

Vidyasagar University

Curriculum for B.Sc. (Honours) in Physiology [Choice Based Credit System]

Semester-V

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC- 11		C11T: Sensory Physiology	Core Course - 11	4	0	0	6	75
		- Lab		0	0	4		
CC- 12		C12T: Endocrinology	Core Course - 12	4	0	0	6	75
		- Lab		0	0	4		
DSE-1		TBD	Discipline Specific Electives -1	4	0	0	6	75
				0	0	4		
DSE-2		TBD	Discipline Specific Electives -2	4	0	0	6	75
				0	0	4		
Semester Total							24	300

L= Lecture, **T**= Tutorial, **P** = Practical, **CC** - Core Course, **TBD** - To be decided, **DSE**: Discipline Specific Elective.

Semester-V

List of Core Course (CC)

CC-11: Sensory Physiology

CC-12: Endocrinology

Discipline Specific Electives (DSE)

DSE-1: Human nutrition and dietetics

Or

DSE-1: Community nutrition and Public health

Or

DSE-1: Clinical Hematology

Or

DSE-1: Biostatistics

DSE-2: Environmental Physiology

Or

DSE-2: Pharmacology & Toxicology

Or

DSE-2: Sports Physiology, Work Physiology and Ergonomics

Or

DSE-2: Ergonomics and Occupational Health

Semester-V
Core Course (CC)

CC-11: Sensory Physiology

Credits 06

C11T: Sensory Physiology

Credits 04

Course Contents:

Classification of general and special senses and their receptors. Muller's law of specific nerve energies. Weber-Fechner law. Mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors- phasic and tonic adaptations.

General Sense: Classification, distribution, function and neural pathway of touch, pressure, pain, thermal and kinesthetic sensation.

Vision: Introduction. Anatomic considerations. The structures of lens. Errors of refraction and their corrections. Contact Lens. Pupillary reflexes, light reflex, near response. Argyll Robertson pupil. Histological details of retina. Photopic and Scotopic vision. The Photoreceptor Mechanism: Genesis of Electrical Responses. Chemical and electrical changes in retina on exposure to light. Visual Pathway and effects of lesion of these path ways. Colour visions and its modern concept. Colour blindness. Other aspects of Visual Function. Visual field, Perimetry. The Image-Forming Mechanism (accommodation and visual acuity) Factors affecting Visual Acuity. Visual acuity and its measurement. Binocular vision and depth perception. Eye Movements. Errors in visual process. Electroretinogram.

Hearing & Equilibrium: Introduction, Sound waves, decibel, Anatomic considerations, structure and functional significance of auditory apparatus – external, middle and internal ears. Structure of Organ of Corti. Hair cells. Mechanism of hearing and its modern theories. Discrimination of sound frequency and loudness. Auditory pathway and centers. Vestibular function. Loss of hearing. Deafness & tests of deafness. Audiometry.

Smell & Taste: Introduction, Smell: Receptors & Pathways - Structure and function of the receptor organs, nerve pathways, centers. Physiology of Olfaction. Olfactometer. Taste: Receptor Organs & Pathways- Structure and functions of the receptor organs, nerve pathways, centers. Physiology of Taste. Features of Taste sensation.

C11P: Histological and Human Experiments

Credits 02

Practical

1. Principles of fixation and staining, staining and identification of fixed nervous tissue.
2. Silver nitrate preparation of corneal cell space.
3. Determination of visual acuity by Snellen's chart / Landolt's C chart.

1. Determination of colour blindness by Ishihara chart.
2. To map the peripheral field of vision with perimeter(Perimetry)
3. Mapping of physiological blind spot and calculation of optic disc size.
4. Recording of auditory and visual reaction time.
4. Exploration of conductive and perceptive deafness by tuning fork method.
5. Audiometry (Demonstration).

CC-12: Endocrinology

Credits 06

C12T: Endocrinology

Credits 04

Course Contents:

General Consideration: Concept of endocrine systems, glands and hormones. Types of endocrine glands. Experimental and clinical methods of study of endocrine glands. General classification of hormones on chemical basis. Concepts of hormone receptors and cell signalling. Mechanisms and Modern Concept of hormone actions: G-protein, Cyclic AMP, cyclic GMP, IP3-DAG, Ca²⁺, Tyrosine Kinase, JAK-STAT pathway and nuclear receptor mediated action. Hypothalamo - hypophysial axis: Feedback regulation, Hypothalamus as a neuroendocrine organ, Releasing Factors, Tropic hormones of hypothalamus. Vascular and neural connections between the hypothalamus and the pituitary, role of median eminence.

