THE UNIVERSITY OF BURDWAN

Syllabus for B.Sc. 3-Year Degree Course in PHYSIOLOGY (Honours) (w.e.f. 2010-2011).

PART – I Examination

PAPER – I 100 marks
Unit – 01 Structural units of Human System, Biophysical and Biochemical Principles, Biochemistry, Elementary idea of nervous system and ANS.

Unit – 02 Blood and body fluids; Respiration, Cardiac Physiology, Circulatory System

PAPER – II 100 marks
Practical: 1. Histology
(a) Hematology ................................................. 20 marks
(b) Fresh –tissue preparation ......................... 15 marks
(c) Identification of permanent slides .......... 20 marks

2. Biochemistry
(a) Qualitative analysis ................................. 10 marks
(b) Quantitative analysis ............................. 15 marks

3. Laboratory Note book ................................. 10 marks
4. Viva-voce ................................................ 10 marks

PART – II Examination

PAPER - III 100 marks
Unit – 03 Physiology of Digestive System, Metabolism, Nutrition and Dietetics.

Unit – 04 Environmental Physiology, Microbiology & Immunology, Work Physiology, Sports Physiology and Ergonomics.

PAPER – IV 100 marks
Practical: 1. Experimental Physiology
(a) Experiments on mammals ......................... 20 marks
(b) Experiments on Human ............................ 15 marks

2. Environmental Physiology .......................... 15 marks

3. Microbiology ............................................. 15 marks

4. Diet Survey .............................................. 15 marks

5. Laboratory Note book .............................. 10 marks

6. Viva-voce ................................................ 10 marks
## PART – III Examination

### PAPER – V

**Unit – 05**  
Nerve-Muscle Physiology, Sensory Physiology, Renal Physiology.  
(50 marks)

**Unit – 06**  
Genetics and Molecular Biology, Central nervous system, Peripheral nervous system.  
(50 marks)

### PAPER – VI

**Unit – 07**  
Endocrine System, Chronobiology.  
(50 marks)

**Unit – 08**  
Social Physiology, Community Health, Comparative Physiology, Instrumentation.  
(50 marks)

### PAPER – VII

**Unit – 09**  
Reproductive Physiology, Developmental Biology.  
(50 marks)

**Unit – 10**  
Biostatistics, Computer Application in Physiology, Skin and Body temperature regulation, Pharmacological Physiology.  
(50 marks)

### PAPER – VIII

**Practical:**  
1. Biochemistry ................................................................. 15 marks  
2. Biostatistics............................................................................. 10 marks  
3. Histology & Histochemistry.................................................... 20 marks  
4. Experiments on toad ............................................................ 20 marks  
5. Field Study Report.............................................................. 15 marks  
6. Laboratory Note book ......................................................... 10 marks  
7. Viva-voce ............................................................................ 10 marks

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DETAILED SYLLABUS

(The numbers in the parenthesis indicates number of lectures required).

Part I SYLLABUS

Paper- I (Theoretical )- 100 Marks
Unit 01- 50 Marks

Structural units of human system, Biophysical & Biochemical principles, Biochemistry; Elementary idea of nervous system and ANS.

Structural units of human system:

Biophysical & Biochemical Principles:

Biochemistry : [10]

Elementary idea of Nervous system and ANS : [10]
Spinal cord: Outline, organization & function.
Peripheral nervous system: Cranial nerves, spinal nerves, function.
Autonomic nervous system: Outline organization & functions.

Neurohistology: [10]
Receptors organs: exteroceptors & interoceptors. Encapsulated & non- encapsulated (free, nerve ending) receptors, muscle spindle innervation & function.

