Vidyasagar University

Curriculum for B.Sc (General) in Physiology

[Choice Based Credit System]

Semester-I

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	**T**	**P**		
CC1 [DSC-1A]		**C1T:** Cellular Physiology, Biophysical Principles, Biochemistry, Digestive system & Metabolism	Core Course-1	4	0	0	6	75
		C1P: Practical		0	0	4		
CC2 [DSC-2A]	TBD	**DSC-2A (other Discipline)**	Core Course-2				6	75
CC3 [DSC-3A]	TBD	**DSC-3A (other Discipline)**	Core Course-3				6	75
AECC		English	AECC (Elective)	1	1	0	2	50
Semester Total							**20**	**275**

L=Lecture, **T**=Tutorial, **P**=Practical, **CC =** Core Course, **TBD =** To be decided, **AECC=** Ability Enhancement Compulsory Course
DSC-1 = Discipline Specific Core of Subject-1, **DSC-2** = Discipline Specific Core of Subject-2,**DSC-3** = Discipline Specific Core of Subject-3.

Semester-I
Core Course (CC)

CC- I : Cellular Physiology, Biophysical Principles, Biochemistry, Digestive system & Metabolism **credits 06**

C1T : Cellular Physiology, Biophysical Principles, Biochemistry, Digestive system & Metabolism **credits 02**

Course Contents:

- **Cellular Physiology and Biophysical Principles**

Membrane physiology: structure and functions of cell and subcelluar membranes, cytoskeletal system, cell junctions and cell adhesion molecules, Physicocemical principles and Physiological importance of : Diffusion, Osmosis, Dialysis, Ultrafiltration, Surface tension, Adsorption, Absorption, pH and buffers, Colloids. Enzymes - classification, coenzymes, factors affecting enzyme action, regulation of enzymes- feedback, covalent and allosteric. Isozymes and non-protein enzymes

- **Biochemistry and Metabolism :**

Carbohydrates **:** classification , structure and properties
Proteins **:** Classification , order of structure (elementary idea), Amino acids**:** classification and properties
Lipids : classification. Fatty acids – Classification, and properties, lipoprotein – Classification and structure
Nucleic acid – structure of DNA and RNA
Vitamins – classification and functions. *Minerals* – functions of Sodium, Potassium, Calcium, Phosphorus, Iron, Zinc, Iodine and Fluoride.
Metabolism – Glycolysis, TCA cycle, Glycogenesis, Glycogenolysis. Gluconeogenesis, Beta oxidation of saturated fatty acid, Ketone bodies – formation and significance. Deamination, Transamination. Amino acid pool, Urea cycle, vitamins in metabolism

- **Digestive System:**

Alimentary cana1 and digestive glands – Structure in relation to functions. Composition, functions and regulation of secretion of digestive juices including bile. Digestion and absorption of carbohydrate, protein and lipid. Movements of the stomach and small intestine

C1P : Practical: Fresh tissue experiments & Identification of permanent slides **credits 02**

1. **Fresh tissue experiments:**

a) Examination & staining of fresh tissue: squamous, ciliated & columnar epithelium, skeletal muscle fibre (Rat/ Goat) by Methylene blue stain.
b) Transitional epithelium, mesentery (Rat/ Goat) (counter stain by Methylene blue)
c) Staining of adipose tissue by Sudan III or IV

2. **Identification of permanent slides:**

Bone, cartilage, lung, trachea, spleen, lymph gland, liver, salivary glands, pancreas, esophagus, stomach, small intestine, large intestine, ovary, adrenal, testis, thyroid, spinal cord, cerebellum, cerebral cortex, kidney, skin, tongue.

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Semester-II

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC4 [DSC-1B]		Blood, body fluid and immune System, Cardiovascular System and Respiratory System.	Core Course	4	0	0	6	75
		Practical		0	0	4		
CC5 [DSC-2B]	TBD	**DSC-2B (other Discipline)**	Core Course				6	75
CC6 [DSC-3B]	TBD	**DSC-3B (other Discipline)**	Core Course				6	75
AECC		**Environmental Studies**	AECC (Elective)				4	100
Semester Total							**22**	**325**

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Semester-II
Core Course (CC)

DSC-1B: Blood, body fluid and immune System, Cardiovascular System and Respiratory System **Credits 06**

DSC1BT: Blood, body fluid and immune System, Cardiovascular System and Respiratory System **Credits 04**

Course Contents:

Blood & Body fluids:

Blood : Properties of blood, Composition, character, properties and function of blood. Plasma proteins: origin, separation and functions. Plasmapheresis. Bone marrow. Formed elements of blood. Erythrocytes :Morphology, fate and functions. Fragility of RBC. Erythropoiesis: Definition, steps of erythropoesis, role of different factors on erythropoesis. Haemoglobin**:** chemistry, biosynthesis, functions, catabolism, derivatives. Abnormal haemoglobin. Anaemia: different types, Clinical significances. Leucopoiesis. Leucocytes : staining, types and morphology, life cycles and functions. Colony Stimulating factor , Phagocytosis, Inflammation. Significances of leucocytosis and leucocytopenia. Leukaemia. Arneth counts. Schilling Index, Reticulocyte counts. Platelets: Structure, functions. Platelets reaction, Critical counts of Platelets. Significance of platelets counts. Thrombocytosis, Thrombocytopenia. Coagulation of blood: Mechanism of blood coagulation, factors affecting blood coagulations, Pro-coagulants, anticoagulants, disorder of coagulation. Fibrinolytic systems. Bleeding disorders, tests for bleeding disorders. Thrombotic disorders. Coagulation time, bleeding time, prothrombin time, hemolysis.

Blood groups - The ABO systems, The Rh systems, The MN system, Importance of blood groups, Immunological basis of identification of ABO and Rh blood groups. Cross matching, Donor and Recipient. Blood transfusion – collection and storage of bloods, Blood products, Preservation injuries, Precaution and hazards of blood transfusions. The RH system and pregnancy, Erythroblastosis foetalis. Blood volume: Normal value. Determination of blood volume. Determination of cell volume, Determination of plasma volume, variation and maintenance of blood volume. effective blood volume, factors influencing blood volume, regulation of blood volume.

Body fluids: Intracellular and extra cellular compartment of body fluids. Water : intake and excretion. Volumes of body water in different compartments and their estimation. Water balance and its regulation. Dehydration and oedema. Lymph and tissue fluids: Composition, formation, circulation , function and fate of lymph and tissue fluids.

