Vidyasagar University

Curriculum for B.Sc (General) in Physiology

[Choice Based Credit System]

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**

L = Lecture, **T** = Tutorial, **P** = Practical, **CC** = Core Course, **TBD** = To be decided, **SEC** = Skill Enhancement 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-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.