Unit 02 : 50 Marks:-

Blood and body fluids; Cardiac Physiology, Circulatory system, Respiration

Blood & Body Fluids: [40]
Erythrocytes :- morphology, life cycle, factors in erythropoiesis, functions & fate of haemoglobin, chemistry, biosynthesis, functions, catabolism, oxyhaemoglobin, methaemoglobin, carbamonoxy haemoglobin & haemin. Abnormal haemoglobin, thalassemia, sickle cell anaemia, porphyrias.
Leucocytes – Morphology, classification, life cycles, functions, Human leucocyte antigen (HLA).
Arneth count, Shilling- index. Platelet count & reticulocyte count- significance.
Megakaryocytes, Anaemia, Megaloblastic & microcytic polycythemia. ESR, TC, DC, PCV, MCH, MCHC, MCV.
Hemostasis, blood coagulation mechanism, coagulating factors, factors hastening & retarding coagulation, anticoagulants, disorders of coagulation, coagulation time, bleeding time, prothrombin time, hemolysis.
Blood groups- ABO system :- Rh antigens, blood transfusion & its hazards. AIDS, hepatitis B & blood group incompatibility- erythroblastosis fetalis.

Cardiac Physiology : [20]
Anatomical organization of cardiovascular system. Microscopic structure of cardiac muscle. Basic

Circulatory System: [20]

Respiration: [20]

PAPER II: PRACTICAL : 100 Marks

<table>
<thead>
<tr>
<th>Histology-55marks ; Biochemistry: (a) Qualitative Analysis – 10 Marks and (b) Quantitative Estimate – 15 Marks, Laboratory Note Book – 10 Marks, Viva-voce – 10Marks</th>
</tr>
</thead>
</table>

1. Histology:
(a)Hematology: 20 Marks
Preparation and staining of human blood cell (Leishman, hematoxylin-eosin), Identification and measurement of WBC. Differential count of WBC, Total count of RBC and WBC.
Estimation of hemoglobin (Sahli’s Method)

b) Staining and examination of fresh tissues: 15 Marks
Squamous, ciliated columnar epithelium (methylene blue), corneal cell space (silver nitrate), urinary bladder (silver nitrate), node of Ranvier (silver nitrate), Adipose tissue (Sudan III or IV), Voluntary muscle (methylene blue).

ii) Study and identification of stained sections of different mammalian tissues and organs: 20 Marks
Bone, different types of cartilage, trachea, lung, spleen, lymph gland, esophagus, stomach, duodenum, ileum, jejunum, large intestine, liver, kidney, ureter, different types of salivary glands, pancreas, adrenal gland, thyroid gland, testis, ovary, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, artery, vein, tongue, uterus.

B. Biochemistry: 25 Marks
1. Qualitative analysis of biochemical molecules: 10 Marks
A. Carbohydrates - Glucose, fructose, galactose, lactose, sucrose, starch, dextrin, maltose.
Protein: Albumin, gelatin, peptone, Glycerol, cholesterol, bile salt and pigment, acetone, lactic acid, urea, uric acid, HCl.
B. Identification of normal and abnormal constituents of urine.

2. Quantitative estimation by titrametric method: 15 Marks
b) Estimation of free and total acidity of stimulated gastric juice.

3. Laboratory notebook: 10 marks

4. Viva-voce: 10 marks.

RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (HONOURS) Part - I COURSE

( The latest edition available should be used for all books)
Oxford University Press.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J.Weibell & E.A.Pfeiffer; Prentice-Hall of India Pvt Ltd.
33. Note Books on Practical Biochemistry, Experimental Physiology and Histology. (Published by the Physiological Society of India, Kolkata.)

Note: In order to maintain the uniformity of practical knowledge among the students of different Colleges, Physiological Society of India has published Practical Note Books in Physiology comprising syllabi of different Universities including Burdwan University with the help of experienced teachers including dignitaries of both Honours and General teaching degree colleges. Hence, members of the Undergraduate Board of Studies in Physiology recommended the aforesaid Note Books (Experimental, Biochemistry and Histology) for use by the students in undergraduate degree course (Honours Practical ) in Physiology.
PART II SYLLABUS

PAPER III : THEORETICAL : 100 marks

UNIT 03 : 50 marks

| Digestive system, | Metabolism, Nutrition and Dietetics |

The Digestive system :


Metabolism :


Sodium, potassium, chloride, calcium, magnesium and phosphorus metabolism. Trace elements (iron, zinc, selenium)- their role and deficiencies.