Immune System

Immune system: Overview, properties of immune system, types of immunity : innate immunity, acquired immunity, active and passive immunity. First and second line defence. Humoral and Cell mediated immunity. Complement system. Immune Competent cells : structure and functions of neutrophil, B lymphocytes, T- lymphocytes (helper, cytotoxic and suppressor), Natural killer cells, monocytes – macrophages. Primary and Secondary lymphoid organs.

Antigen and Antibody : Properties of immunogen, antigens and haptens. Classification, structure and functions of immunoglobulins. Antigen- antibody reaction, physiological effects and clinical significances. Major Histocompatibility Complex.. Brief idea of auto immunity. AIDS. Transplantation immunity.

Vaccination : Immunization- Passive and active immunozation. Immunizing agents. Vaccine. Antisera. Vaccination. Toxin and Toxoids.

Cardiovascular system:

Cardiovascular system - Anatomy and histology of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Electrophysiology of cardiac tissue. Heart Block , basic idea about artificial pacemaker. Cardiac valves, Heart rate and its regulations. Heart sounds. Nerves and its role in the regulation of the heart function. Frank – Starlings law's of heart. Electrocardiography, Echocardiography,

Cardiac cycle : events. different phases and pressure changes in cardiac chamber, factors affecting and regulation. Cardiac output: methods of determination (dye dilution and Fick principle), factors affecting regulation.

Structure of arteries, arterioles, capillaries. Venules and veins. Pulse - arterial and venous. Blood pressure and its regulation and factors controlling. Baro - and Chemoreceptor. Vasomotor reflexes. Methods of measurement of blood pressure. Role of Renin- angiotensin system, Vasopressin or ADH in Blood Pressure regulations.

Peculiarities of regional circulations: Coronary, Pulmonary, Renal, Cutaneous, Hepatic and Cerebral.

Respiratory System:

Anatomy and histology of the respiratory passage and organs. Role of respiratory muscles in breathing. Compliance & elastic recoil of the lung, Lung surfactant, intra thoracic and intra pleural pressure. Respiratory failure. Artificial respiration. Significance of physiological and anatomical dead space. Lung volumes and capacities. Exchange of respiratory gases between lung and blood and between blood and

tissues. Transport of oxygen and carbon dioxide in blood. Regulation of respiration - neural and chemical. Role of respiratory centre, central and peripheral chemo-receptors.

Hypoxia, asphyxia, dyspnea, asthma, cyanosis, dysbarism,. Lung function tests. Non respiratory function of lungs.

DSC1BP: Practical **Credits 02**

Haematology:

1. Study of the compound microscope.
2. Preparation of blood film of your own blood. Staining of the blood film with Leishman's stain. Identification of different types of blood corpuscles.
3. Determination of TC of RBC and WBC by haemocytometer.
4. Differential count of WBC.
5. Determination of ESR of human blood.
6. Estimation of haemoglobin by haemoglobinometer.
7. Preparation of haemin crystals.
8. Determination of Blood groups.
9. Determination of clotting time, bleeding time, prothrombin time.
10. Determination of osmotic fragility of Red Blood Corpuscle.
11. Preparation and staining of bone marrow. Measurement of diameter of megakaryocyte.
12. Reticulocyte staining

Human Experiment:

1. Measurement of arterial blood pressure by Sphygmomanometer at rest and after exercise, Calculate the mean arterial blood pressure (MABP)
2. Measurement of heart rate and pulse rate (30 beats methods) during rest and exercise and graphical plotting.
3. Modified Harvard step test and determination of physical fitness.
4. Pneumographic recording of respiratory movements along with the effect of drinking of water, talking, laughing, coughing, exercise, hyperventilation and breathe holding.
5. **Demonstration:** Measurement of oxygen saturation by pulse oxymeter before and after exercise. Measurement of Peak Expiratory Flow Rate. Measurement of forced expiratory volume (FEV) in first second.

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Semester-III

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
DSC-1C		**DSC1CT:** Nerve –Muscle Physiology, Nervous system, Skin and Body Temperature Regulation	Core Course	4	0	0	6	75
		- Lab		0	0	4		
DSC-2C	TBD	**DSC-2C (other Discipline)**	Core Course				6	75
DSC-3C	TBD	**DSC-3C (other Discipline)**	Core Course				6	75
SEC-1		SEC1T: Public Health and Epidemiology Or Environmental Epidemiology	Skill Enhancement Course-1	1	1	0	2	50
Semester Total							**20**	**275**

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DSC-1 = Discipline Specific Core of Subject-1, **DSC-2** = Discipline Specific Core of Subject-2,

DSC-3 = Discipline Specific Core of Subject-3.

Semester-III

Core Course (CC)

DSC-1C (CC-3): Nerve –Muscle Physiology, Nervous system, Skin and Body Temperature Regulation Credits 06

DSC1CT: Nerve –Muscle Physiology, Nervous system, Skin and Body Temperature Regulation Credits 04

Course Contents:

Nerve-muscle Physiology

Different types of muscle and their structures. Sarcotubular system. Red and white muscles. Properties of muscle: all or none law, rheobase, chronaxie, indefatigability, beneficial effect, summation, refractory period, tetanus and fatigue. Smooth Muscle: Morphology, Single-unit and multi-unit smooth muscle. Muscle spindle. Cardiac Muscle: Morphology, Electrical Properties, Mechanical Properties Pacemaker Tissue.

Mechanism of muscular contraction. Structural, chemical and mechanical changes in skeletal muscle during contraction and relaxation. Isotonic and isometric contraction. Molecular basis of smooth muscle and cardiac muscle contraction and relaxation.

Structure and classification of nerves. Nerve cells. Excitation & Conduction. Measurment of electrical events. Degeneration and regeneration of nerve fibre. Myelination. Origin and propagation of nerve impulse. Velocity of impulse in different types of nerve fibres. Properties of nerve fibre: all or none law, rheobase, chronaxie, refractory period, indefatigability. Properties of mixed nerves. Neurotropin.

Synapse: structure , functional anatomy, classification, mechanism of synaptic transmission. Electrical Events at Synapses, Inhibition & Facilitation at Synapses. Motor unit, motor point. EPSP,IPSP.

Neuromuscular junction: structure, mechanism of impulse transmission, end plate potential. A brief overview on neurotransmitters. Electromyography.

Nervous System:

A brief outline of organization and basic functions of the nervous system - central and peripheral nervous system. Structural organization of the different parts of the brain and spinal cord. Hemi section and complete section of spinal cord. Brown- Sequard syndromes. Receptors : Definition, structure, classification, mode of action. Blocker and Stimulator. Reflexes: Introduction, Monosynaptic Reflexe, Stretch Reflex, Polysynaptic reflex. Withdrawal Reflex. General Properties of Reflexes. Reflex action - definition, classification, properties , reflex arc.

