

# Shree Ram Singh Dhoni Govt. Degree College Jainti (Almora)

## B.Sc. Syllabus (Subject Zoology)

### (ANNUAL MODE)

#### Teaching Plan

### **B.Sc. Zoology: Part – I (First year)**

<b>Paper - I:</b> Animal Diversity – I (Non-Chordata)	<b>MM: 50</b>
Cell Biology, Genetics, Taxonomy and Evolution	<b>MM: 50</b>
<b>Paper - III:</b> Practical's	<b>MM: 50</b>

### **B.Sc. Zoology: Part – II (Second Year)**

<b>Paper – I:</b> Animal Diversity – II (Chordata), Developmental Biology and Palaeontology	<b>MM: 50</b>
<b>Paper – II:</b> Microbiology, Molecular Biology & Elementary Biotechnology	<b>MM: 50</b>
<b>Paper – III:</b> Practical's	<b>MM: 50</b>

### **B.Sc. Zoology: Part – III (Third Year)**

<b>Paper–I:</b> Ecology, Animal Behaviour and Applied Zoology	<b>MM: 50</b>
<b>Paper – II:</b> Animal Physiology, Biochemistry, Histology and Toxicology	<b>MM: 50</b>
<b>Paper – III:</b> Practical's	<b>MM: 50</b>

## Shree Ram Singh Dhoni Govt. Degree College Jainti (Almora)

### Teaching Plan (Dept. of Zoology)

Year	Subject	Paper title		No. of lectures		Max. marks	
		Paper First	Paper Second	Theory	Practical	Theory	Practical
B.Sc 1 <sup>st</sup>	Zoology	Animal Diversity – I (Non-Chordata)	Cell Biology, Genetics, Taxonomy and Evolution	180	100	100	50

**Programme Outcome** –1. Exposure to diversity in animal groups (invertebrates), cell biology and Ecology. 2. To inculcate good laboratory practices in students and to train them about proper handling of lab instruments.

**Programme Specific Outcome:-** 1. To provide Knowledge of various animals from primitive to highly evolved forms and its complexity. 2. To foster curiosity in the students for Zoology & understand potential of various branches of Zoology. 3. To equip students with laboratory skills as well as field based studies to become an successful enterpreneur. 4. To highlight biodiversity and its need of conservation. 5. To make aware about ways of conservation and sustainability. 6. To inculcate knowledge and make successful career in zoology. 7. To inculcate research attitude and aptitude among students. 8. To conduct basic and applied research which has societal and environmental value.

Paper- 1<sup>st</sup>

Units	Topics	No. of Lectures
Unit-I	Salient features and outline classification (upto orders) of various Lower Non-chordate Phyla and related type study and topics as covered under respective Phyla. