template of logbook is attached as annexure. The minimum elements that needs to beincluded are mentioned in the template provided **for log book.**

TEACHING HOURS AND METHODS:

Curricular component	**Time allotted in hours**
Lectures	160
Small group teaching / tutorials / integrated learning /practical	310
Self-directed learning	25
Early clinical exposure (basic science correlation and clinicalskills)	30 (18 +12)
Total	**525**
AETCOM module 1.2 and 1.3 ()	15 (8+7)

Note: It is recommended that **didactic teaching** be restricted to **less than one third of the totaltime** allotted for that discipline

Paper wise distribution of topics
(Paper- I & Paper- II)

Paper	Section	Topics
I	A	MCQs on all topics of the paper I
	B & C	General Physiology
		Blood
		Respiratory System
		Cardio Vascular System
		Cardio respiratory and metabolic adjustment during exercise
		Renal system
		Gastro intestinal system
		Life style, aging, Meditation
		AETCOM module no. 1.2 & 1.3
		Scenario based / application questions can be on any topic of the Paper I
		For long answer question and scenario based / application questions, Topics will not be repeated
II	A	MCQs on all topics of the paper II
	B & C	Endocrine Physiology
		Reproductive System, Physiology of Infancy
		Special senses
		Central nervous system including brain death Temperature Regulation & applied
		Nerve muscle physiology
		Scenario based / application questions can be on any topic of the Paper II
		For long answer question and scenario based / application, Questions, topics will not be repeated

Pattern of **Theory question Paper**
Total Marks- 100; Time -3 hours

SECTION "A" MCQ (20 Marks)

1. Multiple Choice Questions (Total 20 MCQ of One mark each) (4 MCQ Should be CASE based) (20x1=20)

   a) b) c) d) e) f) g) h) i) j)

   k) l) m) n) o) p) q) r) s) t)

SECTION "B" & "C"

SECTION "B" (40 Marks)

2. Short Answer Questions (Any Four out of Five & two SAQs will be *Clinical Application Based*) (4x5 =20)

   a) b) c) d) e)

3. Long Answer Questions (Any Two out of Three) (2x10=20)

   a) b) c)

SECTION "C" (40 Marks)

4. Short answer questions (Any Four out of Five) (4x5= 20)

   a) b) c) d) e)

5. Long Answer Questions (Any Two out of Three) (2x10 =20)

   a) b) c)

Practical Mark's Structure

Internal Assessment Examinations I & II

	Hematology	Clinical Examination / Human Physiology expt. / Short exercises	Journal/ Logbook	Oral /Viva	**Total**
	A	B	C	D	**E**
Max. Marks	15	20	5	10	**50**

Practical Mark's Structure (Prelim)

Seat No.	**Exercise 1**				**Exercise 2**	**Exercise 3**	**Exercise 4**		**Practical (Total)**	**Oral /Viva (Total)**	**PR /Oral (Total)**
	Clinical Examination										
	C.V.S	R.S	C.N.S. & Special Senses	General Exam & Abdomen	Hematology	Short Exercise	Human Physiology Experiment	Journal & log Book			
	A	B	C	D	E	F	G	H	**I**	**J**	**K**
Max. Marks	10.0	10.0	10.0	10.0	10.0	15.0	15.0	10.0	**90**	**10.0**	**100**

*** Short exercises 3 marks each (3x5)**

1. **Case based scenarios / endocrine disorders photographs.**
2. **Interpretation of function tests.**
3. **One skeletal graph**
4. **One cardiac graph 5. Calculation**

****Exercise 4 : Human Physiology Experiment**

1. Basic Life Support in a simulated environment 2. ECG 3. Spirometry
4. PEFR 5. EEG Interpretation 6. Ergography 7. Harward step test 8. Perimetry

*** Suggested Methods of Assessment**

Preclinical exam & OSPE

Pattern of **University Practical examination**:

	Exercise 1				Exercise 2	Exercise 3	Exercise 4	Practical (Total)	Oral /Viva (Total)	PR /Oral (Total)
	Clinical Examination									
	C.V.S	R.S	C.N.S. & Special Senses	General Exam & Abdomen	Hematology	Short Exercises	Human Physiology Experiment			
	A	B	C	D	E	F	G	H	I	J
Max. Marks	10.0	10.0	10.0	10.0	10.0	15.0	15.0	80	20.0	100

*** Short exercises 3 marks each (3x5)**
1. Case based scenarios / endocrine disorders photographs. 2. Interpretation of function tests.
3. One skeletal graph 4. One cardiac graph 5. Calculation

****Exercise 4 : Human Physiology Experiment**
1.Basic Life Support in a simulated environment 2. ECG 3. Spirometry
4. PEFR 5. EEG Interpretation 6. Ergography 7. Harward step test 8. Perimetry

*** Suggested Methods of Assessment**
Preclinical exam & OSPE

Internal Assessment
Physiology

Sr. No.	I - Exam (December)			II – Exam (March)		
	Theory	Practical (Including 05 Marks for Journal & Log Book)	Total Marks	Theory	Practical (Including 05 Marks for Journal & Log Book)	Total Marks
1	100	50	150	100	50	150

Sr. No.	Preliminary Examinations		
	III – Exam (July)		
	Theory	Practical Including 10 Marks for Journal & Log Book	Total Marks
1	200	100	300

1. There will be 3 internal assessment examinations in the academic year. The structure of Preliminary examinations should be similar to the structure of University examination.
2. There will be only additional examination for absent students (due to genuine reason) after approval by the Committee Constituted for the same. It should be taken after preliminary examination and before submission of internal assessment marks to the University.
3. First internal assessment examination will be held in December, second internal assessment examination will be held in March and third internal assessment examination will be held in July.
4. Internal assessment marks for theory and practical will be converted to out of 40. Internal assessment marks, after Conversion, should be submitted to university by 7th of August.
5. The student must secure at least 50% marks for total marks (combined in theory and practical / clinical : not less than 40% marks in theory and practical separately) assigned for internal assessment in a particular subject in order to be eligible for appearing at the final university examination of that subject. Internal assessment marks will reflect as separate head of passing at the summative examination.
6. Remedial internal assessment examination for Non – eligible students: Student who were not eligible due to less than 50% combined or less than 40% in any theory or practical, will re appear as repeater student for Prelim exam which will be conducted before Supplementary Exam. His/her internal assessment will be calculated on the basis of this Examination marks only. Students who will not be eligible in this Examination will appear with regular batch as repeater student.
7. The internal assessment marks of the remedial examination alone shall be considered and concerted into out of 40.
8. Conversion Formula for calculation of marks in internal assessment examinations.

	First IA	**Second IA**	**Third IA (Prelim)**	**Total**	**Internal Assessment Marks: Conversion formula (out of 40)**	**Eligibility to appear for final University examination (after conversion out of 40) (40% Separately in Theory and Practical, 50% Combined)**	
Theory	100	100	200	400	$\frac{\text{Total marks obtained}}{10}$	16 (minimum)	Total of Theory + Practical Must be 40.
Practical	50	50	100	200	$\frac{\text{Total marks obtained}}{5}$	16 (minimum)	

9. Conversion formula for calculation of marks in Remedial internal assessment examination

	Remedial Exam (Prelim)	**Int. Assess. Marks conversion formula (out of 40)**	**Eligibility to appear for Supplementary Exam. (after conversion out of 40) (40% Separately in Theory and Practical, 50% Combined)**	
Theory	200	Total marks obtained / 5	16 (minimum)	Total of Theory + Practical Must be 40.
Practical	100	Total marks obtained / 2.5	16 (minimum)	

While preparing Final Marks of Internal Assessment, the rounding off marks shall done as illustrated in following table

Internal Assessment Marks	**Final rounded marks**
15.01 to 15.49	15
15.50 to 15.99	16

Internal assessment pattern in Community Medicine :
Only one examination in First MBBS, at end of Teaching ; Theory- 50 marks and Practical- 50 marks

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