



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Course Name : Bachelor of Science
Discipline : Zoology
(For those who joined in June 2022 and after)
COURSE SCHEME:

III year B.Sc. ZOOLOGY

Semester	Part	Subject Name	Hours	Credit	Int + Ext =Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of Revision	
V	Core	Animal Physiology	5	5	25+75=100	✓						✓		✓		✓	U3ZYC51/ U24ZYC51	No change	
	Core	Genetics and Biostatistics	5	5	25+75=100	✓						✓		✓		✓	U3ZYC52/ U24ZYC52	No change	
	Core	Microbiology and Immunology	4	4	25+75=100	✓						✓		✓		✓	U24ZYC53	Revised - 20 %	
	Core	LAB: Animal Physiology	2	-	--	✓						✓		✓		✓	---	No change	
	Core	LAB: Genetics and Biostatistics	2	-	--	✓								✓	✓	✓	---	No change	
	Core	LAB: Microbiology and Immunology	2	-	--	✓								✓	✓	✓	---	No change	
	Allied	Sericulture III	4	4	25+75=100	✓						✓		✓	✓	✓	U24ZYA51	Revised - 20%	
	Allied	LAB: Sericulture	2	-	--	✓								✓	✓	✓	---	No change	
	SBE	Employability Skills	2	1	25+75=100													U24PS51	Revised 50%
	NME	Ornamental Fish Culture	2	2	25+75=100	✓								✓	✓	✓	U3ZYN51/ U24ZYN51	No change	
Total			30	21															
Internship programme			60	2													U24IP51	New	



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VI	Core	Ecology and Evolution	5	5	25+75=100	✓							✓	✓	✓	✓	U24ZYC61	Revised - 10%
	Core	Biochemistry	5	5	25+75=100	✓							✓	✓	✓	✓	U24ZYC62	Revised - 10%
	Core	Biotechnology	4	4	25+75=100												U3ZYC63/ U24ZYC63	No Change
	Core	LAB: Animal Physiology, Genetics and Biostatistics	2	2	40+60=100	✓							✓	✓	✓	✓	U24ZYCP61	Revised - 10%
	Core	LAB: Ecology, Evolution and Biochemistry	2	2	40+60=100	✓							✓	✓	✓	✓	U24ZYCP62	Revised - 10%
	Core	LAB: Microbiology, Immunology and Biotechnology	2	4	40+60=100	✓							✓	✓	✓	✓	U24ZYCP63	Revised - 10%
	Allied	Sericulture IV	4	4	25+75=100												U2ZYA61/ U24ZYA61	No Change
	Allied	LAB: Sericulture III and IV	2	2	40+60=100												U3ZYA6P/ U24ZYAP61	No Change
	SBE	Project	2	2	25+75=100												U1ZY6PR/ U24ZY6PR	No Change
	NME	Human Biology	2	2	25+75=100												U3ZYN61/ U24ZYN61	No Change
Total			30	32														



SEMESTER: V

CORE: 7 - ANIMAL PHYSIOLOGY

Contact hours per Week – 5 hours

Credits: 5

Contact hours per Semester – 75 hours

Subject Code: U3ZYC51/ U24ZYC51

Course Outcomes:

- CO1:** Student understand the concept of nutrition and digestion in animals
- CO2:** Students acquire the knowledge of various organs in the animals
- CO3:** Critically analyze the functions of the organ system and adaptations in animals
- CO4:** Acquires the comparative physiology of body osmotic balance in the organisms
- CO5:** To understand the role of hormones in physiological process

Unit I (15 hours)

Nutrition: Modes of Nutrition – Feeding mechanism. Human digestive system- Digestion of Carbohydrates, proteins and lipids - Absorption and assimilation of digested food materials - Physiological importance of fat soluble and water soluble vitamins

Unit II (15 hours)

Structure of spiracle, trachea, gills and Human lungs - Hemoglobin, Transport of oxygen – Oxygen dissociation curves - Transport of CO₂ – Chloride shift, Bohr's effect - Types of Circulation: open, closed and peripheral circulation. Structure of mammalian heart and its working mechanism – Heartbeat and cardiac Cycle- human Blood and its constituents - Blood coagulation and anti coagulants - Blood pressure: Sphygmomanometer, Hypotension, Hypertension.

Unit III (15 hours)

Types of muscles, Ultra structure of skeletal muscle - Sliding filament Theory, Molecular basis of muscle contraction, neuromuscular junction - Structure of nerve cell - Nature of nerve impulse – resting potential and action potential - Properties of nerve impulse - Conduction of nerve impulse – Sodium- Potassium pump, local circuit theory and saltatory conduction theory
Structure of synapse, neurotransmitters - mechanism of synaptic transmission - Sensory neuron and Motor neuron - Reflex action - Classification of Sensory receptors: Photo receptor- eye, Phonoreceptor – ear.

Unit IV (15 hours)

Excretion: Forms of nitrogenous waste material - Classification of animals on the basis of excretory products - Organization of mammalian excretory system, Structure and function of Nephron, Mechanism of Urine formation, Formation of Kidney stones - Osmosis and Simple diffusion: Isotonic, Hypotonic and Hypertonic - Osmoregulation in freshwater fish, marine fish and birds - Thermoregulation in Poikilotherms and Homeotherms

Unit V (15 hours)

Salient features of Hormones and Endocrine glands - Mechanism of hormone action – Role and disorders of Pituitary, thyroid, adrenal and pancreas secretions - Sex hormones and their functions in male and female.

Text books:

1. Rastogi (2008), Essentials of Animal Physiology – IV Edition S.C. New Age International Publishers, New Delhi.
2. R.Nagabhushanam *et al.*, (2008), Text book of Animal Physiology – II Edition India Book House Pvt. Ltd. Mumbai.



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3. N. Arumugam and A. Marikuttikan (2019), Text book of Animal Physiology- 12TH Revised Edition, Published by Saras Publication, Nagercoil.

Reference books:

1. Mohan. P. Arora (2017), Animal Physiology, 7th Revised edition, Himalaya Publishing House, Mumbai.
2. Knut Schmidt Nielson (1994), Animal Physiology: Adaptation and Environment - V Edition Cambridge University Press.
3. P.S Verma, B.S Tyagi, V.K. Agarwal (2010), Animal physiology S.Chand & Company Ltd, New Delhi.
4. Hoar, S.William Hoar (2004), General and Comparative Physiology, Prentice Hall of Indian Pvt.td.

CORE: 8 GENETICS AND BIostatISTICS	
<i>Contact hours per Week – 5 hours</i>	<i>Credits: 5</i>
<i>Contact hours per Semester – 75 hours</i>	<i>Subject Code: U3ZYC52/ U24ZYC52</i>
Course Outcomes:	
At the end of this course, the students will be able to	
CO1: Understand the genetics principles and fundamentals of inheritance.	
CO2: Familiarize the students with mechanism of inheritance of hereditary disease.	
CO3: Recognize the structure and function of genetic material.	
CO4: Acquire the basic knowledge about statistical methods.	
CO5: Analyze the biological data using statistical tools.	

Unit I (15 hours)

Mendelian Principle: Mendel and his experiments and law of inheritance: Law of Dominance, Law of Segregation, Law of Independent Assortment, back cross and test cross- Gene interaction: Complementary genes: Flower colour in sweet peas. Epistasis: coat colour in mice. Supplementary genes: Comb pattern in fowl - Mendelian Traits in human-Multiple alleles: ABO Blood groups and Rh factor in Human beings - Non-allelic gene inheritance: Skin colour in human beings.

Unit II (15 hours)

Linkage and Crossing over: Coupling and repulsion hypothesis, Linkage in Drosophila- Linkage groups, Crossing over in Drosophila- Mechanism of crossing over- Types of crossing over, Sex determination in man and insects- Sex-linkage in man (Haemophilia and Colour blindness) -Chromosomal aberrations: Structural: Deletions, Duplications, Translocations and Inversions, Numerical: Euploidy (Monoploidy, Polyploidy), Aneuploidy (Monosomes, Nullisomes and Trisomes) - Extra Chromosomal Inheritance: Kappa particles in Paramecium. Sex-limited and sex-influenced inheritance.

Unit III (15 hours)

Human Chromosomes: structure and types-Normal human karyotype, inherited disorders: Allosomal (Klinefelter's syndrome and Turner's syndrome), Autosomal (Down



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syndrome) -Chemical basis of Heredity: DNA as genetic material -Nucleic Acids: DNA Structure, Types and Replication, RNA Structure and Types-Gene Mutation: Types - substitution, insertion and deletion-Inheritance in Prokaryotes: Transformation, conjugation and transduction-Genetic code, Gene regulation in prokaryote-Lac Operon concept.

Unit IV (15 hours)

Collection of data - Primary and Secondary data - classification and tabulation - Diagrammatic and Graphic representation - Measures of central tendency - Mean, Median, Mode - Measures of dispersion - Range, Standard deviation, Standard Error-simple problems.

Unit V (15 hours)

Probability-Addition and Multiplication theorem-Binomial distribution- Chi square test-Student's 't' test - Correlation and its types - Rank correlation - Regression - simple problems

Text books:

1. Verma, P.S. and Agarwal, V.K. (2005), Genetics, S. Chand & Co., New Delhi.
2. Pranab Kumar Banerjee (2007), Introduction to Biostatistics (2nd edition), S.Chand and company Limited, Ram Nagar, New Delhi.

Reference Books:

1. Eldon John Gardner, Michael J. Simmons and D. Peter Snustad (2006), Principles of Genetics (VIIIth Edition), John Wiley & Sons Inc., Canada.
2. Stansfield, W.D. (2002), Theory and Problems of Genetics, McGraw Hill Publication, New Delhi.
3. James D. Watson, Tunia A. Baker, Stephen P. Bell, Alexander Gann, Michel Lavine and Richard Losick (2005), Molecular Biology of Gene, Dorling Kindersly (India) Pvt. Ltd., New Delhi.
4. Bhatnagar, S.M. (1999), Essentials of Human Genetics, 4th Edition, Orient Longman.
5. Primrose, S.A. and Twyman, R.M. (2006), Principles of Gene- Manipulation of Genomics., T.J. International, Padstow, UK.
6. Gurumani, N. (2005), An Introduction to Biostatistics (2nd edition), M.J.P.Publishers, Tamil Nadu Book House, Triplicane, Chennai.
7. Rastogi, V.B. (2009), Fundamentals of Biostatistics, Ane's Students edition, New Delhi.
8. Zar, J.H (1999), Biostatistical analysis, Pearson Education, Delhi.
9. Bhaskara Rao, T. (2010), Methods of Biostatistics (3rd Edition), Paras Medical Publisher, New Delhi.



CORE: 9	MICROBIOLOGY AND IMMUNOLOGY
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYC53</i>
Course Outcomes: Upon completion of the course, the students will be able to	
CO1: Identify the structure of microorganisms.	
CO2: Relate the association of microbes with food in daily life.	
CO3: Distinguish the symptoms and mode of transmission of various infectious diseases.	
CO4: Describe the various components of the immune systems.	
CO5: Categorize the vaccines and investigate the aetiology of autoimmune diseases.	

Unit I (12 hours)

General microbial classification – five kingdom concept - Contribution of Edward Jenner and Louis Pasteur- Structure of prokaryotic cell: Capsule, cell wall of gram positive and gram negative difference, mesosome, ribosome and plasmids. Types of Culture media: Simple, Selective, Enriched and Differential Media - Bacterial Growth curve, measurement of bacterial growth and factors affecting bacterial growth – Salient features of virus and fungi - Sterilization - Physical and Chemical methods.