Ascending and Descending tracts : Origin, course, terminations, and functions. Lower motor neurone and upper motor neurone. Postural reflex, Muscle spindle, Muscle tone and its regulation. Decrebrate and decorticoid rigidity.

Arousal Mechanisms, Sleep, & the Electrical Activity of the Brain - The Reticular Formation & the Reticular Activating System, The Thalamus & the Cerebral Cortex: structure & functions. The Electroencephalogram, Physiological Basis of the EEG & Sleep, Interpretation of abnormal EEG pattern.

Control of Posture & Movement - Introduction, General Principles, Basal Ganglia & Cerebellum: Structure & functions. Disorders of basal ganglia and cerebellum.

The Autonomic Nervous System - Introduction, Anatomic Organization of Autonomic Outflow, Chemical Transmission at autonomic Junctions.

Central Regulation of Visceral Function - Introduction, Hypothalamus: Anatomic Considerations, Hypothalamic Function, Relation to Autonomic Function, Relation to Sleep, Hunger, Thirst, Control of Posterior Pituitary Secretion, Control of Anterior pituitary Secretion, Temperature Regulation, fever.
Neural Basis of instinctual Behavior & Emotions - Introduction, Limbic system: Anatomic Considerations, Functions - Sexual Behavior, Fear & Rage, Motivation.

CSF: composition, formation, circulation and functions. A brief idea of speech, aphasia, memory conditioning and learning. Sleep and sleep wakefulness cycle.

Skin and Body temperature regulation:

Histological structure of skin. Colour of the skin. Organization of sweat gland. Composition and function of the sweat. Regulation of sweat secretion. Insensible and sensible perspiration. Composition and function of sebum. Triple response.
Normal body temperature. Channels of heat loss and heat gain process. Regulation of body temperature: Higher centre and mechanism of regulation. Hypothermia and Hyperthermia. Physiological basis of fever. Cold sress. Insulating effects. Acclimatization to colds.

DSC1CP: Practical **Credit 02**

Practical:

1. Isolation and Staining of nerve fibers with node(s) of Ranvier (AgNO3).
2. Staining of skeletal and cardiac muscles by Methylene Blue stain.
3. Measurement of grip strength.
4. Recording of body temperature.
5. To study the response of the skin to blunt injury (triple response) (**Demonstration)**

Neurological experiments:

1. Experiments on superficial (plantar) and deep (knee jerk) reflex.
2. Reaction time by stick drop test.
3. Short term memory test (shape, picture word).
4. Two point discrimination test.

Demonstration:

1. Study of Kymograph, Induction coil, Key and other instruments used to study mechanical responses of skeletal muscle.
2. Kymographic recording of mechanical responses of gastrocnemius muscle to a single stimulus and two successive stimuli.
3. Kymographic recording of the effects of variations of temperature and load (after-load) on single muscle twitch.
4. Calculation of work done by the muscle.
5. Determination of nerve conduction velocity.

Skill Enhancement Course (SEC)

SEC- 1: Public Health and Epidemiology Credits 02

SEC1T: Public Health and Epidemiology

Course Contents:

Unit I: Principles of Epidemiology in Public Health: Overview of epidemiology methods used in research studies to address disease patterns in community and clinic-based populations, distribution and determinants of health-related states or events in specific populations, and strategies to control health problems

Unit II: Statistical Methods for Health Science Analysis and interpretation of data including data cleaning, data file construction and management; implementation of analytic strategies appropriate for the type of data, study design and research hypothesis; parametric and nonparametric methods, measures of association, Linear and Logistic regression, Generalized Linear Modeling, and Survival analysis

Unit III:
Environmental Health. Effects of biological, chemical, and physical agents in environment on health (water, air, food and land resources); ecological model of population health; current legal framework, policies, and practices associated with environmental health and intended to improve public health.

Unit IV: Psychological, Behavioural, and Social Issues in Public Health. Cultural, social, behavioural, psychological and economic factors that influence health and illness; behavioural science theory and methods for understanding and resolving public health problems; assess knowledge, attitudes, behaviours towards disease and patient compliance to treatment.

Unit V: Management of Health Care Program and Service Organizations Techniques and procedures for monitoring achievement of a program's objectives, generating evidence of program effectiveness, assessing impacts in public health settings; evaluation of framework that leads to evidence-based decision-making in public health. Organizational principles and practices including organizational theory, managerial role, managing groups, work design, and organization design at primary, secondary, and tertiary levels of care

Unit VI: Epidemiology of disease. Contemporary methods for surveillance, assessment, prevention, and control of infectious and chronic diseases, disabilities, HIV/AIDS; understanding etiology; determining change in trend over time; implementation of control measures

Suggested Readings:

1. Gordis Leon. Epidemiology (Fifth edition) , Elsevier Saunders.
2. Dona Schneider and David E. Lilienfeld. Lilienfeld's Foundations of Epidemiology, Fourth Edition, Oxford University Press, USA.
3. Porta Miquel. A Dictionary of Epidemiology, Oxford University Press, USA,
4. Somerville Margaret, et al., Public Health and Epidemiology at a Glance, Second Edition, Wiley-Blackwell,
5. Beaglehole. R. Bonita, et. al Basic Epidemiology, 2nd Edition, WHO Publication, Geneva, .
6. Spassoff R.A. Epidemiologic Methods for Health Policy, Oxford University Press,
7. Barkar, D.J.P., Practical Epidemiology: Churchill pub, Livingstone.
8. Knox E. G. Epidemiology in health care planning: A Guide to the Uses of a Scientific Method, Oxford University Press, USA.

Or

SEC-1: Environmental Epidemiology Credits 02

SEC1T: Environmental Epidemiology

Course Contents:

UNIT-I:
Introduction, Definitions, man - environment relation, terms, Historical Background- brief history of social reforms. Branches – Descriptive, research, bio- statistical, economic, Methodological and Administrative.

UNIT-II:

Principles- an epidemic and ingredients - and types of studies – Descriptive, analytical- cohort, case- control and cross sectional an biological studies.

UNIT-III:

Causes – Koch postulates. Immunological proof- cancers and slow viruses- Hills criteria- emergence of new diseases-and effect modifications. Diseases of plants and animals - extinct and endangered animals - causes and effects - Measurements and statistical associations –prevalence rate – incidence rate - Cumulative incidence rate-Mortality rate- Mean and standard error–risk ratio, attributable ratio - simple problems.

UNIT-IV:

Types of sampling - simple random sampling; stratified sampling; systematic sampling; multi stage sampling; cluster sampling.

