INDEX

Sri Venkateswara College

Biological Science

Semester-III

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DISCIPLINE SPECIFIC CORE COURSE – 7:

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		
Physics for Biologists (BS-DSC-301)	**4**	**2**		**2**	Class XII pass with Biology	**NA**

Learning Objectives

The Learning Objectives of this course are as follows:

- To introduce the students to the basic concepts of physics and their applications in biology.
- To empower the students to develop a basic understanding about the principles and concepts of Physics
- To enable the students to develop quantitative approaches to solve physical/biological problems
- Provide a better understanding of various biophysical processes

Learning outcomes

On successful completion of course, the student will:

- Learn about various aspects of mechanics, centrifugal forces, mechanical forces with examples.
- Understand and explain molecular theory, Gauss's law, medical significance and applications of the dielectric properties of biological materials.
- Describe simple harmonic motion, diffraction, lasers and its applications in medical science.
- Appreciate the Doppler effect and the effects of vibrations in humans with respect to physics of hearing, heartbeat etc.
- Learn to investigate the light absorption properties of molecules through spectrophotometry, for qualitative and quantitative analysis of biomolecules

SYLLABUS OF DSC-7

Unit 1: Mechanics **3 weeks**

Conservation of momentum and energy, work energy theorem, Angular momentum, Torque, motion of a particle in the central force field. Influence of mechanical forces (Pressure, shear or elongation) on bone. Viscosity and viscous force, surface tension and viscoelasticity with examples such as, biopolymers, human tissues etc.

Unit 2: Dielectrics **3 weeks**

Dielectrics: Non polar/Polar dielectrics, Molecular theory of Dielectrics, Dielectric Constant, Gauss's Law in presence of dielectric, Three electric vectors and their relations, Electric susceptibility, Energy stored in dielectrics. Behaviour of dielectric in alternating field. Medical significance and applications of the dielectric properties of biological materials.

Unit 3: Waves and Optics **7 weeks**

Simple harmonic motion, Linearity and superposition Principle. Lissajous figures with equal and unequal frequencies and their uses. Effects of vibrations in humans: physics of hearing, heartbeat. Modern Optics: Superposition of waves: Young's double slit interference, Fraunhofer diffraction: diffraction through a single slit/double slit and grating, Resolving power, Resolution of the eye, Lasers: Principle, Population inversion, He-Ne Laser, characteristics of laser, Applications of lasers in medical science, Polarization by double refraction, Nicol prism. Doppler effect.

Unit 4: Spectroscopic techniques **2 weeks**

Beer-Lambert law, light absorption and its transmittance. UV and visible spectrophotometry-principles, instrumentation and applications. Fluorescence spectroscopy, static & dynamic quenching. light scattering in biology.

PRACTICALS

TOTAL HOURS: 60 **CREDIT: 2**

1. Determination of acceleration due to gravity using Kater's pendulum.
2. Determination of the acceleration due to gravity using bar pendulum.
3. Study of Lissajous figures using CRO.
4. Determination of the frequency of an electrically maintained tuning fork by Melde's Experiment.
5. Determination of the wavelength of laser source by through diffraction of (1) Single slit (2) Double slit.
6. Comparison of capacitances using De'Sautty's bridge.
7. Determination of the coefficient of Viscosity of water by capillary flow method (Poiseuille's method).
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine the wavelength of sodium/mercury light using diffraction grating.
10. Verification of Beer Law.
11. Determination of Molar Extinction coefficient.

REFERENCES

1. D. Kleppner, R. J. Kolenkow (1973). An introduction to Mechanics. McGraw Hill.
2. N. K. Bajaj (2008). The Physics of Waves and Oscillations. 5th edition. Tata McGraw Hill.
3. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill.
4. David Freifelder (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Bioogy. 2nd edition. W.H. freeman and Company.

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

DISCIPLINE SPECIFIC CORE COURSE – 8

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		
Protein Structure and Enzymology (BS-DSC-302)	**4**	**2**		**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**Should have studied Chemistry of Biomolecules**

Learning Objectives

The Learning Objectives of this course are as follows:

- Designed with an aim to introduce the students to proteins, most remarkable biomolecules in terms of diversity of structure and function
- Impart knowledge regarding various techniques employedto purify and characterize proteins
- Introduce them to the world of enzymes, biological catalysts with remarkable properties
- Enable them to understand important aspects of enzyme kinetics, mechanism of enzyme action and their regulatory properties
- Introduce the role of proteins and enzymes in medicine

Learning outcomes

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

- Describe the functional diversity of proteins and the different levels of structural organization of proteins
- Explain the relationship between protein structure and function.
- Appreciate and analyse the data from techniques used to purify and characterise proteins.
- Explain enzyme classification, activity, kinetics, inhibition, regulation and mechanism of action of different classes of enzymes
- Acquire knowledge about the application of enzymes in medicine andindustry.

