<table>
<thead>
<tr>
<th>Semester I</th>
<th>Topics</th>
<th>Credits</th>
<th>Marks</th>
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<tbody>
<tr>
<td></td>
<td><strong>1. Homeostasis &amp; Environment</strong></td>
<td>4</td>
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<tr>
<td></td>
<td><strong>2. Physiological system-I (Nervous system, Special Sense, Cardiovascular system, Respiratory system)</strong></td>
<td>4</td>
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<tr>
<td></td>
<td><strong>3. Biochemistry</strong></td>
<td>4</td>
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<tr>
<td></td>
<td><strong>4. Nutrition &amp; Community Health</strong></td>
<td>4 (1x4)</td>
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<td></td>
<td><strong>5. Practical- I (Anatomy, Statistics, Bioinformatics)</strong></td>
<td>4</td>
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<td><strong>Total</strong></td>
<td>20</td>
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<thead>
<tr>
<th>Semester II</th>
<th>Topics</th>
<th>Credits</th>
<th>Marks</th>
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<tbody>
<tr>
<td></td>
<td><strong>1. Physiological System II (Endocrinology, Reproduction, Gastro-intestinal System, Renal Physiology)</strong></td>
<td>4 (1x4)</td>
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<tr>
<td></td>
<td><strong>2. Molecular Biology &amp; Biotechnology</strong></td>
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<tr>
<td></td>
<td><strong>3. Computational Biology &amp;Biostatistics</strong></td>
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<td><strong>4. Social Medicine</strong></td>
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<tr>
<td></td>
<td><strong>5. Practical – II (Review/ Study tour, Functional Physiology, Molecular Methods, Biochemistry)</strong></td>
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<th>Semester III</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>1. Microbiology, Haematology&amp; Immunology</strong></td>
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<td></td>
<td><strong>2. Epidemiology</strong></td>
<td>4</td>
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<tr>
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<td><strong>3. Cell Biology</strong></td>
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<td><strong>4. Ergonomics &amp; Occupational Physiology</strong></td>
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<td><strong>5. Practical-III (Immunology, Pathophysiology/Pharmacology, Ergonomics, Microbiology)</strong></td>
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<td><strong>Total</strong></td>
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<tr>
<th>Semester IV</th>
<th>Topics</th>
<th>Credits</th>
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<tbody>
<tr>
<td></td>
<td><strong>1. Biophysics &amp; Biomedical Instrumentation</strong></td>
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<tr>
<td></td>
<td><strong>2. Pathophysiology</strong></td>
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<tr>
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<td><strong>3. Pharmacology</strong></td>
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<td></td>
<td><strong>4. Project, Seminar &amp; Grand Viva Voce (60+20+20)</strong></td>
<td>4</td>
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<td><strong>Total</strong></td>
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**Total**                                                                 | 80      | 1000  |
**WBSU M.Sc. Physiology Syllabus (2016-18)**

**Semester-I**

**PHYG-228101** (2+2 credits)

**Homeostasis & Environment**


**PHYG-228102** (1+1+1+1 credits)

**Physiological system-I** (Nervous system, Special Sense, Cardiovascular system, Respiratory system)


**Sensory Organ**: Chemical senses- Taste, Olfaction; Visual sense; Auditory and Cutaneous sense.

**Cardiovascular System**: Evolution of heart on comparative basis, Rhythmicity of heart, Junctional tissue, Role of autonomic nervous system on heart, Cardiovascular reflexes, Cardiac metabolism and the role of hormones. ECG – its principle and significance, ECG in cardiac abnormalities: Analysis of Electrocardiography, Angiogenesis and Angiography.

**Respiratory System**: Anatomy of respiratory system. Lung Mechanics, Neural and chemical regulation of respiration, Non-respiratory functions of lungs.

**PHYG-228103** (4 credits)

**Biochemistry**:
Properties of Enzyme, Michaelis-Menten Kinetics, Allosteric modulation, Mechanisms of Enzyme actions. Structure of atoms, molecules and chemical bonds. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.)


Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

Metabolism of carbohydrates, lipids, amino acids, nucleotides, Integration of carbohydrate, fat and amino acids metabolism. Regulation and integration of metabolic pathways. Role of vitamins and minerals in metabolism of carbohydrate, protein, fat and nucleic acid metabolism.

Bioenergetics in metabolism.

**PHYG-228104** (4 credits)

**Computational Biology & Biostatistics**

**Computational Biology:** Basic concepts of computer hardware, software, Operating System and use of open source software and internet, Basics of programming, Word processor - basic operation and its application in biological sciences; MS excel – basic operation and its application in biological sciences; Ms. PowerPoint - steps of PowerPoint presentation, slide preparation for biological items.

Concept of Bioinformatics - field of application, common bioinformatics sites in www.Biological databases, data acquisition, retrieval of biological data - Entrez, DBGET, LinkDB, Database searches - FASTA, BLAST. Sequence analysis tools.

Major Bioinformatics Resources: NCBI, EBI, ExPASy, RCSB, knowledge of various databases and bioinformatics tools available at these resources, organization of databases: data contents and formats, purpose and utility in Life Sciences, Open access bibliographic resources and literature databases:Open access bibliographic resources related to Life Sciences viz., PubMed, BioMed Central, Public Library of Sciences (PloS), Principles of BLAST, sequence analysis and alignment, primer designing, vector design.

**Statistics:** Biostatistics as applied to public health problems principles, use of classical statistical approaches to describe the health of populations. Basic concepts in statistics, approaches and methods, Mean, Median, Mode, t-test (one tail, two tail), Chi square test, Anova (one way & two way), parametric and nonparametric statistics, correlation and regression analysis, trend analysis, operational research, mathematical models, Research related to health economics, medical geography, Sources of biological information and database,
WBSU M.Sc. Physiology Syllabus (2016-18)

**PHYG-228105** (4 credits)

**Practical-I**
Experiments with tissues and organs, ECG, Spirometry, Tools and open source software for analysis of Anatomy, Biostatistics and Bioinformatics
Semester-II

**PHYG-228201** (1+1+1 credits)

**Physiological System II** (Endocrine System, Reproduction, Gastro-intestinal System, Renal Physiology)

**Endocrine System:**
Endocrine functions of the hypothalamus; Pituitary hormones and their molecular action; Regulations different Adrenals hormones, Molecular actions and regulation of Pancreatic hormones; Adipose tissue hormones; Regulation and action of Parathyroid and calcitonin, calcium and phosphate regulation. Non-conventional endocrine molecules in health & disease.

**Reproduction:**
Testosterone & male sex hormones – Molecular mechanism, spermatogenesis, prostate function; Male infertility and its treatment; Female sex hormones – cellular and molecular mechanisms of action, Gametogenesis, folliculogenesis, embryonic development of gonads and the genital ducts, sex determination; Reproductive hormones and their role in fertilization, Implantation, Hormonal regulation of pregnancy, parturition and lactation; Umbilical cord blood and stem cells in health & disease; Placenta and placental hormones; menopause and andropause; Infertility and its treatment, assisted reproduction (IVF,ET), extra-uterine pregnancy, Hyper & hypogonadism; Puberty.

**Gastrointestinal System:**
Histomorphology of Gastrointestinal tract, Gastrointestinal hormones, Role of hepatobiliary systems in gastrointestinal functions, Hepatic circulation, Endoscopy.

**Renal System:**

**PHYG-228202** (4 credits)

**Molecular Biology & Biotechnology:**
Structure of Chromosome, Nucleic acid Structure and Metabolism. DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms.

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.
Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNAsynthetase, translational proof-reading, translational inhibitors, post-translational modification of proteins.

Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

Recombinant DNA technology: Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems; expression of recombinant proteins using bacterial, animal and plant vectors; isolation of specific nucleic acid sequences; generation of genomic and cDNA libraries, plasmid, phage, cosmid, BAC and YAC vectors; isolation, separation and analysis of carbohydrate and lipid molecules.