Methods in Field study – questionnaire preparation; Data analysis; Report writing.

UNIT –VI:

Environmental hazards and Public health management: Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment, dose response, evaluation, exposure assessment. Pollution: Air, water, noise pollution sources and effects. Waste management and hazards: Types and characteristics of wastes, biomedical waste handling and disposal, nuclear waste handling and disposal, Waste from thermal power plants. Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath. Diseases: Social and economic factors of disease including role of health services and other organizations: Infectious (Bacterial-Tuberculosis, Typhoid; Viral - AIDS, Poliomyelitis, Hepatitis; Protozoan- Leishmaniasis, Malaria); Lifestyle and Inherited/genetic diseases, Immunological diseases; Cancer; Diseases impacting on Western versus developing societies.

Suggested Readings:

1. Anisa Basheer, Environmental Epidemiology, Pointer Pub .
2. R.Beaglehole, R. Bonita & T. Kjellstrom Epidemiology WHO Publ., Current edition .
3. Epidemiology of Occupational Health, WHO publication.
4. Rose, G. The Strategy of Preventive Medicine, Oxford pres.
5. Gordis Leon. Epidemiology (Fifth edition) , Elsevier Saunders.
6. Porta Miquel. A Dictionary of Epidemiology, Oxford University Press, USA,
7. Somerville Margaret, et al., Public Health and Epidemiology at a Glance, Second Edition, Wiley-Blackwell,
8. Spassoff R.A. Epidemiologic Methods for Health Policy, Oxford University Press,
9. Knox E. G. Epidemiology in health care planning: A Guide to the Uses of a Scientific Method, Oxford University Press, USA.

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Semester-IV

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
DSC-1D		**DSC1DT:** Sensory Physiology, Endocrine and Reproductive System, Renal Physiology	Core Course	4	0	0	6	75
		- Lab		0	0	4		
DSC-2D	TBD	**DSC-2C (other Discipline)**	Core Course				6	75
DSC-3D	TBD	**DSC-3C (other Discipline)**	Core Course				6	75
SEC-2		**SEC-2:** Biochemical Techniques **Or** Medical Diagnostics **Or** Instrumentation Techniques in Biology	Skill Enhancement Course-2	1	1	0	2	50
Semester Total							**20**	**275**

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DSC-1 = Discipline Specific Core of Subject-1, **DSC-2** = Discipline Specific Core of Subject-2,

DSC-3 = Discipline Specific Core of Subject-3.

Semester-IV
Core Course (CC)

DSC-1D (CC-4): Sensory Physiology, Endocrinology and Reproductive Physiology, Renal Physiology — Credit 06

DSC1DT: Sensory Physiology, Endocrine and Reproductive System, Renal Physiology

Credit 04

Course Contents:

Sensory Physiology

Classification of general and special senses and their receptors. Muller's law of specific nerve energetic. Weber – Fechner Law, Mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors. Receptors as biological transducer. Neural pathway of touch, pressure, pain, thermal and kinaesthetic sensation.

Olfaction and Gustation: Structure of sensory organ, neural pathway of olfactory and gustatory sensation. Physiology of olfactory and gustatory sensation. Olfactory and gustatory adaptation. After-taste.Olfactometer.

Audition & Equilibrium: Sound wave, decibel**,** Structure of ear ,anatomic consideration, Auditory apparatus- external, middle and internal ears. Organ of Corti. Mechanism of hearing and its modern theory. Vestibular function. Discrimination of sound frequency and loudness. Auditory pathways and centres.

Vision: Structure of the eye anatomic consideration.. Structure of the lens. Error of refraction. Pupilary reflex, Light reflex. Argyll Robertson pupil. Histology of retina. Photopic and Scotopic vision. Chemical changes in retina on exposure to light. Genesis of electrical response, Visual pathway and effects of lesions of these pathways. Light reflex. Accommodation and Visual acuity. Errors of refraction. Positive and negative after-image. Light and dark adaptation. Colour vision and colour blindness. Errors in visual processes. Electroretinogram, Visual Field, Perimetry, Binocular vision.

Endocrinology:

Anatomy of endocrine system. Hormones - classification. Experimental and clinical methods of study of endocrine glands. Hormone receptor and cell signalling. Mechanism and modern concepts of hormone action. Basic concept of regulation of hormone actions. Positive and negative feedback mechanism.

Hypothalamo - Hypophysial axis: Basic concept of neurohormone. Hypothalamo-hypophyseal tract and portal system. Releasing factors, Tropic hormones, vascular and neural connections

between the hypothalamus and pituitary.

Pituitary gland: Histological structure, hormones, functions and regulation of anterior, middle and posterior lobes of pituitary. Growth hormone. Oxytocin and Vasopressin. Hypo and hyperactive states of pituitary gland.

Thyroid gland: Histological structure. Thyroid hormone: chemistry, biosynthesis, storage and transport. Functions of thyroid hormones (T_4 T_3) Thyrocalcitonin. Hypo and hyper-active states of thyroid.Regulation of thyroid hormone secretion.

Parathyroid gland: Histological structure, functions of parathyroid hormone. Role in calcium metabolism, Parathyroid hormone and bone. Tetany. Calcitonin- source, function and regulations.

Adrenal Cortex: Histological structure and functions of different hormones. Biosynthesis of adrenocortical hormone. Hypo and hyper-active states of adrenal cortex.

Adrenal Medulla: Histological structure, regulation and hormonal functions of adrenal medulla. Pheochromocytoma.

Pancreas: Histological structure of panchreatic islets. Source, regulation, mode of action and function of pancreatic hormones.Diabetes mellitus.

Brief idea of the origin and functions of renin- angiotensin, prostaglandins. Erythropoietin and melatonin. Gastrointestinal hormones- physiological functions. The endocrine function of the heart : Atrial Natriuretic Peptide and its function.

Reproductive Physiology:
Primary and secondary sex organs: Anatomy and Physiology, secondary sex characters. Puberty, Precocious & Delayed Puberty.

Testis: histology, spermatogenesis, spermiogenesis, testicular hormones and their functions, Abnormalities of the testicular function. Prostate and seminal vesicle.

Ovary: histology, oogenesis, ovarian hormones and their functions. Control of ovarian functions. Physiological mechanism of ovulation. Abnormalities of ovarian functions. Ovarian cysts.

Oestrus and menstrual cycles and their hormonal control. Fertilization, implantation and structure and functions of placenta. Placental hormone. Pregnancy : Physiological changes during pregnancy. Maintenance of pregnancy – role of hormones. Pregnancy tests, Parturation, ectopic pregnancy. Development of mammary gland. Lactation - Role of hormones, Sympathetic nervous system. Menopause. Stem cell biology.