The Pituitary Gland: Introduction. Morphology. Histological structures, functions, and regulation of anterior, middle and posterior lobes of pituitary. Posterior pituitary hormones. Growth Hormone: Chemistry, modes of action and functions of growth hormone. Physiology of Growth & factors influencing growth. TSH, ACTH, FSH, LH, Prolactin, MSH, Vasopressin and Oxytocin. Pituitary Insufficiency Pituitary Hyperfunction in Humans. Cushing's disease, gigantism, acromegaly, dwarfism, Simmond's diseases, Frolich's syndrome, diabetes insipidus.

Thyroid Gland: Introduction. Anatomical considerations. Electron microscopic structure of thyroid gland. Thyroid hormone: Chemistry, Biosynthesis, Storage and Transport of thyroid hormones. Effects of thyroid hormones. Functions of T₄ (Thyroxine) and T₃ (Triiodothyronine). Regulation of Thyroid hormone secretion. Clinical feature of Cretinism. Myxedema, Grave's disease. Hashimoto's disease, iodine deficiency goiter.

Hormonal Control of Calcium Metabolism & the Physiology of Bone

Introduction, Calcium & Phosphate Metabolism, Bone Physiology, Vitamin D & the Hydroxy cholecalciferols. Parathyroid Gland: Histological Structure, Parathyroid hormone: Role in calcium metabolism. Relation of parathyroid hormone with bone formation and bone resorption, fragile bone and aging process, Concept of Vitamin D₃ treatment. Calcitonin: its source, functions and regulation. Hormonal control of calcium homeostasis. Effects of Other Hormones & Humoral Agents on Calcium Metabolism

Endocrine Functions of the Pancreas & the Regulation of Carbohydrate Metabolism:

Pancreas: Introduction. Histological structure of pancreatic islets Cell. Structure, Biosynthesis & secretion of Insulin. Sources, modes of action and functions of insulin. Insulin Excess. Regulation of Insulin Secretion. Glucagon. Other Islets Cell Hormones. Hypoglycemia & Diabetes Mellitus in Humans.

The Adrenal Medulla & Adrenal Cortex:

Introduction. Adrenal Cortex: histological structure. Structure & Biosynthesis of Adrenocortical Hormones. Regulation different types of hormones and functions of adrenal cortex, Effects of Adrenal androgens & estrogens. Physiologic effects of glucocorticoids. Pharmacologic & Pathologic effects of Glucocorticoids. Regulation of glucocorticoid secretion. Effects of Mineralocorticoids Regulation of aldosterone secretion. Cushing's syndrome, Addison's disease, Hyperaldosteronism. Adrenal Medulla: Histological structure, hormonal function of adrenal medulla. Synthesis and metabolism of catecholamine hormones. Regulation of adrenal Medullary secretion. Actions of adrenaline and nor-adrenaline on different organs and their effect. Pheochromocytoma. Summary of the effects of Adrenocortical Hyper & Hypofunction in humans

Endocrine Functions of the Kidneys, Heart, & Pineal Gland

Introduction. The Renin- Angiotensin System. Erythropoietin. The Endocrine Function of the Heart: Atrial Natriuretic Peptide.

Pineal Gland - Histological structure. Chemical nature, biosynthesis, molecular mechanism of action, functions and regulation of secretion of melatonin.

C12P: Endocrinology (Lab)

Credits 02

1. Fixation, staining and identification of endocrine glands.
2. Study of the effects of oxytocin on uterine contraction of albino rat.
3. Study of the effects of adrenaline on uterine movements of albino rat.
4. Estimation of estrogen by spectrophotometric method.
5. Estimation of plasma level of any hormone using ELISA (Demonstration)

Discipline Specific Electives (DSE)

DSE-1: Human nutrition and dietetics

Credits 06

DSE1T: Human nutrition and dietetics

Credits 04

Course Contents:

Basic concept: Nutrition, Nutrients, Nutraceutical, Cosmoceutical, Nutrigenomics. Constituents of food and their significance. Composition and nutritional value of common food stuffs. Calorific value of foods. Dietary requirements of carbohydrate, protein, lipid and other nutrients.