**PHYG-228203 (2+2 credits)**

**Nutrition & Community Health:**


Health planning in India including various committees and National Health Policy and Health Goals set from time to time, Organised sector with reference to Centre, State, District and Block level structures and local bodies and Panchayati Raj. Organisation and functions of community health centres and primary health centres, Health Manpower, Primary Health care and concept. Link of University with Community Health.
PHYG-228204 (4 credits)
Social Medicine:

Definition and scope of social and behavioural sciences in Health Concept and significance of social structure and social organization, Culture and Behaviour related to Health and Disease Political and Economical aspects of Health, Concepts and techniques of Information, Education and Communication including Counselling methodology.

Epidemiology, Etiology, Pathogenesis, Prevention and Control of Communicable Diseases, like Malaria, Cholera, Tuberculosis, Leprosy, Diarrhoea, ARI, Poliomyelitis, Viral Hepatitis, Measles, Dengue, Rabies, AIDS, Plague, etc. Non-communicable diseases, like coronary heart disease, hypertension, diabetes mellitus, cancers, etc.

Occupational disorders like, pneumoconiosis, hearing loss, accidents, dermatosis, etc., Alternative systems of medicine, like Ayurveda, Homeopathy, etc.

Holistic Approach, Non-Governmental Organisations (NGOs) and Private voluntary Organisations (PVOs), Unorganised Sector.

PHYG-228205 (2+2 credits)
Practical-II

Ovariectomy, Isolation of seminiferous tubules, disease model in animal & biochemical analysis, chromatographic separation techniques
Semester-III

**PHYG-228301** (2+2 credits)

**Microbiology, Haematology & Immunology:**

**Microbiology**
Taxonomic classification and nomenclature of bacteria, archaebacteria. Structure and characteristics of Bacterial cell wall, Gram positive and gram negative bacteria, Bacterial chromosomes and Plasmids, Flagella and Ion pump, Microbial Culture, Microbial Growth, Yield and Characteristics. Strategies of Cell Division, Stress Response, Structure of spores, Microbial Genetics (Transformation, Conjugation, Transduction, recombination and transposition), Microbial Fermentation, Industrial production of alcohol, lactic acid, drug. Microbe-Human Interaction: Beneficial and Harmful, Biosensors, Antibiotics. Mycobacterium. Prebiotics and probiotics.


Fungus – structure and reproduction of Yeast, Aspergillus, Penicillum, Candida.

Identification of microbial species.

Protozoa – Identification and life cycle of malaria, leishmania, filaria.

**Haematology & Immunology:**
Erythrocytes development, haemoglobin, iron-ferritin-transferrin system. Erythropoietin.

Blood transfusion.


Major Histocompatibility Complex- Types and detection techniques, Regulation of its expression, Immunogenetics and its applications. Role of Complement in immunological defense, Evolution of immune system. Haematological & Immunological techniques. Cell and Tissue Culture, Role of Cytokines on immunocytes.

Infectious immunity, Cancer immunity, Reproductive Immunity, Brain immunity. Basic mechanism of Autoimmune disorder

**PHYG-228302** (4 credits)

**Epidemiology**

Definition and Concepts of Epidemiology, Concepts of Health and Disease, Role of Genetics in Health and Disease, Levels of Prevention, Types of Epidemiology, Uses of Epidemiology, methods of epidemiologic investigation, appropriate summaries and display of data, dynamic behavior of disease; usage of rates, ratios and proportions; methods of direct and indirect adjustment, and clinical life table which measures and describes the extent of disease problems. Epidemiologic study
designs for investigating associations between risk factors and disease culminating with criteria for causal inferences. Techniques of social sciences research relevant to health fields.

Basic methods for infectious disease epidemiology and case studies of important disease syndromes and entities, Methods, definitions and nomenclature, outbreak investigations, disease surveillance, case-control studies, cohort studies, laboratory diagnosis, molecular epidemiology, dynamics of transmission, and assessment of vaccine field effectiveness. Case-studies focus on acute respiratory infections, diarrheal diseases, hepatitis, HIV, tuberculosis, sexually transmitted diseases, malaria, and other vector-borne diseases.

Application of these disciplines in the areas of health services, screening, genetics, and environment policy. The influence of epidemiology and biostatistics on legal and ethical issues.