Unit II (12 hours)

Normal microflora of human body – Epidemiology of Infectious diseases - sources of infection, methods of transmission, types of infectious diseases and Nosocomial infections - Bacterial diseases – Tuberculosis and Cholera - Viral disease – Rabies and Hepatitis - Fungal disease - Candidiasis and Dermatophytes

Unit III (12hours)

Microorganism of Food – Food spoilage – perishable (meat, Fish and Milk), semi perishable (fruits and Vegetable) and non-perishable (Nuts and cereals) food items – Preservation: Physical and Chemical methods – Fermented foods - Yoghurt - Food poisoning: Bacterial (Botulism, Salmonellosis) and Fungal (Aflatoxin) and their symptoms

Unit IV (12 Hours)

History of Immunology – Paul Ehrlich, Robert Koch and Karl Landsteiner, Organs of the Immune system: Primary lymphoid organs – Bone Marrow and Thymus - Secondary lymphoid organs – Spleen and lymph nodes. Cells of the Immune system - T Cell and B Cells - Types of Immunity: Innate immunity, Physical, Mechanical, biochemical and cellular factors – Phagocytosis. Acquired immunity - Active and passive immunity - Properties of Antigens: Foreignness, Size, Chemical composition and Heterogeneity. Antibodies – Properties, structure and function of IgG. Antigen - antibody reactions: Precipitation and agglutination.



Unit V

(12 hours)

Vaccine- types – Live Attenuated vaccines, Killed vaccines and Toxoid vaccine - Immunization schedule - Hypersensitivity – Type I (Anaphylaxis) and Type II (Antibody dependent cytotoxic reaction) - Autoimmune diseases – Rheumatoid arthritis and Hashimoto's thyroiditis, Immunodeficiency disease – AIDS – Mechanism of HIV to escape from Host Immune surveillance - Transplantation immunology - types of grafts, Mechanism of Graft Rejection.

Text books:

1. Dubey and Maheshwari, (2015), A Textbook of Microbiology, Chand & Company Ltd, New Delhi.
2. C.V.Rao, (2006), A Text Book of Immunology, Narosa Publishing house Pvt Ltd. New Delhi.

Reference Books:

1. Prescott, Harley, Klein, (2010), Microbiology, 6th edition, WCB McGraw Hill Co. New Delhi.
2. Frazier, Westhoff, (1995), Food Microbiology, 4th Edition, Tata McGraw Hill Pvt Ltd. Columbus.
3. Eli Benjamini, Geoffrey Sunshine, Sidney Leskowitz, (1996), Immunology-3rd Edition, WileyLiss, Inc., New York.
4. Goldsby R.A., Kindt T.J, Osborne B. A (2000), Immunology, Kuby, 4th Edition, W.H. Freeman and Company.

ALLIED: 4	SERICULTURE III
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYA51</i>
Course Outcomes: At the end of this course, the students will be able to	
CO 1: Understand the requirements and preparation of a silkworm rearing house.	
CO 2: Identify the improved technologies in silkworm rearing and its impact on cocoon productivity.	
CO3: Comprehend the process of spinning and harvesting of cocoon.	
CO 4: Recognize the procedure of silkworm seed production in a grainage.	
CO 5: Distinguish technologies involved in the rearing of non-mulberry silkworms.	

Unit I

(12 Hours)

Rearing house: Location, orientation, plan and utilities – CSB model rearing house – Rearing appliances: leaf chambers, chopping knife and chopping board, rearing trays, rearing stands and racks, feathers, chopsticks, net, paraffin papers, heater, blower, thermometer,



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humidifier, sprayer, hygrometer, rubber foam pads and ant-wells Disinfection: importance of disinfection – types of disinfectants – formalin, bleaching powder, chlorine dioxide, slaked lime and iodine compounds – methods of disinfection – hygiene practices in sericulture

Unit II (12 Hours)

Egg transportation – egg incubation – incubation time and devices – black boxing and its importance Chawki rearing: Preparation – brushing – methods of brushing – types of chawki rearing: traditional and improved method – optimum environmental conditions – feeding schedule – methods of bed cleaning – spacing – moulting and care during moulting Late age silkworm rearing – methods – optimum environmental conditions – feeding quantity and frequency – methods of bed cleaning – spacing – moulting and care during moulting

Unit III (12 Hours)

Mounting and mounting density – types of mountages – Identification of spinning larva – spinning – environmental requirements – Harvesting – time of harvesting – sorting, storage, packaging and transport of cocoons – leaf-cocoon ratio – maintenance of rearing records – byproducts of silkworm rearing and their utilization

Unit IV (12 Hours)

General account of silkworm egg production and demand – Silkworm seed organization – importance of quality seed cocoon production – Grainage: Location and capacity – model grainage – grainage equipments and their uses – disinfection and hygiene – Grainage activities: Sorting, selection and preservation of seed cocoons – sex separation of pupa – synchronization of moth emergence, pairing and de-pairing – refrigeration of moths – oviposition – mother moth examination – egg preparation methods

Unit V (12 Hours)

Non- mulberry silkworm rearing - environmental conditions and rearing technology Tasar, Eri and Muga silkworm - Seed organization of tasar, eri and muga silkworm.

Text book:

1. Ganga, G., and J. Sulochana Chetty (1991), An Introduction to Sericulture, OXFORD & IBH Publishing, New Delhi.
2. Krishnaswami, S., Narasimhanna, M.N.; Suryanarayan, S.K and Kumararaj, S. (1973), Sericulture Manual-2 - Silkworm Rearing. Agriculture Service Bulletin, FAO, ROME.

Reference books:

1. Dandin, S.B., Jayaswal, J. and Giridhar, K. (2003), Handbook of Sericulture Technologies (3rd Edn.), Central Silk Board (Ministry of Textiles – Govt. of India, BTM Layout, Madiwala, Bangalore.
2. Govindan, R., Ramakrishna Naika and Sannappa, B. (2004), Advances in Disease and Pest Management in Sericulture. Seri Scientific Publishers, Bangalore



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3. Nataraju, B., Sathyaprasad, K., Manjunath, D. and Sawani Kumar, C. (2005),
Silkworm Crop Protection, Central Silk Board, Bangalore.

