Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune-5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

S. Y. B. Sc. Zoology (2024 Pattern)

Choice Based Credit System (CBCS) Syllabus
Under National Education Policy (NEP)

To be implemented from Academic Year 2025-2026

Semester-III

Level:- 5.0 (Second Year) **Sem: III**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2or4), (T/P)(2)	24ScZooU3101	Genetics & Histology of Mammals-II	4		4		40	60	100
	24ScZooU3102	Lab Course on 24ScZooU3101		2		4	20	30	50
VSCP(2)	24ScZooU3501	Lab Course on Beekeeping		2		4	20	30	50
IKS(T/P)(2)	24ScZooU3901	Ancient Knowledge of Animal use in India	2		2		20	30	50
FPP(2)	24ScZooU3002	Field Project I		2		4	20	30	50
Minor (T/P)(2+2or 4)	24ScZooU3301	Applied Zoology	2		2		20	30	50
	24ScZooU3302	LabCourseon24ScZooU3301		2		4	20	30	50
GE/OE(T/P) (2)	24ScZooU3401	Insect Pest and Vector Biology and Management	2		2		20	30	50
AECT(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CCT(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			14	08	14	16			550

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Subject: Zoology Semester- III **SYBSC NEP (2024) syllabus**
Major Core Theory **Credits: 4C (Theory)**
Course Code: 24ScZooU3101

Course Name: Genetics & Histology of Mammals

Course out comes- After successfully completing this course, the students will be able to:

1. Apply the principles of Mendelian inheritance.
2. Understand the cause and effect of alterations in chromosome number and structure.
3. Relate the conventional and molecular methods for gene manipulation in other biological systems.
4. Understand human genetics, its significances and various chromosomal abnormalities
5. Understand the histological structure of integument and alimentary canal
6. Understand the histological structure of visceral organs

Unit	Topic	No. of Lectures
	Section- I Genetics	
I	**Concept of Genes and Genetics**	**9**
	1.1 Genetics: scope and importance 1.2 Elements of heredity and variation: Classical and Modern concept of Gene (Cistron, muton, recon) 1.3 Alleles Mendel's laws of inheritance 1.4 Chromosomal basis of in eritance and its applications. 1.5 Exceptions to Mendelian Inheritance: Incomplete dominance, Codominance, Multiple allelism, Lethal alleles, Epistasis 1.6 Gene interactions – Supplementary, inhibitory, duplicate and complementary inter ctions	
II	**T e recombination and interaction of Genes**	**6**
	2.1 Linkage and crossing over 2.2 Organelle inheritance (itochondrial) Extra-nuclear inheritance, Maternal Inheritance 2.3 Sex Chromosomes and Sex Determination - XX/XO, XX/XY, ZZ/ZW and haploidy/diploidy types 2.4 Concept of dosage Compensation	
III	**Bacterial genetics and Genetic engineering**	**7**
	3.1 Bacteriophages – types and importance 3.2 Concept of Transformation, Transduction 3.3 Model organisms: *Escherichia coli*, *Arabidopsis thaliana*, *Caenorhabditis elegans*, *Drosophila melanogaster*&*Mus musculus*. 3.4 Basics of Genetic engineering – enzymes, vectors (Plasmids, cosmids) 3.5 Applicationsassociated with genetic engineering 3.6 Concept of Genecloning	
IV	**Human Population Genetics and Genetic Counselling**	**8**
	4.1 Human Genetics: Types of inheritance (Autosomal dominant and autosomal recessive, X-linked dominant, and X-linked recessive, Y-linked) Pedigree analysis 4.2 Genetic counselling 4.3 Concept of Barr body and holandric genes 4.4Hardy Weinberg law, concept of gene pool,allelic and genotypic frequency 4.5 Normal Human Karyotype, banding and nomenclature of chromosome subdivisions. 4.6 Genetic disorders: chromosomal aneuploidy (Down, Turner and Klinefelter syndromes), chromosome translocation (Chronic Myeloid Leukemia) and deletion ("cry of cat" syndrome),	

	gene mutation (sickle cell anemia).	
	Section II – Histology of Mammals	
I	Histology of skin and digestive system	**18**
	1.1 V.S. of skin of rat 1.2 Tooth V.S 1.3 Tongue C.S. – pappilae and taste buds 1.4 Alimentary canal – Histological structure of oesophagus,stomach,duodenum,ileum and rectum, 1.5 Glands –Salivary glands, Liver and pancreas	
II	Respiratory organs and blood vessels	**6**
	2.1 T.S. of Trachea and lung 2.2 T.S. of artery and veins	
III	Excretory and Reproductive organs	**6**
	3.1 L.S of kidney 3.2 T.S. of testies and C.S of ovaries	

