

BHARATHIAR UNIVERSITY : COIMBATORE- 641 046

M.Phil. / Ph.D. in Physiology
(w.e.f. 2008-2009 and onwards)

PART-I SYLLABUS

PAPER I : Research Methodology in Physiology

PAPER II : Research Trends in Physiology

PAPER III : Special Papers

1. Cold Physiology
2. Ergonomics and Work Physiology
3. Neurophysiology

Paper-I : Research Methodology in Physiology

UNIT 1

- a). Basic electronics (electrical unit e.g. E.M.F, Charge, Current flow, Resistance, Impedance, Frequency, Conductance etc. ECG, EMG, EEG, GSR (Galvanic Skin Response), EP (Evoked Potential) their principles of measurements, BP measurement.
- b) pH measurement, buffers, estimation of macro molecules (protein, carbohydrate and nucleic acids), enzyme kinetics, Colorimetry- ultraviolet-visible spectrophotometry- principles, instrumentation and application, fluorescence spectrophotometry.

UNIT 2

- a. Chromatography techniques and principles and different types (Affinity chromatography, ion exchange chromatography, Gel exclusion chromatography, Gas chromatography, HPLC, TLC, paper chromatography). Isolation of natural products (extraction, purification and separation).
- b. Different types of microscopic techniques (light microscope, compound microscope, dark field microscope, phase contrast microscope, Normaski microscope, confocal microscopy, transmission electron microscopy (TEM) and scanning electron microscopy (SEM), Cell sorting-flow cytometry,

UNIT 3

- a) Ergometry - its principles and different type of ergometers and their applications. Pulmonary function tests, Spirometry. Respiratory gas analysis (expired air), Blood gas analysis. Physical performance assessment.
- b) Routes of immunization, types of adjuvant and their importance, antigen antibody interaction, monoclonal and polyclonal antibodies. ELISA techniques-principle and applications, Immunoradiometric assay- Principles and applications, Hybridoma.

UNIT 4

- a) Environmental/Bio-meteorological analysis: Heat indices using Dry bulb &Wet bulb thermometer, Kata thermometer. Anaemometer, measurement of Basal Metabolic Rate, energy expenditure Direct and indirect calorimetry).
- b) Isolation of genomic DNA and plasmid DNA, DNA sequencing techniques (PCR, RTPCR, restriction analysis, DNA fragmentation analysis, Hybridization techniques) etc. COMET assay, cell viability assay, karyotyping.

UNIT 5

- a) Statistics in biomedical research- Experimental design, Various sampling methods, Probability, frequency distribution average (arithmetic, geometric, means, mode and median) Standard Deviation, Standard Error of Mean, Degree of Freedom, Significance, t-test, Correlation, null hypothesis, distribution.
- b) Bioinformatics: use of computers in data analysis, Biological databases- DNA sequence databases and protein sequence databases. BLAST, FASTA, Multiple sequence alignment.

Paper-II : Research Trends in Physiology

UNIT 1

- a) Environment factors effective human health and performance (Heat, Cold, High Altitude, Under water and Space).
- b) Occupational environment and Pollution (type, effect on human health).

UNIT 2

- a. Thermoregulatory mechanisms in human beings and adaptive/acclimatization responses.
- b. Glycolysis, gluconeogenesis, citric acid cycle, pentose phosphate pathway, β -oxidation of fatty acids, ketone bodies; integration of metabolic pathways, electron transport chain, oxidative phosphorylation. k_m , competitive, non-competitive and mixed inhibition, effect of pH; principles of toxicology.

UNIT 3

- a) Physical work capacity (Changes in different environmental conditions, High Altitude, Heat and Cold). Anthropometric and body composition changes in different age and sex.
- a) Oxidative stress and types of free radicals, their role in cell metabolism and diseases; antioxidant defense system, detoxification mechanism; neurotransmitter and neuromodulator

UNIT 4

- a) Biorhythms- Different types mechanisms. Effect of circadian rhythms on human health and efficiency.
- b) Development of immune system, regulation of immune response, humoral and cell mediated immunity

UNIT 5

- a) Different heat stress indices (Effective Temperature, WBGT) its measurement principles and applications. Wind Chill Index, Measurement, Applications. Clo value, its definition and application.
- b) Gene structure and function, DNA replication and repair, cloning and expression of genes. Transcription and translation in prokaryotes and eukaryotes.

Physiology

Special Paper – 1 : Cold Physiology

UNIT 1

- a. Temperature regulation-Principle and Heat Balance
- b. Regulation of body temperature-Neuropsychological & biochemical basis of temperature regulation

UNIT 2

- a. Types of Cold exposure, Newton Law of cooling, Insulation
- b. Measurement of body temperature and blood flow (Thermography etc)

UNIT 3

- a. Responses to acute cold exposure, shivering, non shivering thermogenesis, cold induced vasodilatation
- b. Responses to cold adaptation, Eskimos, Australian Aborigine

UNIT 4

- a. Hypothermia, Experimental hypothermia
- b. Frostbite mechanism and treatment modality

UNIT 5

- a. Oxidative stress, reactive oxygen species, Antioxidant systems, Lipid peroxidation
- b. Role of antioxidants, Natural and Synthetic antioxidants

Physiology

Special Paper – 2 : Ergonomics & Work Physiology

UNIT 1

- a. Concept of ergonomics, focus of ergonomics, application of ergonomics, understanding man-machine environment system components, macro and micro ergonomics
- b. Types of muscles, EM Structure of skeletal muscle, mechanism of muscular contraction, chemical basis of muscular contraction, neuromuscular junction and transmission

UNIT 2

- a. Anthropometric principles in work place and equipment design, application of anthropometry I design, designing for a population and for everyone, effectiveness and cost effectiveness
- b. Designing for standing and seated work

UNIT 3

- a. Types of work, O₂ and CO₂ consumption, aerobic and anaerobic work, O₂ debt, maximum aerobic capacity (limit factors affecting standard methods of measurement), lactate threshold
- b. Classification of workload, work rest cycle, physical fitness (measurement factors affecting, environmental impact)

UNIT 4

- a. Effect of environment on human performance (effect of noise, vibration, heat, cold and illumination), personal protection and protective equipment.
- b. Body composition (measurement and analysis), physical activity and obesity, theories of weight control

UNIT 5

- a. Ergonomic methods and tools for work analysis (posture analysis-OWAS, RULA, Comfort/discomfort analysis, CG analysis)
- b. Occupational ergonomics (ergonomics in military and industrial work environment), musculo-skeletal disorders (development, analysis and prevention).

Physiology

Special Paper – 3 : Neurophysiology

UNIT 1

- a. Conduction and transmission of nerve impulse, action potential, processing of information
- b. Synapses, synaptic transmission, CNS neurotransmitters

UNIT 2

- a. Sleep wakefulness, types of sleep, physiology, mechanism, EEG and neurotransmitters involved in sleep wakefulness
- b. Meditation, Physiological effects, applications

UNIT 3

- a. Intellectual functions of cerebral cortex, thoughts and consciousness, memory, consolidation
- b. Limbic system, hypothalamus, hippocampus, amygdala and limbic cortices, sleep deprivation and cognitive function

UNIT 5

- a. EEG, Polysomnography, sleep staging
- b. Evoked potentials, event related potentials, fMRI, PET

UNIT 6

- a. Effect of low oxygen on the body
- b. Sleep at high altitude, cerebral edema, acute mountain sickness.