SYLLABUS OF DSC- 8

Theory

Unit I: Protein structure and folding **5.5 weeks**

Amino acids: structure and their properties; Peptides and proteins; Diversity of proteins; Organization of protein structure- primary, secondary, tertiary and quaternary structures; Protein sequencing- Edman degradation. Peptide bond- dihedral angles; Ramachandran plot; Secondary structure elements: Helices, sheets and turns. Motifs and domains; Structures of myoglobin and Hemoglobin. Oxygen binding curves of myoglobin and hemoglobin Influence of 2,3-BPG, CO_2. Denaturation and renaturation of proteins and introduction to thermodynamics of folding. Role of chaperones in protein folding.

Unit II: Purification and analysis of proteins **2 weeks**

Ammonium sulphate fractionation, dialysis. Chromatographic techniques: Ion exchange chromatography, molecular sieve chromatography. Gel electrophoresis: SDS-PAGE.

Unit III: Introduction to Enzymes and enzyme kinetics **4 weeks**

Protein and non-protein nature of enzymes. Cofactor and prosthetic groups. Classification of enzymes; Fischer's lock & key and Koshland's induced fit hypothesis. Enzyme activity and specificity. Enzyme Kinetics-Michaelis-Menten equation and Lineweaver-Burk plot. Determination of Km, Vmax, Kcat. Types of enzyme inhibitions- competitive, uncompetitive, non-competitive, mixed.

Unit IV: Mechanisms of enzyme action and regulation **3.5 weeks**

Acid-base and covalent catalysis (chymotrypsin); Allosteric regulation and feedback inhibition (ATCase); reversible covalent modification (glycogen phosphorylase); Zymogen; Multi-enzyme complex (PDH). Isoenzymes. Applications of enzymes in medicine, industry and research

2.2 PRACTICALS

CREDIT: 2 **TOTAL HOURS: 60**

1. Introduction to spectrophotometer and verification of Beer law.
2. Estimation of proteins by Biuret method.
3. Estimation of proteins by Lowry's method.
4. Ammonium sulphate fractionation of crude homogenate from germinated mung beans.
5. Assay for acid phosphatase activity and specific activity.
6. Progress curve of enzyme
7. Effect of pH on enzyme activity.
8. Determination of Km and Vmax using Lineweaver-Burk plot.
9. Calculation of Ki for an enzyme

REFERENCES

1. Nelson, D.L., Cox, M.M. (2021). Lehninger: Principles of Biochemistry (8th ed.). New York, WH: Freeman and Company. ISBN: 13: 978-1319381493 / ISBN-10:1319381499.
2. Voet, D., Voet. J. G. (2013). Biochemistry (4th ed.). New Jersey, John Wiley & Sons Asia Pvt. Ltd. ISBN: 978-1-11809244-6.
3. Cooper, T. G. (2011) The Tools of Biochemistry (2nd ed.), Wiley-Interscience Publication (New Delhi); ISBN13: 9788126530168.
4. Price, N. C. and Stevens, L. (1999). Fundamentals of enzymology (3rd ed). Oxford: Oxford University Press; ISBN13: 978-0198502296

Additional Resources

1. Sheehan, D. (2013). Physical biochemistry: Principles and applications (2nd ed). Chichester: Wiley-Blackwell; ISBN13: 978-0470856024

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

DISCIPLINE SPECIFIC CORE COURSE –9 :

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		
Functional Ecology (BS-DSC-303)	**4**	**2**		**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NA**

Learning Objectives

The Learning Objectives of this course are as follows:

- To understand the basic concepts in ecology and levels of organization in an ecosystem
- Obtain a basic understanding of the various aspects of a 'population' and interactions among individuals of the same as well as different species.
- To understand the structure and functions of the community and its processes.
- To comprehend the components of an ecosystem, energy flow and nutrient cycling.
- To appreciate the applied aspects required in restoration of degraded ecosystems.
- To understand trade-offs in life history characteristics of organisms and various behaviors shownby organisms.