Reference:

1. Gardner, E.J. et al. (2006) Principles of Genetics (John Wiley).
2. Russell, P.J. (2010) Genetics (Benjamin Cummings).
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. (VIII edition) Wiley India.
4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. (V edition) John Wiley and Sons Inc.
5. Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings.
6. Inderbir Singh's Textbook of Human Histology (With Colour Atlas and Practical Guide), 2014, 7thEdn.,NeelamVasudeva and Sabita Mishra, Jaypee Brothers Medical Publishers, New Delhi, India.
7. Bailey's Text book of Histology, 1971, 16thedn. Wilfred M. Copenhaver, Richord P. Bung & Mary Bartell Bunge, The William &Wilkings Company, Baltimore.
8. Histology, 1987, 9thEdn., Arthur W. Ham, David H. Cormack, J. B. Lippincott Co. Philadelphia.
9. Essential Histology, 2001, 2nd Edition, David H. Cormack, Lippincott Williams & Wilkins, Philadelphia.
10. A text book of Histology, 2014, 5thedn. Krishna Garg, Indira Bahl&MohiniKaul CBS publication& Distributors, Delhi.
11. Histology, 1977, 4thEdn., R. O. Greep and L. Weiss, McGraw Hill Int. Book Co., New York.
12. Histology of Mammals, 1983, M. V. Athawale and A. N. Latey, NarendraPrakashan, Pune.

Major Core- (Practical) 2C
Course Code 24ScZooU3102

Sr. No	Name of the Practical	No. of Practicals
1.	Application of probability in the law of segregation with coin tossing (E)	1P
2.	Study of mode of inheritance of the following traits by pedigree charts – attached ear lobe, widow's peak, eye colour, tongue rolling, colour-blindness, PTC tasting, hypertrichosis (E)	1P
3.	Study of model organisms used in genetics	1P
4.	Preparation of Drosophila culture, Familiarization with techniques of handling Drosophila, sexual dimorphism	1P
5.	Study of wings, eye, wild type and mutants (D)	1P
6.	Problem solving on monohybrid ratio, Dihybrid ratio, Multiple alleles, lethal genes	2P
7.	Study of structural chromosome aberrations (dicentric, ring chromosomes and inversions in polytene chromosomes) from prepared slides/photographs (D)	1P
8.	Preparation of polytene chromosomes isolated from salivary glands (E)	1P
9.	Down syndrome, Klinefelter syndrome and Turner syndrome, Patau's, Edwards, Cri-du-chat (D)	1P
10.	Blood group identification (E)	1P
11.	Karyotyping in human(E)	1P
12.	Numerical problems onHardy Weinberg law, Allelic frequency, genotypic frequency and quantitative inheritance problems (E)	1P
13.	Study of T.S. of skin,tooth and tongue	1P
14.	Study of T. S. of oesophagus, stomach, duodenum and ileum	1P
15.	Study of T. S. of glands – salivary, liver and pancreas	1P
16.	Study of T. S. of trachea, lungs, artery and vein	1P
17.	Study of T. S. of kidney, testies and ovaries	1P

Lab Course on 24ScZooU3101 – Practicals on Genetics & Histology of Mammals

Practicals (Any 15)

VSC (Practical) 2C
Course Code 24ScZooU3501

Lab course on Beekeeping – Practicals on Beekeeping

Practicals

Sr. No.	Name of the practical	No. of Practicals
1.	Collection and identification of different honey bee species and its castes, Viz. Apis indica, A. dorsata. A. melliferra, A. Florae (E)	1P
2.	Study of habit, habitat and nesting behavior of*Apisdorsata, Apis indica, Apis florae* and *Apismellifera* (D)	1P
3.	Life cycle study of honey bees Life cycle, cast system, Colony organization and division of labour	1P
4.	Temporary mount preparation of mouth parts, leg, wings and sting apparatus of honey bees (E)	1P
5.	Demonstration of honey testing methods. (E)	1P
6.	Study of different Bee products (collection methods, composition and uses: a) Honey b) Wax c) Bee Venom d) Propolis e) Royal jelly f) Pollen grains. (D)	1P
7.	Study of different Bee by-products. (D)	1P
8.	Study of Diseases Bee diseases – Protozoan, Bacterial, Viral, and Fungal – with one example. (D)	1P
9.	Study of Bee pests. (Mites, moths, wax beetle) (D)	1P
10.	Study of Bee Enemies – King crow, Wasp, Lizard and Merops apiaster (D)	1P
11.	Bee keeping equipments: a) Bee box (Langstroth type) b) Honey extractor c) Smoker d) Bee-veil e) Gloves f) Hive tool g) Bee Brush h) Queen excluder. (D)	1P
12.	Processing of honey. (D)	1P
13.	Study of plants crops useful to honey bees for nectar and pollen. (D)	1P
14.	Visit to local apiary/Apiculture institute. (D)	1P
15.	Economics of beekeeping, schemes of KVC, PMEGP and entrepreneurship. (D)	1P