Nutritional evaluation of carbohydrates: Glycemic Index (GI), Classification of dietary fibers with potential of health benefit, Resistant starch as prebiotics - Fructo - oligosaccharide, Galacto-oligosaccharide, soy - oligosaccharide, Nutritive value of major carbohydrates like rice, wheat, roots, tubers, leafy vegetables, red-yellow vegetables and fruits.

Nutritional evaluation of proteins: Essential and Non essential amino acids, Protein Efficiency ratio (PER), nitrogen balance, Net protein utilization (NPU), Biological value(BV) of protein, protein spares, Nutritive value of protein food stuffs like pulses, egg, fish, meat, milk, soybeans.

Nutritional evaluation of fats: essential fatty acids, saturated and unsaturated fatty acids, Dietary requirement of fat, Non-glyceride edible oil, Nutritive value of fat food stuffs like egg, fish, milk, edible oils, and nuts.

Vitamins: Water soluble vitamins (Vit - B complex, Vit - C, Folic acid) and fat soluble vitamins (Vit-A, D, E and K): source, brief chemistry, dietary requirements, functions, deficiency, hypervitaminosis, and antioxidant. Physiological significances of minerals.

Dietary fibers: Concepts and physiological significance.

Energy in human nutrition: Basic concept of energy and units, calorific and physiological fuel value, Body calorie requirements – adult consumption unit. Respiratory quotient (RQ), Total energy expenditure (TEE), Basal metabolic rate (BMR) and Resting energy expenditure (REE), Specific dynamic action (SDA), physical activity ratio (PAR), Determination of BMR by Benedict Roth apparatus and WHO/ICMR prediction equation, Factors affecting BMR, adult consumption unit (ACU), determination of energy requirements of Indians in different age groups by doubly labeled water (DLW) method and prediction equation method.

Physiology of starvation and obesity.

Formulation of diet chart: Basic principle of diet chart. ICMR specified food groups (Five Group Plans, Nine Group Plan and 11-Group Plan), Food guide pyramid. Balanced diet and principles of formulation of balanced diets for vegetarian and non vegetarian, infant, growing child, sedentary adults, moderate working adults, college students, pregnant and lactating mothers and athletes in low and moderate socioeconomic status. Principles of Diet Survey.

Space Nutrition: change of body composition, energy recommendation for space flights, space food system, types of space foods.

a. Food analysis:

1. Estimation of lactose and calcium from milk.
2. Determination of total carbohydrate by phenol-sulphuric acid method from cereals.
3. Estimation of free amino acids by ninhydrin method and total protein by quantitative biurette reagent method from pulses.
4. Determination of acid value and iodine number of fat.
5. Estimation of Vit-C from lemon juice.

b. Identification of food adulterants:

Starch from milk, dalda from butter, saw dust and colouring agents from spices, saccharine in sugar.

c. Planning and preparation of therapeutic diets :

Planning and preparation of therapeutic diets for the following diseases: Hypertension, Obesity, Anemia, Diabetes mellitus, Hepatitis , Gastrointestinal diseases.

d. Diet survey (Field study record):

1. Diet survey report (hand-written) of a family (as per ICMR specification) (Steps- Introduction, Diet History, Methodology, Diet Survey, Clinical Examinations, Remarks, Recommendation and Conclusion) : Each student has to submit a report on his/her own family.
2. A report (hand-written) on the basis of field survey from one of the followings:
 - (1). Physiological parameters of human (at least three parameters).
 - (2). Anthropometric measurements on human (at least three parameters).
 - (3). Epidemiological studies on human.

Or

DSE-1: Community nutrition and Public health

Credits 06

DSE1T: Community nutrition and Public health

Credits 04

Course contents:

Population, society, community and community health: concepts. Nutrition - Introduction. Food as source of nutrients, functions of food, definition of nutrition, nutrients & energy. Adequate,

optimum & good nutrition. Malnutrition and under nutrition, over nutrition. Human nutrition-principle, interrelationship between nutrition, health & diseases. Visible symptoms of good health. Nutrition - fitness, athletics & sports.