EMPLOYABILITY SKILLS

Course Title : Employability Skills	Total Hours : 30 Hours
Course Code : U24PS51	Total Credits : 1

COURSE OUTCOMES:

On completing this course, students can/are able to

Cos	CO STATEMENT
CO1:	enhance their skills in solving quantitative aptitude problems
CO2:	expertise themselves in solving verbal and non-verbal reasoning problems.
CO3:	prepare for various public and private sector exams and placement drives.
CO4:	interpret the concepts of LOGICAL REASONING Skills.
CO5:	analyze the problems logically and approach the problems in a different manner

Unit I: Quantitative Aptitude – I **6 Hours**

H.C.F. and L.C.M. of Numbers - Average - Percentage - Profit and Loss - Ratio and Proportion - Time and Work - Time and Distance - Train Speed.

Unit II: Quantitative Aptitude – II **6 Hours**

Area related problems - Problems on Ages - Boat and Stream - Simple Interest - Compound Interest – True discount – Calendar – Clocks - Data Interpretation - Bar Graphs - Pie Chart.

Unit III: Verbal Reasoning – I **6 Hours**

Analogy - Classification – Series - Coding & Decoding - Coded inequality - Blood relations - Direction sense test.

Unit IV: Verbal Reasoning – II **6 Hours**

Number Test - Ranking and Time Sequence Test - Seating arrangements - Alphabet Test - Logical Venn Diagram.

Unit V: General Knowledge **6 Hours**

Abbreviations & Acronyms - Famous Personalities - Important Days (National & International) - Capital Cities and Currencies – Current affairs - Sports – RBI & Banking Terms – Basics of Computers and Internet.

Reference Books:

1. R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S Chand
Publishing company; Revised edition (21 February 2017).



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2. R.S.Agarwal, A modern approach to logical reasoning, S Chand Publishing company; August 2022.
3. R.S.Agarwal, A Modern Approach To Verbal Reasoning (Old Edition), S Chand Publishing company.
4. R.S.Agarwal, Advanced objective general knowledge revised edition, S Chand Publishing company, 2017.

e-Resources:

1. <https://www.cuemath.com/numbers/hcf-and-lcm/>
2. <https://www.geeksforgeeks.org/speed-time-distance-formula-and-aptitude-questions/>
3. <chrome-extension://efaidnbmnnnibpcajpcgclefindmkaj/https://cdn1.byjus.com/wp-content/uploads/2020/06/Boat-Stream-Sample-Questions.pdf>
4. <https://www.hitbullseye.com/Simple-Interest-and-Compound-Interest.php>
5. <chrome-extension://efaidnbmnnnibpcajpcgclefindmkaj/https://examsdaily.in/wp-content/uploads/2018/09/br.pdf>
6. <https://testbook.com/objective-questions/mcq-on-direction-and-distance--5eea6a0e39140f30f369e42a>
7. <https://unacademy.com/content/cat/study-material/data-interpretation-and-logical-reasoning/ranking-and-time-sequence/>
8. <https://www.toppr.com/guides/computer-aptitude-and-knowledge/basics-of-computers/basic-computer-terminology/>

NME: 1	ORNAMENTAL FISH CULTURE
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U3ZYN51/ U24ZYN51</i>
Course Outcomes: At the end of this course, the students will be able to	
CO1: Study the types and general morphology of ornamental fishes.	
CO2: Provide knowledge about the construction and maintenance of aquarium.	
CO3: Understand the importance of feeds and culture of live feeds.	
CO4: Familiarize the knowledge of ornamental fish breeding.	
CO5: Acquire ideas about the fish diseases and treatment methods.	

Unit I

(6 Hours)

Scope of ornamental fish culture – Adaptations in fishes – Characters of Freshwater Aquarium fishes - Gold fish, Angel fish, Gourami fish Guppy and molly – Characters of Aquarium Plants - *Azolla*, *Ipomea*, *Eichornia*, *Hydrilla* and *Myriophyla*.



Unit II (6 Hours)

Construction of Aquarium fish tank- Bedding materials- Bagging- Fish stocking- Tools for fish keeping-Hand net, Dip tube, Simple siphon, Automatic siphon, Razor blade Scraper, Magnetic scraper, Silicon gun with cartridge, Air line accessories, Feeding ring, Worm Feeder, submersible heater and CO₂ cylinders

Unit III (6 Hours)

Plankton – culture of live feed organisms - Chironomus, Tubifex and spirulina - Artificial feeds - composition, preparation and types of artificial feed - pellet feeds.

Unit IV (6 Hours)

Guidelines for fish breeding - Breeding tank and breeding habit - Breeding methods in egg layers-Siamese fighter, blue gourami and gold fish. Breeding methods in live bearers- Black molly, Guppy and Sword tail. Community aquarium.

Unit V (6 Hours)

Conditions for healthy fish - Diseases and treatment: Protozoan - Costiasis, Ectoparasite disease: Argulosis, Endoparasite disease – Ligulosis – Bacterial - vertical scale disease, Fungal – Gill rot, Viral epizootic Ulcerative Syndrome (EUS).

Text books:

1. Arumugam N. (2010), Aquaculture, Saras Publications, Nagercoil.
2. Jayashree, K.V.Thara devi,C.S Arumugam,N (2019), Home aquarium and ornamental fish culture, Saras Publications, Nagercoil
3. Srivastava C.B.L. (2006), Aquarium Fish Keeping -, Emeritus Professor, Dept. of Zoology, University of Allahabad Publication, KitabMahal, Allahabad.

Reference Books:

1. Jameson J.D and Santhanam, R. (1996), Manual of Ornamental Fishes and Farming technologies- Fisheries College & Research Institute Tamil Nadu Veterinary & Animal Sciences, Thoothukudi.
 2. Dick, Mills (1993), Aquarium Fish, Published by Dorling Kindersley Publishing, Incorporated, New York, U.S.A.
 3. Santhanakumar, G. and Selvaraj, A.M. (1999), Concepts of Aquaculture, Meenam Publications, Nagercoil.
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SEMESTER: VI

CORE: 10	ECOLOGY AND EVOLUTION
<i>Contact hours per Week – 5 hours</i>	<i>Credits: 5</i>
<i>Contact hours per Semester – 75 hours</i>	<i>Subject Code: U24ZYC61</i>
Course Outcomes: At the end of this course, the students will be able to	
CO1: Realize the importance of interrelationship between organisms and environment.	
CO2: Study the adaptations of organisms to their immediate environment.	
CO3: Understand the need of biodiversity for the welfare of living organism.	
CO4: Understand the theories of evolution postulated by various evolutionists.	
CO5: Understand knowledge about the formation of new species.	

Unit 1 (15 Hours)

Ecosystem – types – aquatic and terrestrial; Abiotic factors: Limiting factors - Temperature, Light and Water. Biotic factors; Autotrophs, Heterotrophs and saprotrophs. Food chain and its types - food web energy flow and productivity Biogeochemical cycle: Carbon, Nitrogen, Phosphorus - Intraspecific Relationship: Aggregation, Social behavior, territorialism and migration - Interspecific relationship: Neutralism, Commensalism, Symbiosis, Antagonism, Parasitism, Competition.

Unit II (15 Hours)

Types of Population - Density and Estimation-Natality-Mortality-Age distribution-Growth pattern. Fluctuation and Equilibrium - Biotic potential-Dispersal and distribution-Population Explosion-Regulation of population - Community characteristics - ecological pyramids- Ecotone and Edge effect, Niche, Succession.

Unit III (15 Hours)

Pollution – Air, water and soil – sources, biological effects, and control measures.Green House effect, Global warming and Acid rain Wildlife conservation – IUCN categories - Conservation of forest and wildlife – National Parks and sanctuaries of India - social forestry.

Unit IV (15 Hours)

Origin of life; theories of abiogenesis and biogenesis - Chemical evolution-Urey Miller's Experiment - Origin of Prokaryotic and Eukaryotic cell - Evidences for Evolution-Comparative anatomy, Homologous and Analogous structures, Vestigial organs, Physiological, Embryological, Biochemical, Biogeographical and Paleontological Evidences.

Unit V (15 Hours)

Lamarckism, Darwinism and mutation theory of De Vries, Geological time scale, Significance of Fossils and Connecting Links - Isolating mechanisms – Speciation: Allopatric



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and Sympatric; Convergent, Divergent and Co-evolution - Modern synthetic theory, Mimicry and Adaptive colouration - Evolution of Man – Fossil record only.

Text Books:

1. Sharma P.D (2000), Environmental Biology, Rastogi Publications, Meerut.
2. Verma P.S. and Agarwal V.K. (1993), Environmental Biology. S. Chand and Company, New Delhi.
3. Dr. N. Arumugam (2005), Organic Evolution, Saras Publications, Nagercoil.

Reference Books:

1. Enger E.D. and Smith B.E (2004), Environmental Science. Mc. Graw Hill, New Delhi.
2. Eugene P Odum (2002), Fundamentals of Ecology. Natraj Publishers, Dehradun.
3. J.L. Chapman and M.J.Reiss (1999), Ecology – Principles and Applications. Cambridge University Press.
4. Mohan P.Arora (2009), Organic Evolution. Himalaya Publishing House, Mumbai.
5. Theodosius Dobzhansky., Ayala, F.J., Stebbins, G.L and Vaentine, J.W. (1971), Evolution, Surjeet Publications, New Delhi
6. Dr. Kavita (2009), Organic Evolution, AITBS Publishers, India
7. Dr. Veer Bala Rastogi (2005), Organic Evolution, Saras Publications, Nagercoil.

CORE: 11	BIOCHEMISTRY
<i>Contact hours per Week – 5 hours</i>	<i>Credits: 5</i>
<i>Contact hours per Semester – 75 hours</i>	<i>Subject Code: U24ZYC62</i>
Course Outcomes:	
At the end of this course, the students will be able to	
CO1: Students acquire the concept of atomic and biological chemical bonds.	
CO2: To learn the diversity of biological molecules in a systematic manner.	
CO3: Understand the knowledge of buffer system in the body.	
CO4: To understand the form and functions of macromolecules.	
CO5: To familiarize the various biochemical techniques.	

Unit – I **(15 Hours)**

Structure of atoms - Hydrogen – Carbon - Nitrogen – Oxygen – Chlorine Atomic number, Atomic weight, Molecular weight, Stable and Unstable atoms - Primary Bonds – Ionic bonds, Covalent bonds, metallic bonds Secondary bonds – Hydrogen bond and Vander Waal's bond Water – Physical and Chemical properties and Structure of water.

Unit – II **(15 Hours)**

pH – Concept of pH, Acids and Bases – Dissociation of acid and bases. pH meter – Principle and Applications - Buffer – Types of Buffer system and its significance–



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Bicarbonate buffer system, Plasma protein buffer system, Phosphate buffer system.
Mechanism of buffering action

Unit III (15 hours)

General Classification of Carbohydrates - Monosaccharides – Classification - Biochemical structure of Diose, Triose, Tetrose, Pentose and Hexose sugar – Disaccharides – Glycosidic bond, Biochemistry of Sucrose and Lactose - Polysaccharides –Structure of Starch and Glycogen - Glycogenesis and Glycogenolysis, Biological functions of Carbohydrates

Unit IV (15 hours)

Amino acids – Structure and Classification of Amino acids - Peptide bonds- Polypeptide chain Chemical composition of proteins. Classification of Proteins – Simple, Conjugated and Derived proteins - Biological importance of Proteins - Classification of Enzymes - Mechanism of enzyme action- Lock and Key hypothesis & Induced Fit hypothesis - Factors affecting enzyme activity

Unit V (15 Hours)

Classification of lipids- Glycerol Structure of Simple lipid- Fatty acids– Saturated and Unsaturated fatty acids - Biochemistry of Palmitic acid and Oleic acid, Biological importance of lipids Centrifuge- Types of centrifuge, Principle and its application, Chromatography- Paper, Thin Layer and Column chromatography, Principle and applications of Colorimeter.