Learning outcomes

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

- To comprehend the principles and applications of ecology and ecosystem.
- Know about the importance of ecosystem in general and the effects of changes inecosystem.
- Understand the techniques used for the quantitative and qualitative estimation of bioticand abiotic components of an ecosystem.
- Gain knowledge about the density, frequency and diversity of species in an ecosystem.
- Understand about key interactions between organisms like competition , predation ,parasitism etc.
- Participate in citizen science initiatives from an ecological perspective

SYLLABUS OF DSC-9

Theory

Unit 1: Introduction to Ecology **1.5 weeks**

History of ecology, Autecology and synecology, levels of Organisation, Laws of limiting factors (Liebig's law of minimum, Shelford's law of tolerance), ecological range (Eury and Steno).

Unit 2: Population Ecology **6 weeks**

Population: Unitary and Modular populations; Metapopulation: Density, natality, mortality, life tables, fecundity tables, survivorship curves, sex ratio, age pyramids, dispersal and dispersion; carrying capacity, population dynamics (exponential and logistic growth equation and patterns), r and K selection, density-dependent and independent population regulation; Niche concept, Population interactions: Positive and negative interactions; Competition, Gause's Principle for competition with laboratory and field examples, Lotka-Volterra equation for predation.

Unit 3: Community Ecology 4 weeks

Community structure: Dominance, diversity, species richness, abundance, stratification; Diversity indices; Ecotone and edge effect; Community dynamics (succession): Primary and secondary succession, Succession on a bare rock. Climax: monoclimax and polyclimax concepts (preclimax, postclimax, disclimax etc.). Concept of keystone, indicator and flagship species with plant and animal examples.

Unit 4: Ecosystem Ecology 3.5 weeks

Concept, components, and types of ecosystems (example of Pond ecosystem in detail showing abiotic and biotic components), BOD, eutrophication. Energy flow (Grazing and Detritus food chain), linear and Y-shaped energy flow model, black box model, food web. Ecological pyramids and Ecological efficiencies.

PRACTICALS

CREDITS: 2 **Total weeks: 15**

1. To understand the principle and working of ecological instruments such as Anemometer, Hygrometer, Luxmeter, Rain gauge, turbidity meter, pH meter, Soil thermometer, Min-Max thermometer.
2. To study biotic interactions using specimens/ photographs/ permanent slides of Parasitic angiosperms, Saprophytic angiosperms, root nodules, velamen roots, lichens , corals
3. 3.To study plant-microbe interactions by preparing temporary stained mounts of VAM fungi / mycorrhizal roots/ root nodules.
4. Mark recapture method for determining population density of animals
5. 5.To determine a minimal quadrat area for sampling
6. To determine density, frequency and abundance of herbaceous vegetation by quadrat method
7. To estimate dissolved oxygen content of a given water sample using Winkler's method.
8. Plotting of survivorship curves from hypothetical life table data.

REFERENCES

1. Barrick, M., Odum, E. P., Barrett, G. W., (2005).*Fundamentals of Ecology*.5th Edition.Cengage Learning.
2. Smith, T. M..& Smith, R. L.(2012). *Elements of Ecology* 8th Edition. Pearson.
3. Ricklefs, R. E., & Miller, G. L., (2000).*Ecology*, 4thEdition W.H. Freeman.
4. Sharma, P. D. (2017). *Ecology and Environment*.13th Edition. Meerut: Rastogi Publications.

MOOCs

1. 'Ecology: Ecosystem Dynamics and Conservation from American Museum of Natural History on Coursera https://www.classcentral.com/course/coursera-ecology- ecosystem-dynamics-and-conservation-10618
2. https://alison.com/course/diploma-in-ecology-studies
3. https://swayam.gov.in/ Any ecology based online course that may be available during the semester, depending on its relevance to the present syllabus

DISCIPLINE SPECIFIC ELECTIVE COURSE –DSE-1 :

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Medicinal And Ethnobotany (BS-DSE-1)	**4**	**2**		**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NA**

Learning Objectives:

Plants are imperative to mankind with almost all plants known to possess medicinal values. There is an increased emphasis on indigenous system of medicine which has lent prime focus on medicinal plants. Keeping the therapeutic importance of medicinal plants in mind this course is designed to provide education and training on diverse perspectives of medicinal plants. The course also offers comprehensive knowledge about understanding the difference between ancient wisdom and themodern system of medicine.