Food guide - basic food groups. Use of food guide (according to R.D.A.). Use of food in body - digestion, absorption, transport & utilization. ACU- concept.

Balanced diet. Diet Survey – Principles. Composition and nutritional value of common Indian food stuff - rice, wheat, pulses, egg, meat, fish and milk. Dietary fibres - role of fibers in human nutrition. Calorie requirement. Vitamins and minerals. Malnutrition and under nutrition.

Principles of formulation of balanced diets for growing child, adult man and woman, pregnant and lactating woman. Diet management of obese, diabetic, hypertensive person and athlete. Basic idea on PCM, marasmus, kwashiorkor and their prevention. Iron and iodine deficiency. Recommended dietary allowances, malnutrition and chronic energy, LBW, PEM, xerophthalmia, micronutrient disorders. Physiology of starvation and obesity. Food toxicity. Effect of processing on nutritive values of foods.

Socioecology of nutrition, habitual diets in India and their adequacy. Nutritional assessment of human and community. Malnutrition in a community. National nutrition related health program.

Epidemiology : Concepts. Public health and public health issues: Basic ideas. Etiology, epidemiology and prevention of malaria, dengue, filaria, hepatitis, AIDS, nutritional anemia, atherosclerotic disorders. Causes and management of thalassemia, gout, obesity, endemic goiter, dental carries.

Population problem – principles and methods of family planning and assisted reproductive technology. Sound pollution as a community health issue; definition, concept of noise, source of extraordinary sound, effects of sound pollution on human health, noise index (noise standards).

DSE1P: Practical

Credits 02

Practical:

1. Quantitative estimation of glucose, sucrose by Benedict's method.
2. Estimation of lactose from milk by Benedict's methods.
3. Estimation of Chloride by Mohr's methods.
4. Estimation of amino nitrogen through formol titration methods.
5. Qualitative analysis of pulse, rice, milk to test the presence of carbohydrates, protein, fat.
6. Qualitative identification of lipids and cholesterol.
7. Qualitative assessment of noise by sound level meter.

Field Survey Report:

1. Survey on the status of dietary intake in the surrounding area through visits, etc.
2. Diet survey report of a family (as per ICMR specification). Each student has to submit a report on his/her own family. [Report should be as per ICMR specification. Report should be hand written].
3. A report (hand-written) on the basis of field survey from one of the followings:
 - (1) Physiological parameters of human (at least three parameters).
 - (2) Anthropometric measurements on human (at least three parameters).

Or

DSE-1: Clinical Hematology

Credits 06

DSE-1T: Clinical Hematology

Credits 04

Course Contents:

Anemia and its classification. Laboratory investigation and management of anemia. Iron deficiency anemia, megaloblastic anemia, pernicious anemia- pathogenesis and laboratory investigation. Reticulocytes. Aplastic anemia- laboratory diagnosis. Bone marrow examination. Aspiration techniques.

Hemoglobin - abnormal hemoglobin. Hemolytic anemia and its laboratory investigation. Haemoglobinopathies. Hemoglobin electrophoresis. Sickle cell anemia , Thalassemia- laboratory diagnosis.

Blast cell. Causes and significances of leucocytosis, leucopenia, neutrophilia, eosinophilia, basophilia, monocytosis, lymphocytosis, neutropenia, lymphopenia. Toxic granulation. Leukemia and its classification. HIV on blood cell parameters. LE cells and its significances. Blood parasites.

Hemostasis and Coagulation: Platelet development. Qualitative and quantitative disorders of platelets. Secondary hemostasis. Hemophilia, Willebrand diseases. Disorder of fibrinogen. Fibrinolysis. Bleeding and coagulation disorders.

Blood groups: Immunological basis of identification of ABO and RH blood groups. Biochemical basis of ABO system and Bombay phenotyping. Others blood groups : Kell, Kidd, Duffy, etc. Blood transfusion. Blood banking.

Definition determination and significance of TC, DC ,ESR, Arnth count, PCV, MCV, MHC, MCHC. bleeding time, clotting time, prothrombin time.