Text books:

1. Ambika Shanmugam (2007), Fundamentals of Biochemistry for Medical Students – 10, III cross street, West CIT, Nagar, Chennai.
2. N. Arumugam, *et al* (2014), Textbook of Biochemistry, 5th edition, published by Saras publication, Nagercoil.
3. S.C.Rastogi (2010), Biochemistry, Tata McGraw – Hill Education private Limited, 7 West Patel Nagar, New Delhi

References

1. J.L.Jain, Fundamentals of Biochemistry –Chand & Company Ltd, Ram Nagar, Chennai
 2. Robert.k.Murray, Darryl.K.Granner, A.Mayes & Victor, Harpers Biochemistry – Practice Hall International.
 3. A.S.Saini, 1996, Text book of Biochemistry –2nd edition Nazia printers, 2172 Rodgram, Lal Kaun, New Delhi.
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CORE: 12	BIOTECHNOLOGY
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U3ZYC63/ U24ZYC63</i>
Course Outcomes: At the end of this course, the students will be able to	
CO1: Understand the basic concepts of genetic engineering.	
CO2: Demonstrate the methods of production and identification of recombinants.	
CO3: Outline the steps involved in animal cell culture and its clinical significance.	
CO4: Distinguish the methods of transgenic animal production and gene therapy.	
CO5: Identify the avenues of biotechnological applications for human welfare.	

Unit I (12 Hours)

History, scope and importance of biotechnology – Enzymes of rDNA technology: Exonuclease, Endonuclease, DNA ligase, DNA polymerase, Reverse transcriptase, Taq polymerase – Restriction endonuclease: characteristics and types – Cloning vectors: characteristics – types of vectors: plasmids and lambda phage – structure of pBR 322

Unit II (12 Hours)

Isolation and purification of plasmid – isolation of desired gene – construction of genomic and cDNA library – construction of recombinant DNA - Introduction of recombinant DNA into host cells: transformation, transfection, Calcium phosphate precipitation, Dextran mediated, Lipofection, Electroporation, Retroviral infection, micro injection, Shotgun Method

Unit III (12 Hours)

Animal cell culture: establishment of primary culture – disaggregation of tissue – types of cell lines – physical conditions for cell culture – types of culture – Equipments required for animal cell culture – Applications of animal cell culture: tissue Plasminogen Activator (tPA), Factor VIII & IX, Erythropoietin, therapeutic antibodies – Hybridoma technology: Production and applications of monoclonal antibodies

Unit IV (12 Hours)

Methods of transgenic animal production: embryonic stem cell technology and retroviral-mediated gene transfer – Transgenic cow, chick and fish – applications of transgenic animals – Gene therapy: somatic cell gene therapy for pulmonary diseases and germ line gene therapy – Animal cloning – therapeutic and reproductive cloning – RAPD – Forensic applications of DNA fingerprinting

Unit V (12 Hours)

Commercial production of penicillin and cyanocobalamin – Immobilization of enzymes: methods and applications – Bioremediation of heavy metals and hydrocarbons –



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Potential hazards of biotechnology – Bioethics: problems and solutions – safety issues – legal issues

Text books:

1. Rastogi, S.C., (2009), Biotechnology: Principles and Applications, Narosa Publishing House Pvt. Ltd., New Delhi.
2. Gupta, P.K., (2010), Elements of Biotechnology, Revised 2nd Edition, Rastogi Publications, Meerut.

References:

1. Nair, A.J., (2008), Introduction to Biotechnology and Genetic Engineering, Infinity Science Press LLC, Hingham.
2. Bernard R. and Jack (2010), Molecular Biotechnology: Principles and application of recombinant DNA, ASM Press, Herndon, USA.
3. Primrose, S. B. and Twyman, R. M., (2006) Principles of Gene Manipulation and Genomics, 7th Ed., Blackwell Publishing, West Sussex, UK .

CORE: 14	LAB: ANIMAL PHYSIOLOGY, GENETICS AND BIOSTATISTICS
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYCP61</i>
Course Outcomes:	
At the end of this course, the students will be able to	
CO 1: Understand the physiology of fish respiration and human blood cells	
CO 2: Student demonstrate the blood pressure check up in the human being	
CO 3: Acquires the knowledge of Mendelian hybrid cross and human traits	
CO 4: Interprets the statistical knowledge of the experimental results	
CO 5: Critically analyse the genetic principles of human blood group	

1. Salivary Amylase activity with relation to substrate.
2. Estimation of oxygen consumption in Tilapia fish
3. Qualitative test for nitrogenous waste – Ammonia, Uric acid & Urea
4. Preparation of human blood smear – differentiation of blood cells
5. Enumeration of Red Blood Corpuscles (RBC) by Haemocytometer
6. Enumeration of White Blood Corpuscles (WBC) by Haemocytometer
7. Osmolarity of Red Blood Corpuscles (RBC) in different saline solutions
8. Sphygmomanometer – Demonstration
9. Spotters – Striated muscles, Non-striated muscles and Cardiac muscles (Slide)
10. Model - Structure of Human Heart, Human kidney, Human Eye

LAB IN GENETICS AND BIOSTATISTICS

1. Study of Mendelian traits in human



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2. Study of monohybrid experiment using beads
3. Study of dihybrid experiment using beads
4. Human Blood grouping
5. Calculation of mean, median, mode, standard deviation and standard error using *Polyalthia* leaves
6. Study of polygenic inheritance of quantitative traits (correlation between height and weight of students).
7. Study of probability using coin tossing experiment
8. Spotters- Pedigree chart, DNA model, Klinefelter's, Turner's and Down's syndromes, conjugation, transformation and transduction charts, Bar diagram, Histogram, Pie diagram and Frequency curve

CORE: 13	LAB: ECOLOGY, EVOLUTION AND BIOCHEMISTRY
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYCP62</i>
Course Outcomes: At the end of this course, the students will be able to	
CO 1: Understand the ecosystem of a pond.	
CO 2: Identifies the planktons in the water medium.	
CO 3: Relates the association of animals in the ecosystem.	
CO 4: Acquires the knowledge of evolutionary importance of animals.	
CO 5: Knows the various adaptations in the animals.	
CO 6: Handles the biochemical instruments	
CO 7: Analyses the quality of the biomolecules.	