Learning Outcomes:

On successful completion of the course, a student will:

- Be able to identify the common medicinal plants in their vicinity.
- Learn about the traditional healing sciences namely Ayurveda, Siddha and Unani, which have been used since the ancient times.
- Appreciate the importance of conservation strategies for medicinal plants.
- Be able to understand the importance of medicinal plants, significance of ethnobotany, role of ethnic groups in the conservation of medicinal plants.

Course Contents - Theory

Unit 1: History, Scope and Importance of Medicinal Plants **No. of weeks 5**

Introduction to indigenous systems of medicines- Ayurveda, Unani and Siddha system of medicine)- Ayurveda: History, origin, Panchamahabhutas, Saptadhatu and Tridosha concepts, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system. Unani: History, concept: Umoor-e- tabiya. Plants used in Ayurveda, Siddha and Unani medicine with special reference to *Carum carvi, Plantago ovata, Allium sativum, Asparagus racemosus, Vitis vinifera, Linum usitatissimum, Amaranthus paniculatus.* Polyherbal formulations (with special reference to Safi, Chyawanprash, Trifala, Swalin, Amukkara Choorna, Gandhak rasayana). Natural products – Compounds responsible for biological activity of medicinal plants: their biology, and pharmacology (*Curcumin, Vinblastine, Vincristine, Ecliptine, Cinchonine, Azadirachtin, Artemisinin*).

Unit 2: Conservation of Endangered and Endemic Medicinal Plants **No. of weeks: 4**

Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanical Gardens, herbal gardens, Ethnomedicinal plant gardens. Germplasm conservation, cryopreservation (Cryo banks and DNA banks), Role of NBPGR and JNTBGRI in conservation of plants, Propagation of Medicinal Plants: *In vitro* and *In vivo* strategies. Adulteration of Herbal drugs. Organoleptic, microscopic and phytochemical evaluation of plant drugs.

Unit 3: Ethnobotany and Folk Medicines **No. of weeks: 6**

Introduction, concept, scope and objectives; Ethnobotany in India: Methods to study ethnobotany; Folk medicines of ethnobotany, Role of ethnobotany in modern medicine with special reference to *Rauvolfia serpentina, Trichopus zeylanicus, Artemisia, Withania.* Major and minor ethnic groups of India and their lifestyles. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases. Role of ethnic groups in conservation of plant genetic resources; Brief account of biopiracy and IPR.

PRACTICAL

Credit: 2 **Total weeks: 15**

1. Identification of any ten common medicinal plants in the surrounding area and study their characteristic features.
2. Collection, identification and preparation of herbarium of any five medicinal plants.
3. Extraction and qualitative estimation of active principle compounds (alkaloids, tanins, saponins and flavanoids) from any four medicinal plants. (*Aloe vera, Ocimum, Azadirachta, Catharanthus, Adhatoda, Withania*)
4. Study of components and medicinal uses of common polyherbal formulations used in the traditional system of medicine (Ayurveda, Unani and Siddha).
5. Study of organoleptic, macroscopic and microscopic parameters of any two medicinal plants.
6. To compare the total phenolic content of few locally available medicinal plants
7. Field trip: Industries/Institutes/herbal garden/ medicinal gardens/ nurseries/tribal museum.
8. e-presentations (System of medicine, Conservation strategies, propagation of medicinal plants, folk medicines, application of natural products to certain diseases listed in the syllabus)

Essential readings:

1. Abdin, M. Z. and Abrol, Y. P., (2006). *Traditional Systems of Medicine.* Narosa Publishing House, New Delhi.
2. Kumar, S., (2018). *Ethnobotany*. Kojo press, New Delhi.
3. Purohit and Vyas, (2008). *Medicinal Plant Cultivation: A Scientific Approach,* Agrobios.
4. Trivedi, P. C. (2006). *Medicinal Plants: Ethnobotanical Approach.* Agrobios.

Additional Readigs

1. Colton, C. M., (1997). *Ethnobotany: Principles and Applications*. John Wiley and Sons.
2. Jain, S. K., (1990). *Contributions to Indian Ethnobotany*. Scientific publishers, Jodhpur.
3. Jain, S. K., (1995). *Manual of Ethnobotany.* Scientific Publishers, Jodhpur.