Renal Physiology:

Structure and functions of kidney. Microanatomy of a nephron. Juxtaglomerular apparatous.Mechanism of formation of urine. Counter current system, counter current multiplier. Function of Malpighian corpuscles and renal tubule. Normal and abnormal constituents of urine and their clinical significances. Renal threshold. Physiology of urine storage and micturation.Non excretory function of kidney. Disorders of Renal Functions. Renal stone formation. Renal function tests. Dialysis and Artificial kidney.

DSC1DP: Practical **Credits 02**

1. Staining and identification of kidney and ureters.
2. Silver nitrate preparation of corneal cell space.
3. Study of estrous cycle.
4. Identification of normal and abnormal constituents of urine.
5. Tests for Urinary deposits.
6. Estimation of albumin in urine.
7. Detection of specific gravity of urine.
8. Determination of visual acuity by Snellen's chart / Landolt's chart.
9. Determination of colour blindness by Ishihara chart.
10. Exploration of conductive and perceptive deafness by tuning fork method.
11. Sperm count and sperm motility in rat.

Demonstration:

1. Study of the effects of oxytocin on uterine contraction.
2. Study of the effects of adrenaline on intestinal / uterine movements.
3. Estimation of estrogen by Spectrophotometric method.
4. Pregnancy test from human urine by kit method.
5. Quantitative estimation of Urea in Urine
6. Surgical techniques: principles of surgery in endocrinology. Ovarectomy, hysterectorny, castration and vasectomy in rats.
12. Human vaginal exfoliate cytology.

Skill Enhancement Course (SEC)

SEC-2: Biochemical Techniques **Credits 02**

SEC2T: Biochemical Techniques

Course Contents:

Unit-I: Spectroscopic Techniques

Principle of UV- Visible absorption spectrophotometry, instrumentation and applications. Flourimetry: Phenomena of fluorescence, intrinsic and extrinsic fluorescence, instrumentation and applications

Unit-II: Chromatography

Basic principles of chromatography: Partition coefficient, concept of theoretical plates, various modes of chromatography (paper, thin layer, column), preparative and analytical applications, LPLC and HPLC. Principle and applications of: Paper Chromatography, Thin Layer Chromatography. Molecular Sieve Chromatography, Ion Exchange Chromatography, Affinity Chromatography

Unit-III: Electrophoresis

Basic principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, discontinuous gel electrophoresis, PAGE, SDS-PAGE, Native and denaturing gels. Agarose gel electrophoresis, buffer systems in electrophoresis. Electrophoresis of proteins and nucleic acids, protein and nucleic acid blotting, detection and identification. Molecular weight determination, Isoelectric Focusing of proteins

Unit-IV: Centrifugation

Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient, various types of centrifuges, different types of rotors, differential centrifugation, density gradient centrifugation (Rate zonal and Isopycnic)

Suggested Readings:

1. Human Molecular Genetics, 3rd edition (2003), Tom Strachan and Andrew Read; Garland Science Publishers.
2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 2nd edition (1982), David Freifelder, W.H. Freeman and Company.
3. Principles and Techniques of Biochemistry and Molecular Biology 7th edition (2010), Wilson K and Walker J. Cambridge University Press, 2010.
4. Principles of Gene Manipulation and Genomics, 7th edition (2006), S.B. Primrose and R.M.
   Twyman. Blackwell Scientific
5. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th edition (2009), Bernard R. Glick, Jack J. Paternack, Cheryl I. Patten. ASM press,
6. Molecular Cloning: A Laboratory Manual, 4th edition (2012), Three-volume set by Michael
   R. Green, Joseph Sambrook; Cold Spring Harbor Laboratory Press,
7. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6th edition (2010),

Or

SEC-2: Medical Diagnostics Credits 02

SEC2T: Medical Diagnostics

Course Contents:

Unit-1: Biomedical basis of Diseases

Infectious diseases (Bacterial, Viral, Protozoan); Inherited/genetic diseases (Diabetes, Hypertension); Immunological diseases [Autoimmune hemolytic anemia (AHA), Di George's Syndrome, Systemic Lupus Erythematosus (SLE)]; Cancer- Nature/ types; Treatment, Relation of pathogenesis to symptoms, diagnosis and treatment.

Unit-II: Analytical Technology

Brief and relevant description of the following Wet techniques: UV Chromatography Methods-LC, HPLC and GC-MS Nuclear Magnetic Resonance Spectroscopy (NMR) Atomic Force and Scanning Electron Microscopy (AFM and SEM) Electrochemistry Molecular Modeling and Chemical Databases

Unit-III: Diagnostic Methods

Outline methods used in hospital histopathology, biochemistry, hematology and microbiology laboratories. Theoretical knowledge - ECG, Echo, X-ray, CT, MRI, PET, Ultrasonography.

Suggested Readings

1. Bailey and Scott's Diagnostic Microbiology, 12th edition (2007), Betty A. Forbes, Daniel,F. Sahm and Alice S. Weissfeld; Mosby Elsevier Publishers.
2. Medical Laboratory Technology Methods and Interpretations Volume 1 and 2, 6th edition (2009), Ramnik Sood; Jaypee Brothers Medical Publishers.
3. Current Protocols in Human Genetics, 1st edition (1994), Dracopoli and Nicolas C. Dracopoli; John Wiley and Sons, Inc.,
4. Molecular Cloning: A Laboratory Manual, 4th edition (2012), Michael R. Green and Joseph Sambrook; Cold Spring Harbor Laboratory Press,
5. Microbiology: A Laboratory Manual, 10th edition (2013), James Cappuccino and Natalie Sherman, Benjamin Cummings,

Or

SEC-2: Instrumentation Techniques in Biology Credits 02

SEC2T: Instrumentation Techniques in Biology

Course Contents:

Unit-I: Basics of Microscopy-Features, Working principle, Advantages and limitations - Introduction- Bright field Microscopy - Dark Field Microscopy, Light microscopy-Construction and working of compound microscope - Phase contrast microscopy - Electron microscopy-TEM, SEM

Unit-II: Staining methods - Simple staining; Gram staining - Lacto-phenol cotton blue staining

Unit-III: Optical Methods - Features, Working principle, Advantages and Limitations **-** Absorption Methods; Ultraviolet Spectrophotometer; Infrared spectrophotometer **-** Emission methods; Atomic Absorption Spectrophotometer (AAS) Flame Photometry

Unit-IV: Chromatography methods - Features, Working principle, Advantages and Imitations High performance liquid chromatography (HPL Gas Chromatography

Unit-V: Biotechnology and Immunological techniques- Features, Working principle, Advantages and limitations - Electrophoresis –Introduction, Types of electrophoresis, Agarose gel electrophoresis, Gradient gel electrophoresis, DNA finger printing PCR Technique ELISA (Enzyme Linked Immuno Sorbant Assay)

Suggested Readings:

1. A. R. Murugesan and C. Rajakumari, Environmental Science and biotechnology-Theory and Techniques, MJP Publishers.
2. M. L. Srivastava, Bioanalytical Techniques, Narosa Publishing House.
3. R.Gopalan, P.S.Subramanian and K.Rangarajan, Elements of Analytical Chemistry, Sultan Chand and Sons.
4. S.Sadasivam and A. Manicham, Biochemical methods, New Age International Publishers.