ECOLOGY

1. Estimation of Dissolved oxygen in pond water
2. Mounting of fresh water/ marine water plankton
3. Detection of Transparency of water by Secchi Disc.
4. Observation of Animal Associations.
5. Study of Pond Ecosystem.
6. A Study tour to a minimum of three days duration should be conducted compulsorily, exposing the students to different habitats like forest ecosystem, pollution affected areas, wildlife sanctuaries, zoological parks, aquarium, marine habitat, and museums. A report on the same should be submitted individually in handwritten mode at the time of practical examination and assessed externally.

EVOLUTION

1. Analysis of dermatoglyphic pattern
2. Animals of Evolutionary significance: Peripatus, Limulus, Archaeopteryx



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3. Mimicry: Leaf insect, Stick insect
4. Adaptive colouration: Chameleon
5. Homologous and Analogous organs
6. Vestigial organs
7. Fossils

BIOCHEMISTRY

1. Measurement of pH in different biological samples.
2. Preparation of Phosphate buffer
3. Determination of Acid number in edible oil.
4. Verification of Beer's- Lambert's law using potassium dichromate
5. Separation of Amino acids by Paper Chromatography
6. Centrifuge - Isolation of RBC using centrifuge.
7. Qualitative analysis of Protein, Carbohydrate and Lipids
8. Spotters - pH Meter, Centrifuge, Spectrophotometer, Structure of Glucose (Model/Diagram), Polypeptide chain (Diagram), Lock & Key Mechanism (Book Diagram), Structure of cholesterol (Book Diagram)

CORE: 15	LAB: MICROBIOLOGY, IMMUNOLOGY AND BIOTECHNOLOGY
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYCP63</i>
Course Outcomes:	
At the end of this course, the students will be able to	
CO1: Acquires the knowledge of culturing the microbes.	
CO2: Analyses the microflora by plating techniques.	
CO3: Knows how to prepare the Antigen and Antiserum.	
CO4: Understand the knowledge of immunology and immunological products.	
CO5: Students were able to estimate the Nucleic acids.	
CO6: Able to isolate the DNA.	

MICROBIOLOGY

1. Preparation of culture media – Broth, Agar plates and slants
2. Serial dilution technique for soil sample
3. Pure culture techniques - Pour plate, Spread plate and Streak plate methods
4. Motility by wet mount preparation in curd sample
5. Simple and Gram staining technique
6. Analysis of air microflora by open plate method
7. Spotters-Nutrient Broth, EMB Agar, L rod, Turn table, Inoculation Loop/Needle, laminar air flow, incubator

IMMUNOLOGY

1. Preparation of Antigen (SRBC)



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2. Preparation of serum from sheep blood
3. Isolation of lymphocytes
4. Agglutination – Widal slide test
5. Precipitation – Radial immunodiffusion test – Demonstration
6. Spotters –Immunoglobulin G, Immunization Schedule, Rh Blood group, Spleen and Lymph node.

BIOTECHNOLOGY

1. Isolation of genomic DNA from goat liver/ spleen
2. Agarose gel electrophoresis of DNA (isolated in the previous experiment/ commercial DNA)
3. Estimation of DNA by diphenylamine method
4. Estimation of RNA by orcinol method
5. Production of recombinant insulin (chart/ model)
6. Polymerase Chain Reaction (Visit to a research laboratory may be undertaken)
7. Southern blotting and Northern blotting (ICT tools)
8. Equipments required for animal cell culture (photographs/ models)
9. DNA fingerprinting (chart/ photograph)

ALLIED: 5	SERICULTURE IV	SEMESTER: VI
Contact hours per Week – 4 hours		Credits: 4
Contact hours per Semester – 60 hours		Subject Code: U2ZYA61/ U24ZYA61
Course Outcomes:		
At the end of this course, the students will be able to		
CO1: introduce the concept of cocoon, quality of cocoon and marketing of cocoon.		
CO2: know the pre-cocoon operation for reeling and its significance in reeling technology.		
CO3: acquaint with the technologies of silk reeling and importance in reeling devices.		
CO4: understand the properties and uses of silk, significance of processing and testing of raw silk.		
CO5: know the economics of silkworm rearing and Entrepreneurship development programme.		

Unit I

Evolution of silk reeling industry and its present status – reeling as a cottage Industry – scope and limitation – importance of quality cocoons – Physical and commercial characteristics of cocoons: cocoon colour, shape, size, hardness, grain/wrinkle, weight of cocoon, weight of cocoon shell and shell ratio – Cocoon sorting: objectives and procedure – defective cocoons: double, flimsy, melted, urinated, stained, uzi-infested, moth emerged, deformed and flossy –Cocoon marketing: procedure for procurement of raw material – purchase of cocoon in open auction – grading of cocoons – visual inspection and selection – price fixation



Unit II

Cocoon Stifling methods: sun-drying, steam stifling, hot air drying, Yamato hot air driers – advantages and disadvantages – preservation of cocoons – Cocoon cooking methods: open pan, three-pan, pressurized, floating and sunken systems – merits and demerits – Cocoon brushing methods: stick, hand and mechanical brushing – Reeling water: Use of water in silk reeling – water quality – relationship between water quality and silk reeling – corrective measures

Unit III

Objective of silk reeling – Reeling operations: Formation of reeling end, jettebout, croissure, reels, speed of reels, traverse or distributors – Re-reeling and packing: Objectives, grant reeling, hank preparation, lacing, skeining, booking, bale making and bundling Reeling units: Country charkha, cottage basin, multi-end reeling machine, auto and semi-automatic reeling machines and improved CSRTI reeling devices – advantages and disadvantages

Unit IV

Raw silk properties of Mulberry, Tasar, Eri and Muga silk: physical, chemical and microscopic – factors influencing the properties of raw silk – Raw silk testing: conditioned weight, visual inspection and mechanical tests: winding test, size deviation test, seriplane test, serigraph test and cohesion test – Raw silk grading: International standards (ISA) and Bureau of Indian Standards (BIS) Silk throwing and twisting: objectives of throwing – preparation for twisting, twisting of yarn, soaking, dressing, drying, winding, doubling and twisting – Silk weaving: warping, beaming, drawing denting, weft preparation, power loom and handloom weaving – Chemical processing of silk yarns and fabrics: Degumming, bleaching, dyeing, printing of silk yarns and fabrics – Byproducts of silk reeling industry and their utilization