Nutrition and Dietetics:

An introduction to Nutrition : Mouse candle experiment (Lavosier) Nutritional status of the body; normal, malnutrition and undernutrition; RDA-its significance;

Factors altering nutritional requirement- physical factors, nutrient-nutrient interaction, drug – nutrient interactions; Nutritional assessment; physical examination, anthropometry; nutritional support in patient management- a) TPN (total parental nutrition) and b) PN (parental nutrition).

Vitamins: Water soluble and fat soluble vitamins, sources, dietary requirements, deficiencies, coenzyme functions, Hypervitaminosis, Basal Metabolic Rate, Definition of BMR, factors affecting BMR, Principle of measurement of body surface area. Direct and indirect calorimetry. Determination
of BMR by Benedict-Roth apparatus and Douglas Bag, Respiratory quotient, its variation and significance.

Water metabolism, dehydration, ORS and edema.


Dietary calories: Calorie value and physiological fuel value. Calorie requirements formulated by ICMR for different ages and activity level. Adult consumption Unit (ACU).


Formulation of diet chart: Formulation of balanced vegetarian and nonvegetarian diets for growing child, pregnant and lactating mothers, college students, ICMR, formulation methods of dietary surveys.

Nutritional disorders: Starvation, dietary causes and dietary management of hypertension, diabetes mellitus and RDA.

Unit 04: 50 marks

Environmental Physiology, Microbiology and Immunology, Work Physiology, Sports Physiology, and Ergonomics

Environmental Physiology:


Radiation Pollution: Radioactivity and radiation; radionucleides: What are they? Radionucleides sources: radiation units and dose, Ionizing radiation, Radioactive wastes; Radiation hazards: physiological basis, per capita human exposure by radiation from house hold items: control and preventive measures.

Ecology: Science of environment; relationship between ecology and physiology; ecosystem and its components; Anatomy and physiology of ecosystem; flow of matter and energy through Eco-system; food chain. Pyramid of biomass and energy.

Toxicology: Toxins; toxicology. Principles of toxicology, LD_{50}, Antagonism and synergism; reproductive toxins and neurotoxins; carcinogens, teratogens; mutagens.


Ozone-Layer Depletion: Stratospheric ozone layer and its importance. Dobson unit; formation of
ozone layer, causes of ozone layer destruction; concept of ozone hole; global strategies for the protection of ozone layer.

**Air and Water Pollution** : Air and water pollutants; Causes of pollution; effects of air and water pollution- ocean pollution, oil spills, ground water pollution, concept of drinking water.

**Microbiology and Immunology** :

**Work Physiology, Sports Physiology, and Ergonomics** :

**PAPER IV : PRACTICAL** :

1. Experimental Physiology
(a) Experiments on mammals:
Dale's bath experiment: Kymographic recording of normal movements of rat's intestine in Dale’s apparatus. Effects of acetylcholine on frog / toad rectus abdominis muscle in Dale’s bath.
(b) Experiments on Human :
Sphygmanometric measurement of arterial blood pressure at rest and after exercise. Harvard step
test and determination of physical fitness. Pneumographic effects of talking, laughing, coughing, exercise, hyperventilation and breath-holding. Determination of muscular efficiency by Mosse’s ergograph. Spirometric measurement of vital capacity. Measurement of some common anthropometric parameters - stature, eye height, shoulder height, elbow height, shoulder-elbow length, shoulder breadth, head breadth, head circumference, waist-hip ratio. Calculation of body surface area (using nomogram) and body mass index from anthropometric measurements

2. Environmental Physiology: 15 Marks
   i) Measurement of environmental temperature: dry bulb and wet bulb, relative humidity.
   ii) Determination of B.O.D. by Winker’s method.
   iii) Measurement of noise by sound level meter.

3. Microbiology: 15 Marks
   Sterilization, Gram staining for Gram-positive and Gram-negative bacteria, demonstration of bacterial spore staining, culture technique demonstration.

4. Diet survey report (as per ICMR specifications to be handwritten): 15 Marks

5. Laboratory Note Book: 10 Marks

6. Viva-voce: 10 Marks

RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (HONOURS) Part - II COURSE

( The latest edition available should be used for all books)

17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications
22. Cellular & Molecular Biology, by E.D.P. De Robertis & E.M.F. De Robertis; Lea & Febiger.
23. Molecular Biology of the Gene, by J.D. Watson; H.H. Nancy & others; Benjamin- Cummings.
27. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical Publishers.
31. Text Book of Physiology by G.H. Bell: J.N. Davidson and H. Scarborough. ELBS.
34. Pesticides by P.K. Gupta, Interprint.
35. Environmental Chemistry by P.V. De. Wiley Eastern Ltd.
37. Essentials of Exercise Physiology by L.G. Shaver, Surjeet Publications.
38. Text Book of Environmental Physiology by C. Edger Folk Jr. Lea and Febiger.
42. Sports Physiology by E.L. Fox, Saunders College Publishing Holt-Saunders.
43. The Principles and Practice of Human Physiology by O.G. Edholm and Others, Academic Press.
44. Concise Medical Physiology by S.K. Chaudhury; New Central Book Agency.
45. Medical Physiology by A.B. Mahapatra, Current Books International.
51. Note Books on Practical Biochemistry, Experimental Physiology and Histology. (Published by the Physiological Society of India, Kolkata.)

Note: In order to maintain the uniformity of practical knowledge among the students of different Colleges, Physiological Society of India has published Practical Note Books in Physiology comprising syllabi of different Universities including Burdwan University with the help of experienced teachers including dignitaries of both Honours and General teaching degree colleges. Hence, members of the Undergraduate Board of Studies in Physiology recommended the aforesaid Note Books (Experimental, Biochemistry and Histology) for use by the students in undergraduate degree course (Honours Practical) in Physiology.
PART III SYLLABUS

PAPER V (Theoretical)

Unit 05: 50 marks

| Nerve Muscle Physiology, Sensory Physiology & Renal Physiology |

Nerve muscle Physiology:


Sensory Physiology:

Classification of general & special senses & their receptors. Muller’s law of specific nerve energies. Weber – Fechner law, mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors- phasic & tonic adaptations.

a) Olfaction & gestation : structure of the receptor organs, nerve pathway centers, physiology of taste & smell. After taste, olfactometer, electro- olfactogram.


Colour blindness. Visual field, perimetry, visual acuity - measurement, mechanism, factors controlling visual acuity. Binocular vision & depth perception. Lux, measurement of illumination, critical fusion frequency.

Renal Physiology:
[20]

Unit 06 : 50 marks-

Genetics and Molecular Biology, Central nervous system, Peripheral nervous system.

Genetics and Molecular Biology:
[30]
Double helical structure of DNA, clover-leaf and L-shaped structure of t-RNA, 3-dimensional structure of m-RNA and t-RNA molecules. Chromosome structure, molecular organization, chromosomal proteins, and different levels of chromatin organization; linkage and crossing over. Cell cycle, cell differentiation, Replication, transcription and translation, Genes, protein synthesis, genetic-code. One cistron-one subunit concept; Regulation of gene expression – operon concept, lac operon; inborn errors of metabolism of glycogen, galactose, tryptophan, phenylalanine and tyrosine. Elementary idea of genetic engineering, recombinant DNA technology.

Central Nervous System
[60]

Reflexes: Reflex action; definition and type. Reflex arc: monosynaptic and polysynaptic, Monosynaptic and polysynaptic reflexes with examples.