Vidyasagar University

Curriculum for B. Sc (General) 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		
DSE-1A		Any one from Discipline-1(Physiology) **DSE1T:** Sports Physiology, Work Physiology and Ergonomics **Or** Environmental Physiology **Or** Community Nutrition and Public Health **Or** Biostatistics	Core Course	4	0	0	6	75
		DSE1P: Sports Physiology, Work Physiology and Ergonomics(Pr) **Or** Environmental Physiology(Pr) **Or** Community Nutrition and Public Health(Pr) **Or** Biostatistics(Pr)		0	0	4		
DSE-2A	TBD	Other Discipline (Any one from Discipline-2)/TBD	Core Course	5-1-0/4-0-4			6	75
DSE-3A	TBD	Other Discipline (Any one from Discipline-3)/TBD		5-1-0/4-0-4			6	75
SEC-3		**SEC3T:** Maternal and Child Nutrition **Or** Nutrition and Fitness	Skill Enhancement Course-3	1	1	0	2	50
Semester Total							**20**	**275**

L=Lecture, **T**=Tutorial, **P**=Practical, **DSE=** Discipline Specific Electives**, SEC=** Skill Enhancement Course, **TBD** = To be decided.

Discipline Specific Electives (DSE)

DSE-1A: Sports Physiology, Work Physiology and Ergonomics
Or
DSE-1A: Environmental Physiology
Or
DSE-1A: Community Nutrition and Public Health
Or
DSE-1A: Biostatistics

Skill Enhancement Course (SEC)

SEC-3: Maternal and Child Nutrition
Or
SEC-3: Nutrition and Fitness

Semester-V

Discipline Specific Electives (DSE)

DSE -1A: Sports Physiology, Work Physiology and Ergonomics Credits 06

DSE1AT: Sports Physiology, Work Physiology and Ergonomics Credits 04

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 Ergo meter, 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 – neutrient 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.

Ergonomic – 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. Occupation 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.

DSE1AP: Sports Physiology, Work Physiology and Ergonomics (Practical) Credits 02

List of Practical

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. Determine cardiac cost of specific work.
5. Determination of $VO_{2\,max}$ by Queen College step test.
6. Determination of endurance time by hand grip dyanometer.
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 – 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-1A: Environmental Physiology — Credits 06

DSE1AT: 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, the 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).

Environmental Pollutions and Health Hazards: Concept of 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- aetiology and control.

Air Pollution: definition, sources, air pollutants, effects of air pollution on human health. Water Pollution: definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, concept of safe drinking water standards. Soil Pollution: causes, health hazards, solid waste management, bioremediation, phyto-remediation. 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. Source, health problems and preventions

of Bio- medical waste. Environment and Health impacts assessment – Concept, Steps and application. Brief idea about biotransformation, bioaccumulation, biomagnifications. Population over growth and its effects on health. Xenobiotics. Impacts of green house effects in life. Human health, permissible doses.

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

DSE1AP: Environmental Physiology (Practical) **Credits 02**

Practical:

A:

1. Measurement of environmental temperature – dry bulb and wet bulb, relative humidity, air velocity.
2. Determination of O_2,CO_2, BOD & COD
3. Determination of total alkalinity and chlorine in water.
4. 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.
5. Detection of food additives in different food samples.
6. Biochemical estimation of serum glucose, total proteins, SGPT and SGOT
7. Detection of food additives in different food samples.
8. Determination of light intensity (at library, laboratory, and class room) by lux meter.
9. Determination of sound levels by sound level meter and noise index.

B:

Physiological (experimental) Experiments (Demonstration)

1. Kymographic recording of the effects of Hg, Pb , As compounds and food additives on the movements of perfused heart of toad.

2. Kymographic recordind 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 (Demonstration)

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

Or

DSE-1A: Community Nutrition and Public Health Credits 06

DSE1AT: 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.
Socio ecology of nutrition, Habitual diets in India and their adequacy. Nutritional assessment of human and community. Malnutrition in a community. National nutritional related health program.

Epidemiology : Concepts. Public health and public health issues: Basic ideas.Etiology, epidemiology and prevention of malaria, dengue, filarial, hepatitis, AIDS, nutritional anemia, atherosclerotic disorders. Cause 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).

DSE1AP: Community Nutrition and Public Health (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.

Or

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-1A: Biostatistics — Credits 06

DSE1AT: 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

DSE1AP: 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 (Microsoft Excel).

Skill Enhancement Course (SEC)

SEC- 3: Maternal and Child Nutrition — Credits 02

SEC3T: Maternal and Child Nutrition

Course Contents:

Unit - I

• Nutritional needs during pregnancy, common disorders of pregnancy (Anaemia, HIV infection, Pregnancy induced hypertension), relationship between maternal diet and birth outcome.
• Maternal health and nutritional status, maternal mortality and issues relating to maternal health.

Unit - II

• Nutritional needs of nursing mothers and infants, determinants of birth weight and consequences of low birth weight, Breastfeeding biology, Breastfeeding support and counselling

Unit - III

• Infant and young child feeding and care - Current feeding practices and nutritional concerns, guidelines for infant and young child feeding, Breast feeding, weaning and complementary feeding.
• Assessment and management of moderate and severe malnutrition among children, Micronutrient malnutrition among preschool children
• Child health and morbidity, neonatal, infant and child mortality, IMR, U5MR and MMR; link between mortality and malnutrition;

Unit - IV

Overview of maternal and child nutrition policies and programmes.