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Subject: Zoology Semester- III IKS (T)
Course Code: 24ScZooU3901

SYBSC NEP (2024) syllabus Credits: 2 C (Theory)

Course Name: Ancient Knowledge of Animal Use in India

Course Outcome

1. Student should develop Ancient knowledge of animal use in India
2. Student should develop the knowledge of use of animals in agriculture system in India
3. Student should learn the relationship of environment and health.
4. Student should learn use of wild plants and animals as a food

Unit	Topic	No. of Lectures
I	**Introduction to Indian Knowledge System (IKS)**	**3**
	1. Definition, Concept and Scope of IKS 2. IKS based approaches on Knowledge Paradigms 3. IKS in ancient India and in modern India	
II	**Agriculture and Zoology**	**9**
	1. Use of animals in warfare, Animal husbandry, Animals for medicines, etc. 2. Patterns of animal use in ancient India 3. Apiculture, Lac insect: Tribal knowledge	
III	**Life, Environment, and Health**	**9**

	1. Ethnic Studies, Life Science in animals, Anatomy, Physiology, Agriculture, Ecology and Environment, Āyurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery, and Yoga, etc. 2. Meloid insects in medicines 3. Ancient fauna:Cave arts, Biospeleology (*Katal Shilpa*) 4. Use of leech for health care	
IV	**Dietetics**	**9**
	Study of different texts based on Nalapakadarpana, Bhojanakutuhalam, Sup ashastra, culinary art Modes of preservation of food, Dietary guidelines through branches of Ayurveda, Food and diseases, etc. Tribal knowledge about fish, mollusca, edible insects (NE India) Bugs, Beetles and other animals as food	

Reference books:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
2. Histrory of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).
3. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
4. Lobeno Mozhui , L.N. Kakati , Patricia Kiewhuo and Sapu Changkija (2020) Traditional Knowledge of the Utilization of Edible Insects in Nagaland, North-East India. 9, 852; DOI: 10.3390/foods9070852

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Subject: Zoology Semester- III Minor
Course Code: 24ScZooU3301

SYBSC NEP (2024)
syllabus Credits: 2C
(Theory)
Course Name: Applied Zoology

Learning outcome:
After successfully completing this course, the students will be able to:

1. Understand the culture techniques of prawn, pearl and fish.
2. Understand silkworms rearing and their products.
3. Understand the Bee keeping equipments and apiary management.
4. Understand dairy animals management, the breeds and diseases of goats and learn the testing of egg and milk quality.
5. Learn various concepts of lac cultivation.

Unit	Topic	No. of lectures
1	**Aquaculture**	**07**
	Aquaculture: Prawn culture: Culture of fresh water prawn; culture of marine prawn; preparation of farm. preservation and processing of prawn. Export of prawn.; Fish Culture, Breeding Pond, Fish Seed, Hatching Pond. Transport of fish fry to rearing ponds. Harvesting, preservation of fish. Composite fish farming. By products of fishing industry and common fish diseases.	
II	**Apiculture and Sericulture**	**08**
	Apiculture: Species of honey bees in India. Life history of Apis. Methods of Bee keeping. Bee products and their uses. Natural enemies and their control. Morphology of honey bees. Medicinal value of honey; bee products. Importance of bee colonies in crop pollination. **Sericulture**: Types of silk; Silkworms and their host plants; Mulberry silkworm culture; Life history of silkworm; Natural enemies and their control.	
III	**Dairy Management and Po ltry farming**	**08**
	Dairy: Introduction to common dairy animals. Techniques of dairy management. Milk and milk products. Cattle Diseases. **Poultry**: Types of breeds. Rearing method. Diseases and control measures. Nutritive value of egg and meet. Incubation and hatching of eggs.	
IV	**Vermiculture**	**07**
	Vermiculture: Morphology of *Eisenia foetida*. Rearing of earthworms, Equipments , devices used in vermiculture. products, Vermiwash Collection, Composition and use. Infectious diseases. Non-infectious diseases	

References

1. Shukla, G.S. and Upadhyaya, V.B. (1999-2000). Economic Zoology (Rastogi Publishers).
2. Mani, M.S. (2006). Insects, NBT, India.
3. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture.

