SEMESTER-IV

Category I

(SRI VENKATESWARA COLLEGE)

(BSc Honors in Biological Science in three years)

DISCIPLINE SPECIFIC CORE COURSE – 10:

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Metabolism and Integration (BS-DSC-401)	4	2		2	Class XII Pass with Biology and chemistry	Should have a background in chemistry of biomolecules and enzymes

Learning Objectives

The Learning Objectives of this course are as follows:

- To introduce the students to the basic concepts of metabolism occurring within a living organism.
- to provide the students an understanding of the major metabolic pathway and their regulation.
- To provide knowledge about the possible integration between various metabolic pathways.
- To enable them to corelate adaptations in metabolic pathways and physiological as well as pathophysiological states.

Learning outcomes

On successful completion of the course, students will be able to:

- Outline the pathways involved in catabolism and biosynthesis of glucose.
- Understand the biosynthesis and degradation of glycogen
- Comprehend the catabolism and biosynthesis of fatty acids
- Understand the biosynthesis and degradation of amino acids and nucleotides
- Understand the integration of metabolism

SYLLABUS FOR DSC-10

CREDITS:2 **TOTAL HOURS: 30 hrs**

UNIT I: Carbohydrate metabolism **No. of hours: 14**

Principles of metabolism, anabolism, catabolism, standard free energy change, metabolic roles of ATP, phosphoryl group transfer, nucleotidyl group transfer. Glycolysis as a universal pathway, anaerobic glycolysis, fermentation, gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, Glycogenesis and glycogenolysis and overview of regulation, Pentose phosphate pathway, Pyruvate dehydrogenase complex, oxidation of acetyl CoA. TCA cycle, amphibolic role, ATP calculation, Glycerol-3-phosphate and malate-aspartate shuttle.

UNIT II: Lipid metabolism **No. of hours: 8**

Lipid metabolism - Mobilization of triglycerides, metabolism of glycerol, β-oxidation of saturated, monounsaturated and poly-unsaturated fatty acids, even and odd chain fatty acids. Ketogenesis and significance, Biosynthesis of C-16 palmitic acid, brief overview of cholesterol metabolism and lipoprotein cycle.

UNIT III: Amino acid and nucleotide metabolism **No. of hours: 5**

Transamination and deamination, Urea cycle, glucogenic and ketogenic amino acids, secondary metabolites from amino acids. Nucleotide Metabolism- De novo and Salvage pathways and degradation. Inborn errors of metabolism - Phenylketonuria, Alkaptonuria, Maple syrup, Lesch Nyhan syndrome.

UNIT IV: Integration of metabolism **No. of hours: 3**

Starve feed cycle: Metabolic shifts in absorptive, post absorptive, fasting and starvation states

PRACTICALS

CREDITS: 2 **TOTAL HOURS: 60**

1. Estimation of Random Blood Glucose – Glucose Oxidase- Peroxidase method
2. Estimation of Oral Glucose tolerance test (O-GTT).
3. Determination of Lipid Profile: Total Cholesterol (TC), High Density Lipoproteins (HDL) and Triglycerides (TAG).
4. Estimation of SGPT and SGOT in serum/plasma sample.
5. Estimation of creatinine in serum/plasma sample.
6. Estimation of Blood Urea.
7. Estimation of serum uric acid

Essential Readings

1. Nelson, D.L. and Cox, M.M. (2017). Lehninger: Principles of Biochemistry (7th ed.). W.H. Freeman & Company (New York), ISBN:13: 9781464126116 / ISBN:10-1464126119.
2. Berg, J.M., Tymoczko, J.L., Stryer L., (2012) Biochemistry 7th ed., W.H. Freeman and Company (New York); ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4.
3. Campbell, M.K., Farrel, S.O. (2012) Biochemistry7th ed, S.O. Brooks/Cole, Cengage Learning (Boston); ISBN: 13:978-1-111-42564-7 ISBN:10:1-4292-2936-5.
4. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10:0-07-099487-0

Suggested Readings

1. Principles of Biochemistry (2013) 4th ed., Voet, Donald,Voet, Judith &Pratt, charlotte. Wiley & Sons, Inc. (New Jersey), ISBN:978-1-11809244-6.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, Universityof Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – 11

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Animal Physiology (BS-DSC-402)	**4**	**2**		**2**	Class XII pass with Biology and chemistry	**None**

Learning Objectives

The Learning Objectives of this course are as follows:

- Seeks to understand what the physiological adaptations are that enable animalsto thrive across virtually any environment on earth, and
- How some of these adaptations can reveal the general principles that govern life functions
- Provides an understanding of fundamental principles of animal physiology and how these principles are incorporated into adaptations of different animal groups.
- Emphasizes on integrating the knowledge of how systemswithin diverse organisms' function and respond to changes in their environment
- Serves as a comprehensive guide to understand the complexity of an organ system and to cover the comparative aspects of system in different animal groups.
- The course is based on the "Krogh's principle", which proposes the use of specific organisms convenient to study specific questions and to address the central concept based on evolutionary adaptations.