Or

SEC-3: Nutrition and Fitness — Credits 02

SEC3T: Nutrition and Fitness

Course Contents:

Unit -1: Understanding Fitness

- Definition of fitness, health and related terms
- Assessment of fitness
- Approaches for keeping fit

Unit- 2: Importance of nutrition

- Role of nutrition in fitness
- Nutritional guidelines for health and fitness
- Nutritional supplements

Unit -3: Importance of Physical activity

- Importance and benefits of physical activity
- Physical Activity – frequency, intensity, time and type with examples
- Physical Activity Guidelines and physical activity pyramid

Unit - 4: Weight Management

- Assessment, etiology, health complications of overweight and obesity
- Diet and exercise for weight management
- Fad diets
- Principles of planning weight reducing diets

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Vidyasagar University

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

Semester-VI

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
DSE-1B		Any one from Discipline-1(Physiology) **DSE1BT**:Microbiology, Immunity and Biotechnology **Or** Developmental aspects of embryo and foetus **Or** Clinical Biochemistry **Or** Clinical Hematology	Core Course	4	0	0	6	75
		DSE1BP: Microbiology, Immunityand Biotechnology (Pr) **Or** Developmental aspects of embryo and foetus(Pr) **Or** Clinical Biochemistry (Pr) **Or** Clinical Hematology **(**Pr**)**		0	0	4		
DSE-2B	TBD	Other Discipline (Any one from Discipline-2)/TBD	Core Course	5-1-0/4-0-4			6	75
DSE-3B	TBD	Other Discipline (Any one from Discipline-3)/TBD		5-1-0/4-0-4			6	75
SEC-4		**SEC4T:**Environmental Surveillance **Or** Health Psychology, Physiology of stress and Stress Management **Or** Pharmacology and Toxicology	Skill Enhancement Course-4	1-1-0/1-0-2			2	50
Semester Total							**20**	**275**

L=Lecture, **T**=Tutorial, **P**=Practical, **DSE=** Discipline Specific Electives**, SEC=** Skill Enhancement Course, **TBD** = To be decided.

Discipline Specific Electives (DSE)

DSE-1B: Microbiology, Immunity and Biotechnology
Or
DSE-1B: Developmental aspects of embryo and foetus
Or
DSE-1B: Clinical Biochemistry
Or
DSE-1B: Clinical Hematology

Skill Enhancement Course (SEC)

SEC-4: Environmental Surveillance
Or
SEC-4: Health Psychology, Physiology of stress and Stress Management
Or
SEC-4: Pharmacology and Toxicology

Semester-VI

Discipline Specific Electives (DSE)

DSE-1B: Microbiology, Immunity and Biotechnology — Credits 06

DSE1BT: Microbiology, Immunity and Biotechnology — Credits 04

Course Contents:

Microbiology:

Viruses: DNA & RNA Viruses. Viroids and Prions. Bacteriophages – structure & morphological classification. Bacteria: structure, classification. Staining :- Principal, procedure, uses. Gram stain, Acid – fast stain, Albert stain. Pathogenic and non - pathogenic bacteria. Nutritional requirements of bacteria, nutritional types culture media. Bacterial Growth curve- Preparation, physiological factors required for growth. Bacrterial metabolism: fermentation (ethanol, lactic acid, acetic acid), glyoxalate cycle, Entner – Doudoroff pathway, Phosphoketolase pathway. Bacterial Genetics: elementary idea of transformation, conjugation and transduction. Sterilization, disinfection and pasteurization: Physical and chemical methods used. Antibiotics, Bacteriostatic & Bacteriocidal agents. Bacteriolytic agents. Concepts of antiseptic, probiotics and prebiotics. Basic idea about medical bacteriology, virology and mycology.

Immunity and Vaccination: Elementary knowledge of innate and acquired immunity. Humoral and Cell mediated immunity. Toxin and toxoids. Vaccination : Principles and importance. Passive and active immunisation. Types and uses of vaccine.

Biotechnology: History and importance. DNA and RNA. Gene, Genome and Genetic code, translation. Recombinant DNA technology : concepts, techniques and application., DNA manipulation. Cloning – concept and significances. Cloning vectors. c DNA libraries. DNA sequencing. Basic concepts of Southern, Northern, Western blot techniques and DNA micro array. Polymerase Chain Reaction (PCR). RT-PCR- Basic concepts. Enzyme immobilization: basic concepts. Tissue culture – basic concepts. Human genome projects. Transgenic animals. Hybridoma techniques- Basic concepts. Monoclonal antibody. Protein interaction technology. DNA technology and gene therapy. DNA technology in diseases diagnosis. Genetic Barcode.
Fermentation technology: Fermentation, types, bioreactors, Upstream and downstream processing. Physiology and biotechnology process.
Bio-pesticides, bio plastics, biosensors, biochips: concepts and significances. Bio-safety and intellectual property Rights. Genomics and Proteomics.

DSE1BP: Microbiology, Immunity and Biotechnology (Practical) — Credits 02

Practical

1. Study disinfection and sterilization techniques.
2. Culture procedure and isolation of bacteria.
3. Gram staining techniques of bacteria. Acid- fast staining of bacteria. Spore Staining.
4. Isolation of DNA from blood.

5. Separation of DNA by agarose gel electrophoresis. Extraction of DNA from agarose gel.
6. Prepare SDS-PAGE for protein.
7. Perform immunodiffusion by Ouchterlony methods.
8. Biochemical characterization of microorganisms (**Demonstration**).
9. DNA and Protein quantification (**Demonstration**)
10. Analysis of DNA sequences (**Demonstration**).
11. Application of PCR (**Demonstration**).
12. Prepare ELISA (**Demonstration**).
13. Perform Immunoprecipitation (**Demonstration**).

Or

DSE-1B: Developmental aspects of embryo — Credits 06

DSE1B T: Developmental aspects of embryo — Credits 04

Course Structure:

Theoretical concepts:

General concepts of reproductive system. Stem cell : Characteristics and applications.
Gametogenesis: Spermatogenesis and Oogenesis. Sperm and Ovum of mammals: ultra structure. Egg membrane. Fertilization in mammals.
Cleavage: Cleavage plane, types, role of yolk in cleavage; Cleavage process in mammals.
Blastula formation : Mammals. Morphogenetic movements : types and examples.
Gastrulation : Mammals general concepts of induction, determination and differentiation.
Organogenesis : Development of eye as an example of reciprocal and repeated inductive events.

DSE1BP: Developmental aspects of embryo (Practical) — Credits 02

List of Practical

1. Hematoxylin and Eosin staining of testicular, ovarian tissue sections.
2. Identification of spermatocytes, spermatids, Graafian follicle, Corpus Luteum.
3. Demonstration of preserved mammalian embryo.