DSE 1P: Practical

Credits 02

1. General blood picture

2. Differential Leucocyte Count. Absolute leucocyte count
3. Determination of haemoglobin by various methods.
4. Determination of total RBC count and WBC count.
5. Determination of PCV
6. Determination of red cell indices
7. Determination of ESR.
8. Determination of reticulocyte count.
9. Staining of bone marrow
10. Determination of blood groups.
11. Determination of toxic granulation of neutrophil
12. Determination of total platelet count.
13. Demonstration of thrombin time.(**Demonstration**)
14. Perform sickling test (**Demonstration**)
15. Perform Heinz bodies(**Demonstration**)
16. Demonstration of leukemic slides (**Demonstration**).
17. Determine fibrinogen conc.(**Demonstration**)
18. Demonstrate malarial slide(**Demonstration**)
19. Haemoglobin electrophoresis(**Demonstration**).

Or

DSE-1: Biostatistics

Credits 06

DSE1T: Biostatistics

Credits 04

Course Contents:

Scope of statistics– utility and misuse. Principles of statistical analysis of biological data. Basic concepts – variable. Population and sampling -- parameter, statistic. Presentation of data, frequency distribution, frequency polygon, histogram, bar diagram and pie diagram. Different classes of statistics - mean, median, mode, mean deviation, variance, standard deviation, standard error of the mean, standard score. Degrees of freedom, probability. Normal distribution. Student's t- distribution. Testing of hypothesis - Null hypothesis, errors of inference, levels of significance, t- test and z score for significance of difference. Distribution-free test - Chi-square test. Linear correlation and linear regression

DSE1P: Biostatistics (Practical)

Credits 02

Practical:

1. Computation of mean, median, mode, standard deviation and standard error of the mean with physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects.

2. Graphical representation of data in frequency polygon and histogram.
3. Student's t test for significance of difference between means.
4. Demonstration: Statistical analysis and graphical representation of biological data with computer application program one way ANOVA .

DSE-2: Environmental Physiology

Credits 06

DSE2T: Environmental Physiology

Credits 04

Course Contents:

Ecosystem – Structure and function, different types of ecosystem, food chains, food webs and energy flow and mineral cycling in ecosystems; primary production and decomposition , biogeochemical cycle. Global environmental problems: global climate change, ozone layer depletion, concept of ozone hole, green house effect, global warming and its consequences.

Environment – Physical and biological aspects. Effects of exposure to hot and cold environment. Acclimatization to hot and cold environment. Heat disorders and its preventive measures. Effects of hypobaric and hyperbaric environment. Caisson disease. Mountain sickness. Acclimatization to high altitudes. Preventive measure for hypobaric and hyperbaric effects. Physiological effects and preventive measures against G force, noise, vibration and radiation. Types of pollutants (Primary, secondary and tertiary).

Environment and human health: Definition: hygiene, health and public health. Air, Water, Food Borne Diseases: causes, symptoms and control. Food Additives and Adulterants: definition, examples and human health hazards. Vector borne epidemic diseases: Malaria and Plague- etiology and control. Environmental Pollution and Health Hazards: Air Pollution: Definition, sources, air pollutants, effects of air pollution on human health, Water Pollution: Definition, types, health hazards, water pollutants, biological oxygen demand (BOD), thermal pollution, concept of safe drinking water standards. Soil Pollution: causes, health hazards, solid waste management - bioremediation, phytoremediation. Sound pollution: Definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (noise standards). Radionuclide Pollution: ionizing radiations, effects of ionizing radiation on human health, permissible doses. Arsenic Pollution: sources, sources of arsenic in ground water, drinking water standard for arsenic (WHO, USEPA), health effects of chronic arsenic poisoning. Climate change, health impact.

Environmental management: Environmental ethics. Conservation of topsoil, ground water and wild lives; rain water harvesting; sanctuary, national park, biosphere reserve, wildlife (conservation) Act, 1992.

Toxicology: Toxins and Toxicology. Factors Affecting toxicity. LD₅₀, LOD₅₀, ED₅₀, NOEL, LOEL. Concept of acute and chronic Effects. Birth defects and teratogens. Concepts of bio-magnification and bio-concentration. Popular food additives and Food adulterants. Prevention of food adulteration Act, 1954. Other food toxicants: BPA, BPS, Pesticides, PAH, Dioxin, PCB, Heavy Metals: Pb, Hg, Cd, As etc.