DISCIPLINE SPECIFIC ELECTIVE COURSE –DSE-2 :

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Hormone biochemistry (BS-DSE-2)	**4**	**2**		**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NA**

Learning Objectives:

The course is designed to enable the students to understand and appreciate the delicate network and balance of hormones required for the healthy functioning of the human body. The course emphasizes on studying the different types of hormones along with their physiological action. The students will be taught the consequences of any hormonal imbalances (over and underproduction of hormones) with special emphasis on human diseases. It provides an understanding of the different endocrine factors that regulate metabolism, growth, electrolyte and mineral homeostasis, glucose homeostasis, stress physiology and reproductive function. It also prepares a student for postgraduate studies in any course related to molecular medicine.

Learning Outcomes:

On successful completion of the course, a student will:

- Understand the role of endocrine system in maintaining ionic and glucose homeostasis
- Should be able to describe molecular, biochemical and physiological effects of all hormones and factors on cells and tissues.
- Understand the integrative communications that regulate, growth, appetite, metabolism and reproduction
- Prepares the student for interpreting clinical parameters in a real-life situation.

Course Contents -Theory

Unit 1: Introduction to hormones and Hypothalamic-hypophyseal system: 2.5 weeks

Introduction to hormones; Hypothalamic - pituitary axis- anatomy, histology, vasculature, and secretions. Physiological and biochemical actions of hypothalamic hormones and Anterior pituitary hormones; Hormone feed- back regulatory cascade. Posterior pituitary hormones –structure, physiology and biochemical actions of AVP and Oxytocin; Diabetes insipidus

Unit 2: Hormones regulating growth, energy metabolism and calcium homeostasis

5 weeks

Regulation of Growth: growth hormone and somatomedin, Endocrine disorders - gigantism, acromegaly, dwarfism, pygmies. Thyroid gland- Biosynthesis of thyroid hormone and its regulation: Role of TRH, TSH in T_4 synthesis and response. Physiological and biochemical action of Thyroxine. Pathophysiology of thyroxine secretion: Goiter, Graves' disease, cretinism, myxedema.
Regulation of calcium homeostasis: PTH, Vitamin D and calcitonin. Mechanism of Ca^{2+} regulation involving bone, skin, liver, gut and kidneys. Pathophysiology - rickets, osteomalacia, osteoporosis.

Unit 3: Hormones regulating glucose homeostasis, stress physiology and electrolyte balance: 5 weeks

Hormones of the Pancreas: structure, synthesis, regulation of release, incretins, physiology and biochemical actions of insulin and glucagon. Role of these hormones in blood glucose homeostasis; Pathophysiology - diabetes type I and type II. GIT hormones: Secretin, gastrin and incretins.
Physiology and action of Aldosterone; the Renin Angiotensin System. Physiology and Biochemical actions of Cortisol; Role of POMC and CRH in cortisol synthesis; Adrenal medullary hormones: epinephrine and norepinephrine. The Fight or flight response; Dual receptor hypothesis. General adaptation syndrome: acute and chronic stress response. Pathophysiology – Addison's disease, Conn's syndrome, Cushing syndrome.

Unit 4: Reproductive hormones: 2.5 Weeks

Male and female sex hormones. Role of testosterone in male secondary sexual characteristics. Interplay of hormones during ovarian and uterine phases of menstrual cycle; Placental hormones; role of hormones during parturition and lactation. Hormone based Contraceptives.

PRACTICAL

Credit: 2 **Total weeks: 15**

1. Glucose tolerance test.
2. Estimation of serum Ca^{2+} by o-CPC method
3. Determining the thyroid profile by estimating T_4 and TSH under normal and pathophysiological conditions.
4. Estimation of estrogen during different days of the menstrual cycle.
5. HCG based pregnancy test.
6. Estimation of serum electrolytes.
7. Presentation on GI Tract hormones and Adipokines
8. Case studies: Diabetes Insipidus, Acromegaly and dwarfism, Diabetes Mellitus, Rickets, Osteoporosis, Cushing syndrome

3.3 Essential readings:

1. Vander's Human Physiology (2008) 11th ed.,Widmaier, E.P., Raff, H. and Strang, K.T. McGraw Hill International Publications, ISBN: 978-0-07-128366-3.
2. Sherwood, L. (2012) Introduction to Human Physiology 8th edition; Brooks/Cole, Cengage Learning. ISBN-13: 978-1133104544.
3. Victor Rodwell, David Bender, et al. (2018) ISE Harper's Illustrated Biochemistry Thirty-First Edition, McGraw Hill (A and L Lange series), ISBN-10. 1259837939 ; ISBN-13. 978-1259837937

