



**Parishkar College of Global Excellence
(Autonomous), Jaipur**

CHOICE BASED CREDIT SYSTEM (CBCS)

B. Sc. (Zoology, Botany & Chemistry)

ZOOLOGY

Faculty Members

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PREAMBLE

The University Grants Commission (UGC) has initiated several important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters. The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. The HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students.

Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Centric Elective (DCE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

3. Skill Enhancement Course (SEC) SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Duration of the Course

The duration of Bachelor of Science with Zoology shall be of three academic years. Each year shall be divided in two semesters i.e. semester-1, semester-2. Accordingly, the three years shall consist of six semesters. However, a student is required to pass out the said course within a maximum period of 6 years from the date of admission to 1st semester where after he/she shall stand unfit for the course.

Department Overview

With the new era of education under CBCS system of UGC the department aims to develop a curriculum for Parishkar in such a way that the students have a complete holistic development of their character and values. Many qualified minds worked together to provide “a cut above” to the ever-growing demands of the industry and to prepare students for higher studies and research devoted to society. The interactive method of teaching at Parishkar College of Global Excellence is to bring about attitudinal changes to future professionals of the industry with an edge of creativity.

The department of Zoology was established in Parishkar 2014 onwards. The department imparts equal importance to practical, theoretical and co-curricular activities apart from experiential and digital modes of learning. Projects and Industrial projects form an integral part of the curriculum. Along with the syllabus, Parishkar College of Global Excellence emphasizes on Value Addition Programs and a complete Holistic development of students open elective programmes and Placement Training Programs, training students in group discussions, facing interviews and so on.

Programme Outcomes

On successful completions of the B.Sc. Programme students will be able to

- Understand and apply the fundamental principles, concepts and methods in key areas of science and multidisciplinary fields
- Demonstrate problem solving, analytical and logical skills to provide solutions for the scientific requirements.
- Develop the critical thinking with scientific temper.
- Communicate the subject effectively.
- Understand the importance and judicious use of technology for the sustainable growth of mankind in synergy with nature.
- Understand the professional, ethical and social responsibilities.
- Enhance the research culture and uphold the scientific integrity and objectivity.
- Engage in continuous reflective learning in the context of technological and scientific advancements.
- Express proficiency in oral and written communications to appreciate innovation in research.
- Develop industry-focused skills to lead a successful career.

Programme Highlights

- Approaching the subject from theoretical and practical points of view.
- Opportunity to attend seminars, workshops etc.
- Extra-curricular activities for peer interaction, growth of organizational skills and personality development.
- Well-equipped and spacious laboratories.
- Well qualified and experienced staff.
- Industrial collaboration/training.
- Placement opportunities.
- Good library and internet facilities.
- Industrial /Institutional projects. Guest lectures by experts from the field.

B.Sc. Pass Course Scheme								
Proposed scheme for choice-based credit system in B.Sc. Zoology								
Semester	Subject 1 (Credit-6)	Subject 2 (Credit-6)	Subject 3 (Credit-6)	Ability Enhancement (Credit-4)	Skill Enhancement (Credit-4)	Subject 1 (Credit-6)	Subject 2 (Credit-6)	Subject 3 (Credit-6)
I	Botany	Zoology		English/Hindi Communication	SEC-1			
II	Botany	Zoology	Chemistry		SEC-2			
III	Botany	Zoology	Chemistry		SEC-3			
IV	Botany	Zoology	Chemistry		SEC-4			
V			Chemistry			Botany	Zoology	Chemistry
VI				EVS		Botany/Dissertation	Zoology/Dissertation	Chemistry/Dissertation

Note: -

- Switch Dissertation with either of the Elective Paper (Only One).
- Freedom of selection of various subjects for industrial exposure.

Credits Scheme

S.No.	Course	Credits	Total Credits	
1.	Core Paper-12	6	12 × 6	72
2.	Ability Enhancement-2	4	2 × 4	8
3.	Skill Enhancement-4	4	4 × 4	16
4.	Elective Course-6	6	6 × 6	36
Total				132

- Student can opt any SEC offered by any Department.

Types and Nomenclature of Courses in Zoology for BSc Pass Course

Core Courses

1. Animal Diversity
2. Physiology and Biochemistry.
3. Comparative Anatomy and Developmental Biology of Vertebrates.
4. Genetics and Evolutionary Biology

Discipline Centric Elective Courses (Any 2)

1. Cell Biology
2. Animal Biotechnology
3. Fish and Fisheries
4. Reproductive Biology
5. Animal Behaviour and Ecology
6. Applied Zoology

Skill Enhancement Courses (Any 4). Student can opt any SEC offered by any Department.

1. Medical Diagnostic
2. Bioinformatics and Biostatistics
3. Food Nutrition Health and Disease.
4. Apiculture

Ability Enhancement Courses

1. English/ Hindi Communication
2. Environmental Science

Course Description

The student will have to study twelve core courses (4 in each subject), two ability enhancement courses, four skill enhancement courses and six discipline specific elective course for successful completion of the BSc degree Program.

For subject Zoology

Students have to study the given 4 core courses however they have choice in Discipline elective course and Skill enhancement course.

Course Assessments

- Assessments will be in form of written exams, Assignments and lab work.
- Examinations in one semester will be one midterm and one final.
- Assignments will be judged upon the timely submission and contents.
- Lab work will be assessed as routine lab work, lab assignment and project.
- Continuous process of evaluation will be followed

Semester I
CORE COURSE I
ANIMAL DIVERSITY
THEORY (CREDITS 4)

Course objectives

- The course intends to explore the diverse animals in a systematic manner.
- The course would define the gradual development of complexity in the process of evolution.
- This gives a broad outlook of diverse animal kingdom and their specific features in detail.

Learning outcomes

After the successful completion of this course the students will be able

1. To identify the vast animal kingdom.
2. To understand the basics of Taxonomy.
3. To understand the organisation of animal body from simple to complex forms.
4. To understand the specific feature of organism in general context to nature.

Unit 1

13 hours

Protista- Helminthes

Discussion on recent diseases

Taxonomy, Vocabulary of Zoology, Institutions of Zoology, Scope of Zoology, Level of organisation in organisms

Kingdom Protista General Characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

Economic Importance of Protozoans in respect to human, diseases, regulation of environment and useful Protozoa.

Phylum Porifera

General characters and classification up to classes; Canal System in sponges.

In contribution of carbon storage of environment.

Phylum Cnidaria

General characters and classification up to classes; Polymorphism in Hydrozoa

Phylum Platyhelminthes

General characters and classification up to classes; Life history of *Taenia solium*

Phylum Nemathelminths

General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations

Unit 2:

15 hours

Annledia – Echinodermata

Phylum Annelida

General characters and classification up to classes; Metamerism in Annelida, Economic importance its significance in regulation of self-fertilization.

Phylum Arthropoda

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects. Communication in Arthropoda

Phylum Mollusca

General characters and classification up to classes; Torsion in gastropods.

Phylum Echinodermata

Economic Importance of Arthropoda their sections as pesticides and attractants.

General characters and classification up to classes; Water-vascular system in Asteroidea, Star fish

Unit 3

12 hours

Protochordates

General features and Phylogeny of Protochordata, Agnatha

General features of Agnatha and classification of cyclostomes up to classes. Importance of Jaws in classification.

Economic Importance of Arthropoda their sections as pesticides and attractants.

Pisces

General features and Classification up to orders; Osmoregulation in Fishes, Parental Care, Types of scales and fins, Migration.

Food industry of Fishes

Unit 4

20 hours

Tetrapoda Amphibia- Mammals

Amphibia

General features and Classification up to orders; Parental care. Adaptations to live outside water.

Reptiles

General features and Classification up to orders; Identification of Poisonous and non-poisonous snakes with examples, Snake bite identification, Structure of Fangs, Biting mechanism in snakes. Venom of snakes and other organism, their application in medicine.

Aves

General features and Classification up to orders; Flight adaptations in birds, Migration in Birds.

Mammals

Classification and Characters up to orders; Origin of mammals and phylogeny. Phylogeny and evolution to predict future human and relationship with aliens

ANIMAL DIVERSITY PRACTICAL (CREDITS 2)

1. Study of the following specimens:

Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus,

Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis,

Any six common birds from different orders, *Sorex*, Bat, *Funambulus, Loris*

2. Study of the following permanent slides:

T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

3. Key for Identification of poisonous and non-poisonous snakes

An “animal album” containing photographs, cut outs, with appropriate write up about the above-mentioned taxa. Different taxa/ topics may be developed by the different sets of students for this purpose.

ESSENTIAL READINGS

- Kotpal R.L, (2015) Modern Text Book of Zoology: Invertebrates Rastogi Publications, India
- P.S.Verma, **Invertebrate Zoology (2001)** (Multicolour Edition),S. Chand Publishing, India
- Jordan EL, Verma PS (2021) Invertebrate Zoology, S Chand and Company Publishing, India.
- Kotpal R.L, (2015) Modern Text Book of Zoology: Vertebrates Rastogi Publications, India
- Verma P.S., Agarwal V.K. Chordate and Embryology **(2016)** S. Chand Publishing, India
- Jordan EL, Verma PS (2021) Chordate Zoology, S Chand and Company Publishing, India.
- Sharma S K, Goyal P.K, (2019) Chordata, CBH, India

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrímsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers In

Semester II

CORE COURSE II PHYSIOLOGY AND BIOCHEMISTRY THEORY (CREDITS 4)

Course objectives

- The course intends to explore the working systems of animals inside the body.
- The course would explain the basic vital process of living animal systems like digestion, reproduction and others.
- This gives a broad outlook of what animal body is made of in terms of chemical molecules.

Learning outcomes

After the successful completion of this course the students will be able

1. To identify the vital functions of metabolism in animal body.
2. To understand the basics functioning of system in mammalian organisms.
3. To understand the biomolecules.
4. To understand the functioning of biomolecules in an organised animal system.

Unit 1 Physiology

17 Hours

Digestion: Types of nutrition, feeding mechanism, balanced diet. Physiology of digestion, absorption and assimilation of carbohydrates, proteins and lipids. Gall bladder as an accessory gland for digestion. Diseases and causes of diseases of digestion

Respiration: Organs of respiration gills, lungs and skin. Pulmonary ventilation, Respiratory Quotient, volumes and capacities, Transport of Oxygen and carbon dioxide in blood. Variations in lungs due to smoke, air pollution, Cigarette etc

Excretion and its types: Structure of Kidney, Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism, Osmoregulation. Dialysis, Kidney Stone.

Nerve and muscle: Structure of a neuron and synapse, Resting membrane potential, Graded potential, Reflex arc, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction.

Unit 2 Physiology

16 Hours

Cardiovascular system Composition of blood, Homeostasis, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle. Heartbeat, Blood pressure, clotting, blood groups, ECG and EEG. Importance of Spleen.

General information of heartbeat rates and cardiac arrest.

Reproduction and Endocrine Glands Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle Structure and function of pituitary, pineal, thyroid, Parathyroid, pancreas and adrenal glands.

Unit 3 Metabolism- Carbohydrate and Lipid

14 Hours

Introduction to metabolism: Anabolism and Catabolism.

Carbohydrate Metabolism Glycolysis, Krebs cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain Glucagon and Insulin activity in sugar level maintenance.

Lipid Metabolism Biosynthesis and β oxidation of palmitic acid. Hormonal diseases in respect crime control

Unit 4 Protein Metabolism and Enzymes

13 Hours

Protein metabolism Transamination, Deamination and Urea Cycle

Types of Enzymes

Enzymes Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation.