Objectives and organisation of important agencies, like WHO, UNICEF, FAO, ILO, Indian Red Cross Society, UNFPA, World Bank, Asia Development Bank, Ford Foundation, CARE, Rockefeller Foundation, etc. and their role in Health care activities in India

**PHYG-228303** (4 credits)

**Cell Biology:**

Stem Cell Biology: Introduction to concepts in stem cell biology (renewal, potency, differentiation, plasticity etc.), Embryonic and adult stem cells, Germline stem cells and germline-derived pluripotent cells, Induced pluripotent stem cell (iPS), Cloning, therapeutic cloning and nuclear cloning, Tissue regeneration and regenerative medicine, Tissue specific stem cells, Chromatin and stem cells, Telomeres and stem cells, Planaria stem cells, Regeneration in vertebrates, Mesenchymal stem cells, Hematopoietic stem cells, Stem cells and diabetes, Stem cells and cancer, Cancer Stem Cell.

**PHYG-228304** (2+2 credits)
Ergonomics & Occupational Physiology:

Ergonomics:
Concept of system design; Effect of man, machine and environment; Failure of system-accident; Management of systems; Work, time and motion study; Ergonomics & safety: Application of ergonomics for the development of safety; Analysis of accident; Unsafe conditions; Personal protective device; Occupation health and safety norms; Anthropometry: Definition of anthropometry; Static, dynamic & Newtonian anthropometry; Application of anthropometry in design; Nutrition in sports and exercise; Cardio-respiratory changes in sedentary and trained persons during exercise; Concept of physical fitness; Physiological effects of doping/drug abuse.

Prevention and health measures of occupational hazards – nutrition, disease control,

Occupational Physiology:
Occupational hazards in work place – mechanical, chemical, biological, fire, toxic substances, and Explosive materials
Occupational safety and health – concept of health and safety; Accidents – theories of accident, effect on industry; method of assessment of accidents, promotion of safety, health and safety training, personal protective devices

PHYG-228305 (2+2 credits)
Practical-III:

Experiments with Microbial cells, Biochemical assays, Experiments with blood and cells, Ergonomical measurements and designing,
WBSU M.Sc. Physiology Syllabus (2016-18)

**Semester-IV**

**PHYG-228401 (4 credits)**

**Biophysics & Biomedical Instrumentation**


**PHYG-228402 (4 credits)**

**Pathophysiology:**

Pathophysiology of different communicable and noncommunicable diseases associated with different system; differences between symptoms, syndrome and disease. Thalassemia; Pathogenesis of thrombosis and purpura. Immune complex, Inflammation, Allergy, Tissue Transplantation. Immunological defence against infectious diseases, Cancer, Autoimmunity, Leukemia; Lymphoma; Eosinophilia; Immunodeficiency diseases (HIV etc). Iatrogenic diseases; Pulmonary diseases like ventilation failure, asthma and COPD, alveolar fibrosis, pulmonary hypertension, Artificial ventilation and lung transplantation. Renal Diseases like Nephritis, Kidney stone, Renal failure. Disorders of pituitary and adrenal functions, Thyroid secretions and their clinical manifestations; Autoimmune and genetic disorders of endocrine glands. Disorders of Menstrual cycle; Infertility and its treatment, assisted reproduction (IVF,ET), extra-uterine pregnancy. Lifestyle diseases: Stroke and Neurological disorders of brain - mechanism of development of Alzheimer’s, Parkinson’s disease and Epilepsy. Neuropsychiatric diseases – Depression, bipolar disorder, Schizophrenia & psychosis. Cardiovascular diseases like Atherosclerosis, Ischemic heart disease, Myocardial infarction, Cardiac hypertrophy, Cardiac valve disorder. GI tract related diseases like Ulcer, Varices, Irritable Bowel Syndrome, Pancreatitis.
WBSU M.Sc. Physiology Syllabus (2016-18)

**PHYG-228403** (4 credits)
**Pharmacology:**


Metabolism of xenobiotics: Drug detoxifying enzymes; Bioavailability of drugs; LD$_{50}$, ED$_{50}$. Drug clearance, Isolation, purification, and identification methods of drugs from natural sources; Bioassay of drugs; Use of microbes for synthesis of drugs.


**PHYG-228405** (4+4 credits)
**Project, Seminar & Grand Viva Voce:**