DSE2P: Environmental Physiology

Credits 02

Practical:

A:

1. Determination of O₂, CO₂, BOD & COD.
2. Determination of total alkalinity and chlorine in water.
3. Determination of dissolve oxygen in the supplied water samples-supplied water, ground water extracted by shallow and deep tube wells, stream waters, pond water etc.
4. Detection of food additives in different food samples.
5. Biochemical estimation of serum glucose, total proteins, SGPT and SGOT
6. Measurement of environmental temperature – dry bulb and wet bulb, relative humidity, air velocity.
7. Determination of light intensity (at library, laboratory, and class room) by lux meter.
8. Determination of sound levels by sound level meter and noise index.

B: Physiological (experimental) Experiments

1. Kymographic recording of the effects of Hg, Pb , As compounds and food additives on the movements of perfused heart of toad.
2. Kymographic recording of the effects of Hg, Pb , As compounds and food additives on the intestinal movements of rats in Dale's bath.

C: Histo-chemical Experiments

Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.

Or

DSE-2: Pharmacology & Toxicology

Credits 06

DSE2T: Pharmacology & Toxicology

Credits 02

Course Contents:

1. **Pharmacology: General Pharmacology:** The importance of pharmacology in the study of physiological processes. Definition of drug, agonist and antagonist.. Nature and source of drugs, routes of drug administration and their advantages, receptor and receptor subtypes. Drug-receptor

interaction, desensitization of receptors. Drug delivery. **Pharmacokinetics:** Drug absorption, distribution, metabolism, and excretion, bioavailability, first pass metabolism, excretion and kinetics of elimination, Biological half life of drug and its significance, Drug-drug interactions. **Pharmacodynamics:** Beneficial versus toxic effects of drugs. Principles and mechanism of drug action, factors affecting drug action. Drug biotransformation. Bioavailability. Drug accumulation. Dose – Response Curve. Adverse drug reaction. Gene therapy.

General considerations, pharmacological classification, mechanism of action and uses of following classes of drugs acting on various systems.

Drugs acting on nervous system: a) General anaesthetics (Nitric oxide, halothane), b) sedative and hypnotic drugs (Phenobarbitone, diazepam), c) Opioid analgesics (Morphine), d) CNS stimulants (strychnine, amphetamine). Neuromuscular blockers : Tubocurarine and succinyl choline. E) Adrenergic stimulants : Amphetamine and ephedrine. α - adrenergic stimulants – Methoxamine and clonidine. β - adrenergic stimulants – Metaproterenol and salbutamol. Adrenergic antagonists : Labetolol. α - adrenergic blockers – Phenoxybenzamine and phentolamine. β - adrenergic blockers – Propranolol and atenolol.

Autacoids & chemotherapy of microbial diseases: Brief introduction to autacoids : drug therapy of inflammation, NSAID and other drugs (aspirin, celecoxib). Chemotherapy of microbial diseases: Antibacterial (sulfonamides), antifungal (amphotericin B).

Hormones and hormone antagonists: Insulin and oral hypoglycaemic agents (tolbutamide, rosiglitazone), thyroid and anti-thyroid drugs (eltroxin, carbimazole), estrogen and progestins (progesterone, hydroxyprogesterone caproate).

Diuretics - Carbonic anhydrase inhibitor, loop diuretic, potassium sparing and osmotic diuretics.

Antianginal drugs : Nitroglycerine and calcium-channel blocker – Nifedipine and verapamil.

2. **Toxicology:** **a. Introduction:** Brief history, Different areas of modern toxicology, classification of toxic substances. Toxins and toxicology. Factors affecting toxicity. **b. Toxic agents, toxic exposure and response:** Toxic agents: Human exposure, mechanism of action and resultant toxicities of the following xenobiotics: Metals: lead, arsenic, Pesticides: organophosphates, carbamates, organochlorine, bipyridyl compounds and anticoagulant pesticides. Toxic exposure and response: Effect of duration, frequency, route and site of exposure of xenobiotics on its toxicity. Characteristic and types of toxic response. Interactions between two and more xenobiotics exposure in humans. Tolerance and addiction. **c. Eco-toxicology:** Brief introduction to avian and aquatic toxicology, movements and effects of toxic compounds in food chain (DDT, mercury), bioaccumulation, biomagnification, acid rain and its effect on ecosystems, concept of BOD and COD. **d. Mechanism of toxicity & evaluation of toxicity:** Mechanism of toxicity: Delivery of the toxicant, mechanisms involved in formation of ultimate toxicant, detoxification of ultimate toxicant. Evaluation of toxicity: various types of dose response relationships, LD₅₀, LC₅₀, LOD₅₀, ED₅₀, NOEL, LOEL, TD₅₀ and therapeutic index. **e. Fate of xenobiotics in human body:** Absorption, distribution, excretion and metabolism of xenobiotics (biotransformation, Phase- I reactions including oxidations, hydrolysis, reductions and phase II conjugation reactions). Toxic insult to liver, its susceptibility to toxicants with reference to any two hepatotoxicants.