Minor - (Practical) 2C
Course Code 24ScZooU3302
Lab Course on 24ScZooU3301 – Practicals on Applied Zoology
List of Practicals (Any 15)

Sr. No	Title	No. of Practical
1	Morphological characterization of common fish species.	1P
2	Identification of two major carps – *Labeorohita* and *Catlacatla* and their life cycles.	1P
3	Study of life cycle and caste system of Honeybees(through charts/specimens).	1P
4	Worker honey bee with emphasis on leg modifications whole mount preparation of the 3 pairs of legs and wings.	1P
5	Life cycle of mulberry silkworm, *Bombyx mori* (model/chart/specimens) and Life cycle of Tussar silkworm, *Antheraeamylitta.*	1P
6	Study of systematic position and taxonomy of useful earthworms	1P
7	Study of setting and maintenances of vermiculture unit. (E)	1P
8	Study of different tools and techniques in vermiculture, Vermiwashproduction.(E)	
9	External morphology and nomenclature of dairy animals.	1P
10	Types of dairy product.	
11	Determination of thespecific gravity of milk by using a mercury lactometer	1P
12	Test for good quality eggs (Floating test, cracking test) and for fertilized andunfertilized eggs (Light test, Cracking test).	1P
13	External morphology of poultry birds (model).	1P
14	Project report on visit to dairy farm or visit to Poultry farm (Poultry management and Poultry breeds)	1P
15	Writing a business proposal for a funding agency taking into account the guidelines and permits available	1P
16	Compulsory study tour/visit to aquaculture Institute/ aquaculture Research Station or fish farm	1P

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Subject: Zoology Semester- III OE (T)

SYBSC NEP (2024) syllabus
Credits: 2C (Theory)

Course Code: 24ScZooU3401 Course Name: Insect Pest, Vector Biology and Management

Course outcomes

After completing this course the students will be able to

1. Understand the importance of pest identification and monitoring.
2. Know the methods of sampling of the pests.
3. Understand the mode of action of nematicides and the consequences of their use.
4. Understand the effective way of insect pest management strategy.
5. Students will learn how ecological factors (e.g., climate, host plant, natural enemies) and economic factors (e.g., crop value, pest damage) contribute to pest problems
6. Understand the principles of IPM, assess management approaches.

Unit	Content	No. of Lectures
I	**Conservation Background to Insect Pests and Vectors**	**7L**
	1.1 Insect pests and vectors of plant and animal diseases 1.2 Pest status: (major, minor, occasional, migrant) 1.3 Human practices and pest occurrence. 1.4 Density dependent and independent factors affecting pest and vector population. 1.5 Sampling and monitoring methods of arthropod pests.	
II	**Insect Pest and Chemical Control**	**5 L**
	2.1 Insecticides. 2.1.1 Types of insecticides, 2.1.2 Formulation; 2.1.3 Toxicity 2.1.4 Safety 2.2 Application of insecticides:Droplet size; Application equipment, 2.3 Problems associated with usinginsecticides 2.3.1 Hazardous of pesticides and antidot 2.4 Environmental and cultural control (Irrigation, Fertilizer, Sanitation. Alternate hosts, Multiple and intercropping, Separation in time and space, Crop geometry). 2.5 Host resistance 2.5.1 Basis for resistance 2.5.2 Mechanisms of resistance	
III	**Insect Pest and Biological Control**	**9L**

	3.1 Biocontrol agents: Predators, Parasitoids, Parasites. 3.2 Pathogens: fungi, viruses, bacteria, microsporidia, nematodes, arthropods. 3.2.1 Transmission of pathogens. 3.3 Techniques of biocontrol 3.3.1 Constraints and reasons for failure of biocontrol. 3.3.2 Use of pheromones/ allelochemicals in pest management 3.3.3 Mating disruption/confusion 3.3.4 Alarm pheromones and oviposition deterrents; repellents. 3.3.5 Exclusion and barriers, Traps. Physical disturbance. 3.3..6 Use of Larvivorous Fish and plants in vector control .	
IV	**Legislation and other alternatives**	**7L**
	4.1 Exclusion and routes of entry 4.2 Risk assessment 4.2.1 Damage thresholds Forecasting 4.2.2Increasing agroecosystem resistance 4.3 Legislation for Pesticide use 4.4 Effects of regulation 4.5 Genetically modified organisms: New concepts and practices 4.6Integrated vector management. 4.6.1 The integrated control/ IPM 4.6.2 Constraints towards IPM adoption 4.6.3 Eradication versus management concept	