Cerebral cortex: Definition and basic concepts. Internal structure: cortical layers. Cytoarchitectonic areas; sensory and motor areas. Higher cortical functions; learning and memory. Hemispheric dominance. Language function:- Broca’s area, physiology of speech and speech disorders. Prefrontal functions.

Thalamus: Definition, Gross features, position and relations. Structure and nuclear groups, Functions of the thalamus. Lesions of thalamus.

Hypothalamus: Definition, positions and relations; Internal structure: groups, connections: afferent and efferents, Functions: endocrine, automatic, temperature regulations, feeding and drinking behaviour and other behavioural functions.

Reticular formation: Definition and position, basic structure: reticular nuclei and fibres, connection; functions of ascending and descending reticular formations. Decerebrate and decorticate rigidity.

Basal Ganglia: Definition and terminology. Gross anatomy: caudate nucleus; lentiform nucleus, claustrum, amygdaloid body, substantia nigra, subthalamic nucleus, connections of basal ganglia: neostriatum, globus pallidus, amygdaloid body, substantia nigra; Subthalamic nucleus. Functions of basal ganglia, Disorders of basal ganglia: Parkinsonism, chorea, athetosis, hemiballismus.


Endocrine System:


Cushing’s disease, gigantism, acromegaly, dwarfism, Simmond’s disease, Frolich’s syndrome, diabetes insipidus.

GI hormones: General idea – secretin, gastrin, VIP, GIP, CCK-PZ.
Thymus: Its endocrinal functions.

Chronobiology:
Unit-08 : 50 marks

<table>
<thead>
<tr>
<th>Social Physiology &amp; Community health, Comparative Physiology</th>
<th>Instrumentation</th>
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<table>
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<tr>
<th>Comparative Physiology</th>
<th>Instrumentation</th>
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<tbody>
<tr>
<td>Nitrogen metabolism, osmoregulation, electric organs, and bioluminescence.</td>
<td>Basic principles of light, compound and electron microscopy (scanning and transmission) Cathode ray oscilloscopes, NMR, HPLC, Spectrophotometer.</td>
</tr>
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PAPER VII THEORETICAL : 100 Marks

UNIT 09 : 50 Marks

<table>
<thead>
<tr>
<th>Reproductive Physiology, Developmental Biology</th>
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<tbody>
<tr>
<td>Reproductive Physiology</td>
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<tr>
<td>Primary and secondary sex organs, secondary sex characters. Puberty and its control, gonadal steroid hormones- synthesis and catabolism, general idea of sex differentiation.</td>
</tr>
<tr>
<td>Ovary</td>
</tr>
<tr>
<td>Developmental Biology</td>
</tr>
<tr>
<td>Fertilisation and formation of trilaminar germ disc from zygote; development of heart, GI tract and urinary system; foetal circulation and changes occurring at birth.</td>
</tr>
</tbody>
</table>
Biostatistics:
2. Data: sources and presentation. Qualitative and quantitative data. Methods of presentation-tabulation; frequency distribution, drawings, graphical representation of qualitative and quantitative data. Histogram, Frequency polygon and curve, scatter and dot diagrams. Bar diagram, Pie or sector diagram.
4. Biological Variability; Mean deviation, Standard deviation (SD), coefficient of variation (CV).
5. Sampling: Definition and types; Characteristics, Sampling techniques-random and non-random sampling, simple random sampling. Systematic sampling. Precision of sampling.
6. Standard error of mean (SEM): Calculation and application in physiological sciences, z-test (for large samples) and t-test (Student’s t-test or Gosset’s t-test) for small samples.
7. Simple correlation, correlation coefficient: Spearman's ρ and Pearson's product-moment correlation-coefficient (r); Linear regression.

Computer:
Basic concept, input and output devices, binary data systems, binary operations. Addition, subtraction, multiplication, Boolean algebra, elementary idea of computer language and programming. Application of computer knowledge in Physiology.