Unit V

Entrepreneurship development programme (EDP): Emergence and objectives of EDP – essential qualities to become an entrepreneur – selection of a potential entrepreneur – EDP in raising mulberry saplings, organization of chawki rearing centres, silk reeling units and mass production of parasitoids and predators – Mulberry cultivation (per hectare) – Cost and returns under irrigation and rain fed condition – Economics of silkworm rearing: Investment and returns

Text book:

1. Ganga, G., and J. Sulochana Chetty (1991) An Introduction to Sericulture, OXFORD & IBH Publishing, New Delhi.

Reference books:

1. Jolly. M.S. Chowdhuty. S.N and Sen (1975) Non-Mulberry Sericulture in India, Central Silk Board, Bangalore.



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2. Ullal S.M. and Narasimhanna M.N. (1987) Handbook of Practical Sericulture, Central Silk Board, Bangalore.
3. Mahadeveppa, D., Halliyal, V.G., Shankar, A.G. and Bhandiwad, R. (2000) Mulberry Silk Reeling Technology, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Yong Woo Lee (1999) Silk Reeling and Testing Manual, FAO Agricultural Services Bulletin, No. 136, Rome, Italy.
5. Khanka S.S. (2007) Entrepreneurial Development, S. Chand Publishing Co, New Delhi.

ALLIED: 6	LAB: SERICULTURE III & IV
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U3ZYA6P/ U24ZYAP61</i>
Course Outcomes: At the end of this course, the students will be able to	
CO1: Understands the knowledge of rearing tools and disinfection.	
CO2: Knows how to rear the different ages of silkworm.	
CO3: Able to differentiate the good and defective cocoon.	
CO4: Acquires the knowledge of different types of silk wastes.	
CO5: Quantitatively estimate the sericin and fibroin content of the silk.	

SERICULTURE III

1. Model and layout of silkworm rearing house with a rearing capacity of 100 DFLs
2. Silkworm rearing equipments and their uses
3. Effective concentration of disinfectants and preparation of disinfectants – disinfection of rearing houses and equipments
4. Methods of brushing of silkworms
5. Young-age silkworm rearing – methods and operations
6. Late-age silkworm rearing – methods and operations
7. Mounting – mountages, identification and mounting of spinning larvae
8. Plan of model grainage building and grainage equipments
9. Processing of seed cocoons – deflossing – sorting – selection of good cocoons – assessment of seed cocoons – pupal examination
10. Mother moth examination – individual and mass – whole and sampling methods – surface sterilization of silkworm eggs
11. Study of Meiosis in testis of Silk moth
12. Rearing of non-mulberry silkworm

SERICULTURE IV

1. Preparation of line graph/ bar chart on trend of silk yarn and other textile fibre production over a period of 10 years
2. Determination of good cocoon and defective cocoon percentage



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3. Determination of commercial characters of cocoon: average cocoon weight, shell weight, shell percentage or shell ratio, average filament length, reelability, raw silk recovery percentage, renditta and denier
4. Different methods of cocoon stifling (Photographs/ ICT tools)
5. Methods of cocoon boiling
6. Reeling units: Epprouvette, Charaka, Cottage basin, Multi-end and Automatic reeling devices (Photographs/ ICT tools/ Field visit)
7. Identification of textile fibers by physical and chemical test, microscopic examinations, flame tests and solubility test for polyester, cotton and silk
8. Estimation of sericin and fibroin percentage
9. Study of different types of silk wastes
10. Preparation of a project detailing cost and economics in sericulture
11. Visit to the silkworm (chawki/ late age) rearing houses, grainage centre, cocoon markets and/ or silk reeling establishments and/ or silk fabric manufacturing unit and/ or museum of Extension Division of CSRTI, Mysore must be undertaken to expose the students various aspects of post cocoon technology. The students should submit a consolidated report on such visits individually in handwritten mode at the end of the course and it should be assessed externally.

SBE	PROJECT
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U1ZY6PR/ U24ZY6PR</i>

NME: 2	HUMAN BIOLOGY
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U3ZYN61/ U24ZYN61</i>
Course Outcomes:	
At the end of this course, the students will be able to	
CO1: Understand the balanced diet and their importance.	
CO2: Learn the functions of various organs of the human body.	
CO3: Learn an idea about the determination of sex in human.	
CO4: Understand the role sex hormones.	
CO5: Study the socio-cultural aspects of human evolution.	

Unit I

(6 hours)

Composition of food, Balanced Diet, Vitamins and minerals – deficiency diseases, Calorific value of food, malnutrition and obesity



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Unit II (6 hours)

Structure of human lungs – Blood – Blood Composition, Structure and function of heart, Blood Pressure – Structure of Kidney, Nephron – Formation of Urine

Unit III (6 hours)

A general introduction about chromosomes, DNA and genes – Sex determination in man – Human Blood Groups and Rh factor

Unit IV (6 hours)

Male and female sex hormones – Puberty – menstrual cycle – menopause – parturition – methods of contraception – types of Twins – Test tube baby

Unit V (6 hours)

Origin of man – Diversification, Biological and cultural evolution – Future evolution of man.

STD: HIV, Gonorrhoea and Syphilis.

AIDS and Cancer awareness

Text books:

1. Arumugam, N. (2008), Developmental Biology, Saras Publication, Nagercoil.
2. Gupta, P.K. (1999), Genetics, Rastogi Publications, Shivaji Road, Meerut U.P. India.
3. Dobzhansky, T., Ayala, F.J., Stebbins, G.L. and Valentine, J.W. (1971), Evolution, Surjeet Publication, New Delhi.

Reference books:

1. Rastogi, V.B. (2006), Organic Evolution, 13th edition, Medtech, A division of Scientific International.
 2. Ambika Shanmugam (2006), Fundamentals of Biochemistry for medical students, Books and Allied Publishers (P) Ltd, Chennai.
 3. Hoar, S. William (2005), General and Comparative Physiology, Prentice Hall, India.
 4. Verma, P.S & Agarwal, V.K. (2006), Chordata Embryology: developmental biology, S. Chand Publication, New Delhi.
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