References:

1. VanEmden,H.F.andM.W.Service.(2004)PestandVectorControl.Cambridge University Press.
2. Cameron,M.&Lorenz,L.(2013)BiologicalandEnvironmentalControlofDisease Vectors. CABI, UK
3. Chaterjee, K.D. (1981) Parasitology: Protozoologyand Helminththology: Introduction to Clinical Medicine.(12th .Edition) Chaterjee Medical Publishers
4. Mullen,G.andDurdenL.(2009). Medicalandveterinaryentomology,Academic press, London.
5. Kochchar,S.K.(2009).ATextBookofParasitology.Wisdom Press

Semester- IV

Level:- 5.0 (Second Year) Sem: IV

Course Type		Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2or4), (T/P)(2)	24ScZooU4101	Comparative Anatomy and Physiology of Chordates	4		4		40	60	100
	24ScZooU4102	LabCourseon24ScZooU4101		2		4	20	30	50
VSCP(2)	24ScZooU4501	Lab Course on Sericulture		2		4	20	30	50
CEPP(2)	24ScCopU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P)(2+2or 4)	24ScZooU4301	Food Nutrition and Health	2		2		20	30	50
	24ScZooU4302	Lab Course on 24ScZooU4301		2		4	20	30	50
GE/OE(T/P) (2)	24ScZooU4401	Lab Course on Apiculture		2		4	20	30	50
SECT(2)	24ScZooU4601	Lab Course on Aquatic Biology		2		4	20	30	50
AECT(2)	24CpCopU4701 / 24CpCopU4702	MIL-II(Hindi)/MIL-II(Marathi)	2		2		20	30	50
~~CCT(2)~~	~~24CpCopU4001~~	~~HealthandWellness~~	~~2~~		~~2~~		~~20~~	~~30~~	~~50~~
Total			10	12	10	20			550

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Subject: Zoology Semester- IV Major Core T
Course Code: 24ScZooU4101

SYBSC NEP (2024) syllabus
Credits: 4C (Theory)

Course Name: Comparative Anatomy and Physiology of Chordates

Course outcomes:

1. Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.
2. Have an overview of the evolutionary concepts including homology and homoplasy, analogy and phylogeny in relation to major organ system features
3. Understand how cells, tissues, and organisms function at different levels and in their correlation. Student would be able to identify organ-systems of vertebrates.
4. The course content also provides the basis of understanding their abnormal function in animal and human diseases and new methods for treating those diseases.
5. Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc.
6. Get a flavour of research besides improving their writing skills and making them well versed with the current trends

Course Contents

Unit	Content	No. of Lectures
I	Integumentary system	7L
	1.1Comparative Anatomy of skin –Fish, Amphibia, Reptile, Bird, Mammals. 1.2. Derivatives of skin- I) Hard derivatives: Scales, Horns, Antlers, Claws, Nails, Feathers, Hairs II) Soft derivatives: Glands –a) Unicellular b) Multicellular On the basis of function- Mucous, poison, Luminescent, sweat, sebaceous, scent, Mammary, Femoral, Uropygial glands.	
II	Structure and function of digestive system	8L
	Comparative anatomy of oral cavity, teeth (dentition mammals). Structure and diversity of alimentary canal and digestive glands in chordates. Biological significance of nutrients- carbohydrates, proteins, fats, vitamins and minerals. Physiology of digestion with special reference to enzymes involved.	
III	Structure and function of, circulatory systems	6L