Learning outcomes

Upon completion of the course, the students will be able to:

- Students will know how animals obtain energy from their environment.
- Students will understand the unique role of various organs and organ systems inperforming various vital functions.
- Students will understand the role of physiology in adapting to various environments.
- Students will appreciate the importance of homeostasis in different animals.
- Students will learn to apply critical thinking and integrate scientific knowledge to understand the basic physiological principles which led to diverse evolutionary adaptations.

SYLLABUS OF DSC- 11

Theory

TOTAL HOURS: 30 **CREDITS: 2**

Unit 1: Production of Energy **No. of hours: 4**

Feeding patterns found in different animals; Intracellular and extracellular digestion, cellulose digestion in animals: invertebrates, ruminants, non-ruminants and coprophagy.

Unit 2: Gas Exchange in Organisms **No. of hours: 5**

Physiology of aquatic and terrestrial breathing; Respiratory organs in aquatic and terrestrial organisms: respiration in insects: terrestrial, aquatic and cyclic respiration, respiration in fishes: ventilation, water pumping and counter current flow, respiration in birds: air sacs, lung function and crosscurrent flow

Unit 3: Bulk Transport **No. of hours: 6**

General plan of circulatory system in invertebrates and vertebrates: closed and open system of circulation, single circulation and double circulation: circulation patterns of cockroach, bony fishes and amphibians. Physiology of vertebrate heart: cardiac output, regulation of heartbeat- Starling' s law of the heart.

Unit 4: Regulatory Physiology **No. of hours: 10**

Homeostasis in animals: regulation of water and solutes in aquatic and terrestrial animals; osmoconformers and osmoregulators; physiology of osmoregulation in marine invertebrates, elasmobranchs and bony fishes (freshwater and marine); water balance in terrestrial animals: kangaroo rat.

Patterns of thermoregulation: heat exchange with the environment. Ectotherms: tolerance to high temperature (lethal temperature), tolerance to cold and freezing temperature (freeze tolerant and intolerant animals). Endotherms: thermogenesis and regulation of body temperature. Structural and functional adaptations to temperature stress (taking examples of arctic fox, penguins, and camels)

Unit 5: Integrative Physiology **No. of hours: 5**

An overview of neuronal structure and function; general principles of sensory physiology- chemoreceptors (gustatory and olfactory); mechanoreceptors (statocyst in invertebrates and lateral line system of fishes); sonar system in bats; electroreceptors (electric organs in fishes); thermoreceptors.

PRACTICALS

TOTAL HOURS: 60 **CREDITS: 2**

1. Effect of isotonic, hypotonic and hypertonic saline solutions on erythrocytes
2. Study of mouth parts and digestive system of *Periplaneta**
3. Preparation of temporary mounts: nerve cells and blood smear
4. Enumeration of Differential Leucocyte Count (D.L.C)
5. Effect of temperature on action of salivary amylase.

6. Study of permanent slides of nephridia of earthworm and mammalian oesophagus, stomach, ileum, rectum, liver, trachea, lung, kidney, spinal cord
(*Subject to UGC guidelines)

Essential Readings

1. Moyes, C. D., & Schulte, P. M. (2008). Principles of Animal Physiology. San Francisco, CA: Pearson/Benjamin Cummings.
2. Randall, D. C., Burggren, W. W., & French, K. (2002). Eckert Animal Physiology. New York: W. H. Freeman.
3. Schmidt-Nielsen, K. (2010). Animal Physiology: Adaptation and Environment. Cambridge: Cambridge University Press.

Suggested readings.

2. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics. S. Chand andCo. Ltd.
3. Reece, J. B., & Campbell, N. A. (2011). Campbell Biology. Boston: Benjamin Cummings /Pearson.