Or

DSE-1B: Clinical Biochemistry — Credits 06

DSE1BT: Clinical Biochemistry — Credits 04

Course Contents:

Unit 1: Introduction: Organization of clinical laboratory, Introduction to instrumentation and automation in clinical biochemistry laboratories safety regulations and first aid. General

comments on specimen collection, types of specimen for biochemical analysis. Precision, accuracy, quality control, precautions and limitations.

Unit 2: Evaluation of biochemical changes in diseases: Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile. Pathophysiological significances of glucose, serum protein,albumin, urea, creatinine, uric acids, ketone bodies.Pathophysiological significances of following enzymes : Lactate dehydrogenase, Creatinine kinase, Amylase, Acid and alkaline phosphatase, beta glucoronidase, SGPT & SGOT.

Unit 3: Assessment of glucose metabolism in blood: Clinical significance of variations in blood glucose. Diabetes mellitus. Glycosylated Hb.

Unit 4: Lipid profile: Composition and functions of lipoproteins. Clinical significance of elevated lipoprotein. Lipid profile in health and diseases.

Unit 5: Liver function tests: Structure of the liver, liver function tests, causes of different liver diseases, liver function tests in the diagnosis of liver diseases. Pathophysiological significance of bilirubin.

Unit 6: Renal function tests and urine analysis: Composition of urine. Use of urine strip / dipstick method for urine analysis. Basic ideas on different types of test for renal diseses.

Unit 7: Tests for cardiovascular diseases: Involvement of enzymes in diagnostics of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin.

DSE1BP: Clinical Biochemistry (Practical) **Credits 02**

List of Practical

1. Collection of blood and storage. Separation and storage of serum.
2. Estimation of blood glucose by glucose oxidase peroxidase method.
3. Estimation of blood glucose by Nelson – Somogyi method.
4. Estimation of blood inorganic phosphates by Fiske- Subbaraow method.
5. Estimation of serum total protein by Biurate methods, and determination of albumin globulin ratio.
6. Estimation of triglycerides.
7. Estimation of bilirubin (direct and indirect).
8. Quantitative determination of serum creatinine and urea.
9. Determination of serum amylase by iodometric method.
10. Estimation of creatine kinase.

Or

DSE-1B: Clinical Hematology **Credits 06**

DSE1BT: 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.

DSE1BP: Clinical Hematology (Practical) **Credits 02**

List of Practical

1. General blood picture
2. Differential Leucocute 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**)

Skill Enhancement Course (SEC)

SEC- 4: Environmental Surveillance Credits 02

SEC4T: Environmental Surveillance

Course Contents:

UNIT – I: Environmental Surveillance Monitoring – definition, advantages, disadvantages, scale of observation, GEMS and its goal current and future status of environmental surveillance and monitoring
UNIT - II: Types of Environmental surveillance, systematic ground surveys (SGS), soil, surface water and air surveillance – parameters and instruments, standards, sensors and RUSS, Surveillance devices, Social Network Analysis
UNIT - III: Water quality surveillance and air, water and health, Water quality and sanitary inspection data collection. Sampling site selection and sample approaches. Systematic aerial reconnaissance flight surveillance, using the surveillance data, Household water and the safe water chain
UNIT – IV: Biological surveillance programme for the monitoring of crop pests, Biometric surveillance – aquatic bodies, various invertebrates and vertebrate vectors surveillance, Biomarkers in environmental surveillance
UNIT - V: Disease surveillance (of pathogens) – Definition, World Health Organization AIDS surveillance case definition, Anthrax, Avian influenza, Dengue hemorrhagic fever, Hepatitis, Influenza, Plague, Severe Acute Respiratory Syndrome, Smallpox

Or

SEC-4: Health Psychology, Physiology of stress and Stress Management Credits 02

SEC4T: Health Psychology, Physiology of stress and Stress Management

Course Contents:

Health Psychology:

Introduction: Definition, Mind-body relationship, Bio-psychosocial model of Health, Life styles and disease patterns. Behaviour and Health: Characteristics of health behaviour; Barriers to health behaviour; Theories of health behaviour and their implications. Health Enhancing Behaviour: Exercise, nutrition, accident prevention, pain and stress management. Health and Well-being: Happiness; Life satisfaction; Resilience; Optimism and Hope.

Physiology of Stress:

Stress: Definition, Nature of stress, symptoms of stress. Physical and Emotional Stressors. General Adaptation Syndrome. Role of Hypothalamic - Pituitary- Adrenal Axis and Sympatho-adrenal Medullary Axis in coping stress. Effects of chronic stress: Immunological, Cardiovascular, Emotional problem.

Stress Management

Various sources of stress: environmental, social, physiological and psychological. Stress and health: effects of stress on health, eustress, distress**.** Managing stress: Methods - yoga, meditation, relaxation techniques, Problem focused and emotion focused approaches.

Or

SEC- 4: Pharmacology and Toxicology — Credits 02

SEC4T: Pharmacology and Toxicology — **Credit 01**

Course Contents:

Unit I: General pharmacology and toxicology

Nature and source of drugs, routes of drug administration and their advantages, definitions and scope of toxicology. Introduction to eco-toxicology.

Unit II: Mechanism of toxicity

Formation of ultimate toxicant of xenobiotics and its interaction with target molecules.

Unit III: Pharmacokinetics

Membrane transport, absorption, distribution of xenobiotics. Brief introduction to biotransformation, Phase- I reactions including oxidations, hydrolysis, reductions and phase II conjugation reactions and excretion of drugs.

Unit IV: Pharmacodynamics

Mechanism of drug action, receptors and receptors subtypes, Dose response relationship and combined effect of drugs. Concept of LD50, LC50, TD50 and therapeutic index.

Unit V: Introduction and classification of the drugs acting on:

a. Central and autonomic nervous system, neurotoxic agents.
b. Cardiovascular system and cardiotoxic agents.
c. Kidney and nephrotoxic agents.

Unit VI: Introduction and classification

a. Anti-inflammatory and analgesic drugs and their related toxicity.
b. Endocrine drugs
c. Antimicrobial chemotherapeutic drugs

SEC4P: Pharmacology and Toxicology **Credits 01**

Practical

1. To study presence of paracetamol /aspirin in the given sample.
2. Determination of Dissolved water (DO) using Winkler's method.
3. To determine the total hardness of water by complexometric method Using EDTA.
4. To determine Acid value of the given oil sample.
5. Calculation of LD50 value of an insecticide from the data provided.
6. Handling of laboratory animals and various routes of drug administration **(Demonstration).**
7. Separation of a mixture of benzoic acid, beta- napthol and napthelene by solvent extraction and identification of their functional groups **(Demonstration).**
8. Pharmacodynamics : dose- response curve **(Demonstration).**