PHYSIOLOGY AND BIOCHEMISTRY PRACTICAL (CREDITS 2)

1. Blood group testing
2. Blood cells identification and count
3. Diabetes Sugar testing kits
4. Sphygmomanometer blood pressure instrument.
5. Preparation of hemin and hem chromogen crystals.
6. Artificial Respiration techniques
7. ECG reading technique.
8. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
9. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
10. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
11. Estimation of total protein in given solutions by Lowry's method.
12. Study of activity of salivary amylase under optimum conditions

ESSENTIAL READINGS

- Bhatia A L, Kohli KS, (2015) Animal Physiology and Biochemistry, RBD Publication house.
- Agarwal RA, Srivastava AK, Kumar Kaushal (2016) Animal Physiology and Biochemistry, S Chand and Company.
- Sastri KV, (2013), Animal Physiology and Biochemistry, Rastogi Publication.
- Sharma S K, Goyal PK, (2013) Animal Physiology and Biochemistry, CBH Publication
- Rana Shinde, MN Chatterjea (2008) Textbook of Medical Biochemistry, Jaypee Brothers Medical Publishers Pvt. Limited.
- Prema Sembulingam, K Sembulingam.(2019.) Essentials of Medical Physiology, Jaypee Brothers Medical Publishers Pvt. Limited.

SUGGESTED READINGS

- Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Leininger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill

Skill Enhancement Course I MEDICAL DIAGNOSTICS THEORY (Credits 4)

Course objectives

- To develop some knowledge about +different medical tests performing and its need.
- To develop basic skill of test performing ability.
- To organise and perform a test in medical laboratory

Learning Outcomes.

After successful completion of this course the student should be able to

1. To collect samples for testing.
2. To perform the tests independently in a lab.
3. To perform all tasks in any medical lab.

Unit 1:

Introduction to Medical Diagnostics and its Importance 14 Hours

Overview of medical diagnostic tools and machines and their working principle.

Unit 2:

Diagnostics Methods Used for Analysis of Blood 16 Hours

Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.) BT and Ct, Blood group testing, LFT.SGOT, SGPT essay.

Unit 3:

Diagnostic Methods Used for Urine Analysis

15 Hours

Urine Analysis: Physical characteristics; Abnormal constituents as blood, albumin, KFT

Unit 4:

Non-infectious Diseases

15 Hours

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit. Some other tests like X-Ray, PET, MRI, CT scan.

Essential Readings

- Park, K. (2007), *Preventive and Social Medicine*, B.B. Publishers,
- Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology*, II Edition, Bhalani Publishing House
- Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*

SUGGESTED READINGS

- Guyton A.C. and Hall J.E. *Textbook of Medical Physiology*, Saunders
- Robbins and Cortan, *Pathologic Basis of Disease*, VIII Edition, Saunders
- Prakash, G. (2012), *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd

Skill Enhancement Course II
Bioinformatics and Biostatistics
Theory (Credit 4)

Course Objective

- To understand the art of developing and presenting into categories
- To understand and present data in form of tables, graphs and diagrams.
- To evaluate and deduce the significance of data.
- To understand the application of Bioinformatics.
- To understand use and generate data categories and then into data base.

Learning Outcomes.

After successful completion of the course the student will be able

1. To develop data and present it in scientific method.
2. To explain data in different form of tables and graphs.
3. To understand the application of Bioinformatics.
4. To use and work on NCBI.

5. To comprehend the databases primary and secondary and structured data base.

Unit 1 Bioinformatics

15 Hours

History scope and importance of bioinformatics and important contributions, Aims and tests of Bioinformatics and its applications. Basics of Internet HTML introduction to NCBI data model, Various file format for biological sequences.

Unit 2 Bioinformatics

15 Hours

Database Tools and their bases, importance of databases, biological databases Primary sequence Database composite sequence, Secondary Database, Nucleic acid sequence database, Protein sequence databases and structured Database bibliographic databases.

Unit 3 Biostatistics

15 Hours

Data collection categorisation and presentation, Primary and Secondary data collection, sampling methods, Merits and demerits, sampling errors categorisation of grouped and ungrouped data with continuous and discontinuous series. Presentation, Tabulation and diagrammatic presentation as line, bar, pie Dot, Ogive and histogram graphs.

Unit 4 Biostatistics

15 Hours

Major of central tendency and significance, mean, median, mode, standard deviation and standard error, Chi Square test, Student's t test simple correlation and linear regression

Essential readings

- Prasad and Satguru (2020) Elements of Biostatistics, Rastogi Publications
- Sharma AK (2005) Text Book of Biostatistics II, Discovery Publishing House.