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DISCIPLINE SPECIFIC CORE COURSE –12 :

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Plant Physiology (BS-DSC-403)	**4**	**2**		**2**	Class XII pass with Biology and chemistry,	**None**

Learning Objectives

The Learning Objectives of this course are as follows:

- Gives the students an insight into the structure-function integration in plants.
- To appreciate the complex interactions of the plant with the environmental and edaphic factors that forms a major portion of plant physiology
- To provide students with comprehensive exposure to the subject of plant physiology.
- Aims to familiarize the students with the role of various functional processes of plants in their growth and development;
- To understand transport mechanisms and translocation in the phloem,
- Appreciate the commercial applications of plant physiology.

Learning outcomes

By the end of the course, the student will be able to:

- Comprehend the fundamental concepts of plant physiology
- Understand the physiological mechanisms of plant growth, function, and development.
- Understand the integration of soil, atmosphere, and plant in carrying outthe life processes by plants.
- Understand the complex regulation of phenomena of growth and flowering.
- Be able to use the knowledge gained to help crop growers, fruit farmers,floriculturists and others in the related area.

SYLLABUS OF DSC-12

Theory

Credits: 2 **Total Hours: 30**

Unit 1: Water relations **No. of hours: 9**

Water potential and its components (solute potential, pressure potential, gravimetric potentialand matric potential); inter cellular water transport (diffusion, mass flow and osmosis), short- distance transport (water absorption by roots), aquaporins, pathway of water movement (apoplastand symplast), water and ion uptake from soil into roots, root pressure, guttation, ascent of sap, cohesion-tension theory; Transpiration and its significance, factors affecting transpiration, anti- transpirants; Mechanism of stomatal movement (starch-sugar hypothesis, proton transport theory).

Unit 2: Plant Nutrition: uptake and distribution **No. of hours: 10**

Essential elements (macronutrients and micronutrients, criteria of essentiality, roles and deficiency symptoms), methods of study and use of nutrient solutions (ash analysis, hydroponics and aeroponics), Soil cation exchange capacity, transport of ions across cell membrane-passive transport and active transport, experimental evidence in support of phloem as the site of sugar translocation, Source-sink relationship, pressure flow model, phloem loading and unloading.

Unit 3: Regulation of plant growth **No. of hours: 5**

Discovery, basic structure, bioassays, physiological roles and commercial applications of auxins, gibberellins, cytokinins, abscisic acid and ethylene, general mechanism of mode of action of hormones. Brassinosteroids and Jasmonic acid (brief)

Unit 4. Physiology of Flowering **No. of hours: 6**

Photoperiodism: SDPs, LDPs, DNPs, photoinductive cycle(perception of photoperiodic signal), physiology of flowering (florigen concept), phytochrome (discovery, structure and responses on photomorphogenesis) vernalization, seed dormancy and germination (causes and methods to overcome dormancy).

2.1 Practical

Credit:2 **Total Hours: 60**

1. To determine the osmotic potential of plant cell sap by incipient plasmolytic method.
2. To determine the water potential by weight method.
3. To study the effect of two environmental factors on transpiration of an excised twig.
4. To calculate stomatal index and stomatal frequency of two surfaces of leaves of a mesophyte and a xerophyte.
5. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and a xerophyte (any one surface)
6. To demonstrate suction due to transpiration
7. To demonstrate the role of auxins in rooting of the cuttings
8. To study the phenomenon of Bolting
9. To study the role of Ethylene in fruit ripening
10. To study the effect of pH on anthocyanin pigments

Essential readings:

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons.U.S.A. 4th edition.
2. Kochhar, S.L. and Gujral, S.K. (2011). Comprehensive Practical Plant Physiology, Macmillan India Ltd, New Delhi.
3. Noggle, G.R. and Fritz,G.J. (1986).Introduction to Plant Physiology, 2nd Ed. PrenticeHall of India Ltd., New Delhi.
4. Salisbury, F.B. and Ross, C.W. (2005). Plant Physiology, Thomson Wadsworth, 4th edition.
5. Taiz, L., Zeiger, E. Moller, I.M. and Murphy, A. (2015). Plant Physiology and Development, Sinauer Associates Inc. U.S.A 6th edition.

Suggested readings:

1. Bhatla, S.C. and Lal M.A. (2018). Plant Physiology, Development and Metabolism, Springer Nature, 1st edition.
2. Nobel, P.S. (2009). Physicochemical and Environmental Plant Physiology, Academic Press, 4th edition.

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