3. **Clinical toxicology:** Management of poisoned patients, clinical methods to decrease absorption and enhance excretion of toxicants from the body use of antidotes.

DSE2P: Pharmacology & Toxicology

Credits 02

Pharmacology

1. Handling of laboratory animals. Routes of drug administration (Oral, I.M.)
2. To study the presence of acetaminophen/ aspirin in given sample.
3. Effect of analgesic (Tail-flick test).
4. Pharmacodynamics: dose- response curve.
5. Kymographic recording of the effects of atropine and propranolol on the perfused heart of toad.
6. Setting of organ bath and kymograph. To record the effects of acetylcholine using guinea pig ileum / rat intestine.
7. Anti-anxiety effect of valium (Plus maze test) **(Demonstration)**
8. To study the stages of general anesthesia **(Demonstration)**.
9. To determine partition coefficient of general anesthetics **(Demonstration)**.
10. Study of competitive antagonism using acetylcholine and atropine **(Demonstration)**.

Toxicology

1. Determination of Dissolved Oxygen (DO) using Winkler's method.
2. Determination of Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) of water.
3. To perform quantitative estimation of residual chlorine in water samples.
4. To determine the total hardness of water by complexo-metric method using EDTA.
5. To determine acid value of the given oil sample.
6. Calculation of LD₅₀ value of an insecticide from the data provided.
7. Separation of a mixture of benzoic acid, beta- naphthol and naphthelene by solvent extraction and identification of their functional Groups **(Demonstration)**.
8. To estimate formaldehyde content of given sample **(Demonstration)**.

Suggested Readings:

1. Essentials of Medical Pharmacology, 7th edition (2010), K.D. Tripathi, Jaypee Brothers,
2. Pharmacology, 7th edition (2011), H.P. Rang, M.M. Dale, J.M. Ritter and P.K. Moore, Churchill Livingstone.
3. Hand book of Experimental Pharmacology, 4th edition (2012), S.K. Kulkarni, Vallabh Prakashan, 2012.
4. Cassarett and Doull's "Essentials of Toxicology" 2nd edition (2010), Klaassen and Whatkins, McGraw Hill Publisher.
5. Introduction to Toxicology, 3rd edition (2001), John Timbrell, Taylor and Francis Publishers.
6. Principles of Toxicology, 2nd edition (2006), Stine Karen and Thomas M Brown, CRC press.

Or

DSE -2: Sports Physiology, Work Physiology and Ergonomics

Credits 06

Course Contents:

Sports & work Physiology: Concepts of physical work and physiological work. Physical work: Definition and units of measurement. Classification of physical work. Classification of workloads. Differences between work and sports. Energetic of muscular works. Measurement of energy cost for various physical work. Cardiovascular and respiratory changes during graded exercise. Aerobic and anaerobic capacity. Maximum aerobic power.

Exercise Physiology. Exercise & Performance. Exercise Physiology & Gender. Environmental Exercise Physiology. Maximal oxygen consumption and post exercise oxygen consumption – definition, factors affecting, measurement and significance. Muscle fatigue and recovery. Tests for Physical work capacity – measurement with Bicycle Ergometer, Tread Mill and Harvard Step Test. Work rest cycle and importance of rest pause.

Physical Training: General principles and different methods. Effects of overtraining and detraining. Nutrition in sports – nutrient and caloric requirements for different kinds of sports. Sports injury and its management. Sports rehabilitation and sports medicine. Role of sports in emotion and social factors. Basic concepts of sports psychology. Sports Biochemistry. Ergogenic aids. Ergogenic aids & Dietary supplement.