	Structure and evolution of heart in vertebrates. Functional anatomy of heart, cardiac cycle, cardiac output, Integration of cardiovascular function, electrocardiogram. Composition of blood, Mechanism of blood coagulation.	
IV	Structure and function of Respiratory systems	6L
	Structure of typical holobranch gill Comparative anatomy and functional significance of lungs in amphibians, reptiles, birds and mammals. Aquatic and terrestrial respiration; transition from water to air breathing. Breathing and gas exchange, gas transport, Hb and O2 dissociation, BMR.	
V	Structure and function of Excretory systems	7L
	Types and development of kidneys and their ducts in anamniotes and amniotes. (Archinephros, Pronephros, Mesonephros, Metanephros kidney) Nephron- structure, types and their function. Physiology of excretion in vertebrates; urine formation, counter current mechanism, Role of ADH and RAAS in excretion. Mechanisms of osmoregulation in fresh water and marine organisms, stenohalinity and euryhalinity. Mechanism of thermoregulation in homeotherms and poikilotherms.	
VI	Structure and function of Nervous System	9L
	Structural and functional evolution of brain and spinal cord in various classes of chordates. Peripheral nervous system- functional significance of somatic and autonomic nervous systems. Structure and functions of neuron, ionic basis of resting and action potentials, nerve impulse and its transmission, synapse and synaptic transmission, Reflex action. Types of sense organs- vision, hearing, taste, smell and touch in chordates.	
VII	Structure and function of Reproductive System	7L
	Comparative details of testes and ovaries from fishes to mammals; modes of reproduction; estrous and menstrual cycle, implantation, gestation, parturition, lactation and birth control.	

References*:*

1. Weichert, C.K. (1970) Anatomy of Chordates (4th edition).
2. Jordan, E. L. and Verma, P. S. (2013) Chordate Zoology (14th edition).
3. Saxena, R. K. and Saxena, S. (2015) Comparative Anatomy of Vertebrates (2nd edition).
4. Vander, A.; Sherman, J. and Luciano, D. (2003) Human Physiology (9th edition).
5. Randall, D. *et al*. (2002) Eckert Animal Physiology (5th edition) Freeman.
6. Hill, R.W. *et al.* (2008) Animal Physiology (3rd edition) Sinaur Associates.
7. Guyton, A.C. *et al*. (2008) Textbook of Medical Physiology (12th edition) W.B. Saunders Co.
8. Withers, P.C. *et al.* (1992) Comparative Animal Physiology (1st edition) Brooks Cole.
9. Comparative Anatomy of the Vertebrates, G. C. Kent, R. K Carr,9thEdn., 2001, McGraw Hill, Boston, USA
10. Vertebrate Comparative Anatomy: Functions And Evolution-Kenneth V.Kardong, WCB-WMC. Brown Publishers.
11. Outline of Comparative Anatomy of Vertebrates.- J.S. Kingsley. Central Book Depot , Allahabad.

Major Paper-11 (Practical)
2C Course Code
24ScZooU4102
Lab Course on 24ScZooU4101 – Practicals in Comparative Anatomy and Physiology of Chordates

Practicals (Any 15)

Sr. No.	Name of Practical	No. of practicals
1.	Comparative study of skin , Temporary mount of external scales in fishes (cycloid, placoid, ganoid, ctenoid).	1 P
2.	Comparative study of brain with the help of models and charts.	1 P
3.	Comparative study of reproductive system with the help of models and charts.	1 P
4.	Comparative study of excretory system with the help of models and charts.	1 P
5.	Comparative study of digestive system with the help of models and charts.	1 P
6.	Comparative study of lungs with the help of models and charts	1 P
7.	Comparative study of heart with the help of models and charts.	1 P
8.	Study of action of salivary amylase.	1 P
9.	Rate of oxygen uptake in fish. And effect of temperature on opercular movement of fish.	1 P
10.	Measurement of blood pressure using sphygmomanometer	1 P
11.	Estimation of haemoglobin &Estimation of bleeding and clotting time	1 P
12.	Preparation of temporary mounts: Blood film and squamous epithelium,	1 P
13.	Counting of white blood corpuscles	1 P
14.	Counting of red blood corpuscles	1 P
15	To study endocrine disorders by using photographs	1 P
16	Study of normal and abnormal ECG by using available graphs.	1 P

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Subject: Zoology Semester- IV VSC
Course Code: 24ScZooU4501

SYBSC NEP (2024) syllabus
Credits: 2C (Practical)
Course Name: Lab Course on sericulture