Suggested readings:

1. Endocrinology (2007) 6th ed., Hadley, M.C. and Levine, J.E. Pearson Education (New Delhi), Inc. ISBN: 978-81-317-2610-5.
2. Guyton, A.C. and Hall, J.E., (2016) Reed Textbook of Medical Physiology 13th ed., Elseviers India Pvt. Ltd. (New Delhi). ISBN: 978-1455770052

DISCIPLINE SPECIFIC ELECTIVE COURSE –DSE-3 :

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Applied entomology (BS-DSE-3)	**4**	**2**		**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NA**

Learning Objectives:

The study of Applied Entomology provides an insight about the role of insects as powerful competitors of man as they cause enormous injury to crops and animals and also act as vectors of many diseases. This course will help the students to understand the concept of insect pests and their population dynamics in relation to changing environmental conditions as well as the role of economically important insects in tremendous commercial benefits to humans. The students will learn about various types of pests, their distinguishing features, life cycle, damage to crops and human health by them. This will be of help in choosing the appropriate control measures to manage the pest population in nature and to avoid heavy economic losses.

Learning Outcomes:

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

- Learn about the concept of pest and pest status.
- Understand the difference between various types of pests and Crop losses and extent of damage caused by them.
- Gain knowledge about economically important insects; important pests of crops, fruits, vegetables, stored grains and also about medically important insects.
- Analysis of varied types of control measures for management of pest populations and list suitable control measures- specific for every pest.

Course Contents- Theory

Unit 1: Pests and Economically important Insects **2.5 weeks**

Introduction, Factors responsible for emergence of pest, Pest status, Pest population dynamics. Economically important Insects; Honey Bee and Silkworm

Unit 2: Bionomics and Control of Crop pests **3.5 weeks**

Rice pest (*Leptocorisa acuta*); Wheat pest (*Sesamia inferens*); Pulse pest (*Helicoverpa armigera*); Cotton pests (*Pectinophora gossypiella*); Vegetable pest (*Raphidopalpa foveicollis).*

Unit 3: Stored Grain Pests **3 weeks**

Bionomics and strategies for the management of stored grain pests; *Sitophilus oryzae, Corcyra cephalonica, Trogoderma granarium, Callosobruchus chinensis*.

Unit 4: Medically Important Pests **2.5 weeks**

Bionomics and Management of the Medically Important pests; Fleas, Mosquitoes, Housefly.

Unit 5: Pest Management Tactics **3.5 weeks**

Methods of Physical, Mechanical, Cultural, Biological, Genetic control of insects; Chemical controls. Integrated Pest Management (IPM).

PRACTICAL

Credits: 2 **Total weeks 15**

1. Identification of Agricultural Pests and Damage caused by them: *Leptocorisa acuta, Sesamia inferens, Helicoverpa armigera, Raphidopalpa foveicollis*.
2. Identification of Stored Grain Pests and Damage caused by them: *Sitophilus oryzae, Corcyra cephalonica, Trogoderma granarium, Callosobruchus chinensis.*
3. Study of the Morphological Features of Rat flea, Mosquitoes, Housefly and their Medical Importance.
4. Determination of LD50 or LC50 of Insecticides based on the data provided.
5. Instruments used in chemical control of pests.
6. Project report on any one economically important insect/ rearing of a pest.
7. Field Trips to Entomological Institutes/Museums/Laboratories

3.3 Essential Readings:

1. Atwal, A.S. (1993) Agricultural Pests of India and South East Asia. Kalyani Publishers, New Delhi.
2. Dennis, S. Hill (2005) Agricultural Insect Pests of the Tropics and Their Management, Cambridge University press. Suggested Readings:
3. S. Pradhan. Insect Pest of Crops. National Book Trust, New Delhi.

Suggested Readings:

1. Pedigo, L.P. (1996) Entomology and Pest Management. Prentice Hall, New Delhi.

Online Tools and Web Resources:

- https://swayam.gov/appliedentomology
- http://mesamalaria.org/updates/mooc-medical-entomology-organized-institut-pasteur
- https://www.pasteur.fr/en/mooc-medical-entomology-insect-vectors-andtransmission-pathogens
- https://www.entsoc.org/resources/education/online-courses