Ergonomics – Basic concepts and its application in industry to improve efficiency. Ergonomics-importance of ergonomics in occupational health and well beings. Physical work environment. Occupational hazards- Physical, biochemical hazards. Occupational diseases – Silicosis, Asbestosis, Farmer's Lung. Industrial safety.

Anthropometry : Anthropometry and its implication in general. Different body dimension measures in anthropometry and their significances. Sports Anthropometry.

DSE2P: Practical**Credits 02**

1. Measurements of resting and working heart rate using thirty beats and ten beats methods respectively.
2. Measurement of blood pressure before and after different graded exercise.
3. Determination of Physical Fitness Index (PFI) of an individual and recording of recovery heart rate after standard exercise.
4. Determination of cardiac cost of specific work.
5. Determination of $VO_{2\max}$ by Queens College step test.
6. Determination of endurance time by hand grip dynamometer..
7. Six minutes walk tests.
8. Measurement of some common anthropometric parameters – stature, weight, eye height(standing), shoulder height, sitting height, knee height (sitting), arm reach from wall, mid upper arm circumference, waist

circumference, hip circumference, neck circumference, head circumference, chest circumference.

9. Determination of body surface area (using a nomogram) and Body Mass Index (BMI) for an anthropometric measurement.
10. Measurement of body fat percentage.

Or

DSE-2: Ergonomics and Occupational Health

Credits 06

DSE2T: Ergonomics and Occupational Health

Credits 04

Course Contents:

Ergonomics: Genesis and concept of ergonomics, significance and growth. Importance of ergonomics in occupational health and well being. Application of ergonomics in design and work efficiency. Human machine interaction- concepts, fundamentals of human computer interaction, fundamental idea of display and control. The bio-mechanism of work as related to the user, the work and the environment. Classification of physiological work load. Concept of work rest cycle.

Work environment – Work place components, functional design and arrangements of workplaces, work study, indices of indoor comfort – ventilation, lighting, temperature, noise. Work place stressors and work place risk factors.

Physical work environment: (a) Thermal environment, its' effects, Heat stress indices, (b) Noise and vibration, it's effects on workers. Occupational deafness, (c) Illumination level and it's effect on visual performances, (d) Ergonomic principles of control of physical hazards.

Ergonomic principles of reducing work place stressors and improving work efficiency

Anthropometry and ergonomics: Definition, terminology used in anthropometry. Different body dimensions measured in anthropometry. Anthropometric measurements and its applications in interior designing for different work areas and workers. Concept of percentile and its calculation, and use of percentile values in anthropometry. Static anthropometry, applications of anthropometric data in design. User interface and control display compatibility. Components of worker input – affective, cognitive, temporal and physical (Physical, Physiological, Psycho – physiological aspects of work).

Occupational Health: Concept. The occupational medical history, workers compensations, disability prevention and management. Occupational health risk. Occupational Injury: Musculoskeletal injury, peripheral nervous injury, eye injuries, facial injuries, hearing loss, injury caused by physical hazards, Ergonomics and the prevention of occupational injuries. Occupational exposures: Metals, chemicals, solvents, gasses & airborne toxicants, pesticides. Occupational illness: Brief idea on : Clinical toxicology & immunology, cardiovascular toxicology, liver, renal & neurotoxicology. Occupational hematology, infection, skin disorders & lung disease. Reproductive toxicology. Occupational Diseases: Human diseases associated with occupational exposure. Brief idea on pneumoconiosis, asbestosis, silicosis, farmer's lung and work-related musculoskeletal disorders.

Program management: Occupational stress, substances abuse & employee assistance programs. Occupational safety, industrial hygiene, biological monitoring. Prevention of accidents. Concept of industrial safety.

DSE2P: Ergonomics and Occupational Health

Credits 02

1. Measurement of working heart rate by ten beats methods.
2. Determination cardiac cost of specific work.
3. Measurement of blood pressure before and after different grades of exercise.
4. Measurement of some common anthropometric parameters. Calculation of BSA and BMI from anthropometric data.
5. Measurement of WBGT indices.
6. Measurement of noise level by noise level meter.
7. Assessment of illumination.
8. Determination of strength by hand grip dynamometer.