List of Practical's

Sr. No	Title	No. of Practical
1	Origin and history of Sericulture. Sericulture map of India and World.	1P
2	Introduction to Mulberry and non-mulberry sericulture. Popular silkworm species of India	1P
3	Systematic position, morphology and Life cycle of *Bombyx mori* of mulberry silkworm. Identification of sexes at pupal / moth level.	1P
4	Rearing houses and equipments used in sericulture	1P
5	Anatomy of silkworm 1. Digestive system-Nutritional requirements of silkworm 2. Excretory system-Morphology and ultrastructure of Malpighian tubules 3. Study of reproductive system 4. Silk gland-Structure and functions	1P
6	Cocoon harvesting and assessment- Cocoon stifling and cooking. Silk reeling: Charaka, cottage basin and multi-end. Silk exchanges; weaving and dyeing.	1P
7	By-products of sericulture industry and their utilization.	1P
8	Diseases of silk worm and prevention, control and management	1P
9	Cultivation, Pruning, harvesting, transportation and preservation of mulberry.	1P
10	Determination of physico-chemical parameters for mulberry cultivation (pH,N,P,K etc. in different soil samples)	1P
11	Pests and diseases of mulberry and their management.	1P
12	Contract farming and its scope in sericulture and Occupational health hazards in sericulture.	1P
13	Handicrafts making from cocoons, removing silk from coccons without boiling	1P
14	Compulsory study tour/visit to Sericulture Institute/ Sericulture Research Station or Farm.	1P
15	Writing a business proposal for a funding agency taking into account the guidelines and permits available	1P

Recommended readings

1. Manual on sericulture (1976). Agricultural Services Division. Rome: Food and Agriculture Organization of the United Nations,

2. Ullal, S.R. and. Narasimhanna, M.N. (1987) Handbook of Practical Sericulture: CSB, Bangalore

3. Silkworm Rearing and Disease of Silkworm (1956) Ptd. By Director of Ptg., Stn.& Pub. Govt. Press, Bangalore

4. Jolly, M. S. (1986) Appropriate Sericultural Techniques; Ed., Director, CSR & TI, Mysore.

5. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1 (1972) Fuzi Pub. Co.

Ltd., Tokyo, Japan.
6. Narasimhanna, M. N. (1988) Manual of Silkworm Egg Production;, CSB, Bangalore. 7. Sengupta, K. (1989) A Guide for Bivoltine Sericulture. CSR & TI, Mysore.

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

Subject: Zoology Semester- IV Minor (T)
Course Code: 24ScZooU4301

SYBSC NEP (2024) syllabus
Credits: 2C (Theory)
Course Name: Food Nutrition and Health

Learning outcomes
After successfully completing this course, the students will be able to:

1. Understand the role of food and nutrients in health and disease.
2. Provide culturally competent nutrition services for diverse individuals.
3. Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level, and socio-economic status of clients and groups.
4. Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas.

Unit	Content	No. of Lectures
Unit 1	**Nutrition and dietary nutrients**	**3**
	1.1 Basic concept of Food: Components and nutrients. 1.2 Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing mothers, infants, school children, adolescents and elderly people.	
Unit 2	**Macro nutrients and micronutrients**	**7**
	1.1 Nutritional Biochemistry 1.2 Macronutrients. Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. 1.3 Micronutrients. Vitamins- Water-soluble and Fat-soluble vitamins- their sources and importance. Important minerals *viz*., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions	
Unit 3	**Malnutrition and nutrient deficiency diseases**	**10**

	3.1 Definition and concept of health 3.2 Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus) 3.3 Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders- their symptoms, treatment, prevention 3.4 Life style dependent diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention. 3.5 Social health problems- smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes, treatment and prevention. 3.6 Other ailments *viz*., cold, cough, and fever, their causes and treatment.	
Unit 4	**Dise ses caused by microorganisms**	**10**
	4.1 Food hygiene: Potable water- sources and methods of purification at domestic level. 4.2 Food and Water-borne infections: Bacterial diseases: cholera,	

	dysentery; typhoid fever, viral diseases: Hepatitis, Poliomyelitis etc., 4.3 Protozoan diseases: amoebiasis, 4.4 Parasitic diseases: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention. 4.5 Causes of food spoilage and its prevention.	

Subject: Zoology Semester-IV Minor (P) **SYBSC NEP (2024) syllabus**
Course Code: 24ScZooU4302 **Credits: 2C**
(15Practical) Course Name: Lab Course on 24ScZooU4301 (Food Nutrition and Health)
List of Practical's