Suggested Readings

- Design and Analysis of Experiments, by Douglas C. Montgomery 8 edition
- Basics of Biostatistics: A Manual for Medical Practitioners 2017 by Jatinder Bali (Author), Anil Kant (Author)

Skill Enhancement Course III Food, Nutrition, Health and Diseases Theory (Credit 4)

Course Objective

- To understand the concept of food and nutrition
- To understand the importance of Nutrition on health
- To understand the different types of diseases and prevent it.
- To understand the causes diseases and prevent it to maximum.

Learning Outcomes.

After successful completion of the course the student will be able

1. To define health and ill health
2. To define the concept of food nutrition and balanced diet.
3. To work out a balanced diet for maintaining normal health.
4. To understand life style dependent diseases.

5. To identify the causes of exposure and outbreak of infectious disease.

Unit 1

15 hours

Basic concept of food and nutrition

Food function, Components and food-nutrients Concept of a balanced diet, nutrient needs and dietary pattern for various groups adults school children, adolescents and elderly

Unit 2

15 hours

Health and deficiency diseases

Introduction to health- Definition and concept of health Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders- their causes, symptoms, treatment, prevention and government programs, if any.

Unit 3

15 hours

Life style related diseases

Life style related diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary and lifestyle modifications social health problems- smoking, alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS) - their causes, treatment and prevention

Unit 4

15 Hours

Food hygiene

Potable water- sources and methods of purification at domestic level Food and Water borne infections: Bacterial infection: Cholera, typhoid fever, dysentery; Viral infection: Hepatitis, Poliomyelitis, Protozoan infection: amoebiasis, giardiasis; Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention Brief account of food spoilage: Causes of food spoilage and their preventive measures

Essential Readings

- Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
- Srilakshmi B. Nutrition Science; 2002; New Age International (P) Ltd

Suggested Readings

- Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
- Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
- Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd. Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.
- Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence.
- Manay MS, Shadaksharaswamy. Food-Facts and Principles; 1998; New Age International (P) Ltd. Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing

Skill Enhancement Course IV
Apiculture
Theory (Credit 4)

Course Objective

- To understand the concept of Apiculture
- To gain knowledge about the honey bees, the social behaviour, management of equipment and colonisation
- To make aware of the economic importance and its diseases.
- To benefit them by culture techniques, develop entrepreneurship bees wax and honey.

Learning Outcomes.

After successful completion of the course the student will be able

1. To know about bee keeping apiculture status in India Honey bee species and diseases
2. To understand honey bee behaviour, bee colony and its management.
3. To know artificial bee hive construction and handling.
4. To manage an apiculture unit.

Unit 1

Honey Bees

15 Hour

Scope of Bee keeping, Present status of Apiculture in India, Honey bee Systematic position, species of Honey bees, Morphology and Life history. Siting apparatus and bee poisoning diseases, Viral, Bacterial fungal and protozoan infections.

Unit 2:

Bees and their Behaviour

15 Hour

Bee colony castes, natural colonies and their yield. Bee forging – pollen and nectar yielding plants. Honey Bee –Behaviour swarming pheromones queen and its management.

Unit 3

Apiary

15 Hour

Apiary Management natural and Artificial Bee Hives, Types-Constriction of Space frames Selection of Sites, handling, Maintenance, instruments Employed in Apiary.

Unit 4

Economic importance

15 Hour

Honey extraction: Honey composition, honey extraction, seasonal maintenance, **bee wax** and its uses: national and international markets for honey and wax; apiculture as self-employment venture.

Essential Readings

1. Bisht D.S., Apiculture, ICAR Publication.
2. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi

Suggested Readings

1. Singh, S. Bee keeping in India, Indian Council of Agriculture Research, New Delhi.
2. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
3. Johnson, J., and Jayachandra, I. 2005. Apiculture, Olympic graphic, Marthandam

4. Shukla, G.S. and Upathway, V.B. 2000. Economic Zoology, Rastogi publication Meerut.