Skin and body temperature regulation:

Pharmacological Physiology:

PAPER VIII: Practical: 100 Marks

Biochemistry: 15 marks; Biostatistics: 10 marks; Histology & Histochemistry: 20 marks; Expts on Toad: 20 marks; Field study report: 15 marks; Lab Note Book: 10 marks; Viva-voce: 10 marks

1. Biochemistry: 15 marks
   a) Photocolorimetric estimation of blood constituents:
      i) Blood glucose by Folin-Wu method.
      ii) Blood inorganic phosphate by Fiske-Subbarow method.
      iii) Estimmatuion ofb serum protein by biuret method
iv) Estimation of serum amylase by iodometric method.
ii) Estimation of food carbohydrate by Benedict’s method.

2. Biostatistics : 10 Marks
Statistical analysis of data of body temperature, pulse rate, systolic blood pressure, respiration, height and weight of the students of the class by the following methods : Computation of frequency distribution, drawing of histogram and frequency polygon, mean, median, standard deviation, standard error. t-test (one tail) for significance of difference between sample means.

3. Histology and histochemistry : 20 Marks
i) Staining and identification of supplied paraffin sections of mammalian tissues by H/E staining. Liver, kidney, oesophagus, duodenum, ileum, large intestine, lungs, spleen, lymph node, ovary, testis, salivary glands, thyroid, adrenal, pancreas, spinal cord, cerebellum, cerebrum.
ii) Histochemistry : Staining and demonstration of mucopolysaccharides (PAS), demonstration of alkaline phosphatase and staining of nuclear elements by iron-haematoxylin and hepatic or splenic iron by Prussian blue method.

4. Experiments on toad : 20 Marks
i) Perfused Heart: Preparation of amphibian Ringer solution; Kymographic recording of perfused heart beat of toad. Study of effects of changes in perfusion fluid pressure, excess calcium and potassium ion concentration, acetyl-choline, adrenaline and vagal stimulation.

5. Field Study Report : 15 Marks
A report (hand-written) on the basis of field survey from one of the followings :
1. Physiological parameters (at least three parameters to be measured) : Heart rate, blood pressure, respiratory rate, PFI, blood hemoglobin content, differential count of WBC and visual acuity.
2. Anthropometric Measurements (at least three parameters)
3. Epidemiological studies
4. Optional- Visits to institutes of National importance engaged in physiological, biomedical, biochemical and nutritional research.

6. Laboratory Note Book : 10 Marks
7. Viva-voce : 10 Marks

CORRIGENDUM OF ANNEXURE - IV

Guidelines for Educational Excursion and Field Report:
Students are to attend Compulsory Educational Tour to different Laboratories and National Institutes of biomedical importance for exposure to modern techniques or to undertake field studies on tour (e.g. Population Survey, Diet Survey, Anthropometrical Survey, Group Projects etc. only for Part -III ).
A Field Report is to be submitted by each student during the Practical Examination as per syllabus.

**General Instruction:**
Questions to be set from each Chapter of each Unit with equal weightage as far as practicable.

**RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (HONOURS) Part - III COURSE**

( The latest edition available should be used for all books)

17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J.Weibell & E.A.Pfeiffer; Prentice-Hall of India Pvt Ltd.
19. Molecular Biology of the Gene, by J.D.Watson; H.H.Nancy & others; Benjamin- Cummings.
29. The Kidney: An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
30. Text Book of Physiology by G.H.Bell: J.N.Davidson and H.Scarborough. ELBS.
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GUIDELINES FOR THEORETICAL PAPERS FOR PART-I, PART-II & PART-III

I. DISTRIBUTION OF QUESTIONS AND MARKS IN THEORETICAL PAPERS.

In each paper of 100 marks the distribution of questions and marks will be as follows:

1. Out of fourteen questions of two mark each, eight questions are to be answered  
   2 X 8 = 16
2. Out of eight questions of twelve mark each, four questions are to be answered  
   12 X 4 = 48
3. Out of ten questions of six mark each, six questions are to be answered  
   6 X 6 = 36