Sr. No.	Topic	No. of Practicals
1.	Detecting adulteration in a) Milk b)Sugars c)Tea powder d) Edible oil e) Ghee f) Red chili powder g) Turmeric [E]	1P
2.	Estimation of Lactose in milk [E]	1P
3.	Study of the stored grain pests from slides/photograph(*Sitophilus oryzae, Trogoderma granarium, Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control. [D]	1P
4.	Preparation of temporary mounts of the above stored grain pests [E]	1P
5.	Diet for specific health conditions-Under weight, Obesity, Diabetes, Hypertension, (Calorie deficit conditions) [D]	1P
6.	Diet for specific health conditions-like Peptic ulcers, Constipation, Lactose Intolerance, Anemia(clear fluid diet, soft fluid diet) [D]	1P
7.	Estimation of blood glucose level or colorimetric determination of blood glucose level [E]	1P
8.	To study eating disorder at adolescence [D]	1P
9.	Estimation of Hb in blood [E]	1P
10.	Calculation of BMI and BMR [E]	1P
11.	To study disease causing protozoa, bacteria, parasites with the help of slides/photographs [D]	1P
12.	To estimate the nutrients requirements for individuals with different age groups and Dietetics and Counseling–Concept of balanced diet, Planning of normal diet. [D]	1P
13.	Study of nutrition labeling on selected foods [D]	1P
14.	Detection of artificial food colour by TLC [E]	1P
15.	Determination of pH of different food samples using pH meter and pH paper [E]	1P
16.	Study of Nutritional disorders-Epidemiology, clinical features, prevention and dietary treatment for Protein Energy malnutrition, nutritional anaemias & vitamin deficiency Disorders. [D]	1P

Subject: Zoology Semester- IV
OE (P)
Course Code: 24ScZooU4401

SYBSC NEP (2024) syllabus

Credits:
2C (Practical) Course Name:
Lab Course on Apiculture

Practicals

Sr. No.	Name of the practical	No. of Practicals
1.	Collection and identification of different honey bee species and its castes, Viz. Apis indica, A. dorsata. A. melliferra, A. Florae (E)	1P
2.	Study of habit, habitat and nesting behavior of *Apis dorsata, Apis indica, Apis florae* and *Apis mellifera* (D)	1P
3.	Life cycle study of honey bees Life cycle, cast system, Colony organization and division of labour (D)	1P
4.	Temporary mount preparation of mouth parts, leg, wings and sting apparatus of honey bees(E)	1P
5.	Demonstration of honey testing methods. (E)	1P
6.	Study of different Bee products (collection methods, composition and uses: a) Honey b) Wax c) Bee Venom d) Propolis e) Royal jelly f) Pollen grains. (D)	1P
7.	Study of different Bee by-products. (D)	1P
8.	Study of Diseases Bee diseases – Protozoan, Bacterial, Viral, and Fungal – with one example. (D)	1P
9.	Study of Bee pests. (Mites, moths, wax beetle) (D)	1P
10.	Study of Bee Enemies – King crow, Wasp, Lizard and Merops apiaster (D)	1P
11.	Bee keeping equipments: a) Bee box (Langstroth type) b) Honey ex ractor c) Smoker d) Bee-veil e) Gloves f) Hive tool g) Bee Brush h) Queen excluder. (D)	1P
12.	Processing of honey. (D)	1P
13.	Study of plants crops useful to honey bees for nectar and pollen. (D)	1P
14.	Visit to local apiary/Apiculture institute and handling of bees. (E)	1P
15.	Economics of beekeeping, schemes of KVIC, PMEGP and entrepreneurship. (D)	1P

Subject: Zoology Semester- IV
SEC (P)
Course Code: 24ScZooU4601

SYBSC NEP (2024) syllabus

Credits:
2C (Practical) Course Name:
Lab Course on Aquatic Biology

Practical

Sr. No	Title	No. of Practical
1	Study of the topography of a lake.	1P
2	Instruments used in limnology (Secchi disc, van Dorn bottle, conductivity meter, Turbidity meter) and their significance.	1P
3	Gravimetric estimation of total solids, dissolved solids and suspended solid in an effluent	1P
4	Study of different water sampling methods	1P
5	Physico-Chemical analysis of a lake water	1P
6	Analysis of biological components associated with lake/any water body	1P
7	To determine the free CO_2 of water.	1P
8	To estimate Dissolved Oxygen content by Winkler's method/COD/BOD (E)	1P
9	Biological– Zooplanktons – Identification of Zooplanktons of a lake/ any water body.	1P
10	Estimation of turbidity/penetration of light, TDS of water sample collected from water body.	1P
11	Calculate the Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake / water body.	1P
12	Identification of Zooplankton- Copepods, Hydromedusae, Pteropods, Chaetognatha etc	1P
13	Identification of benthic organisms from water sample.	1P
14	Collection and preservation of crustaceans, molluscs and fishes	1P
15	Group discussion or Seminar presentation on one or two related topics. Compulsory study tour/visit to water body.	1P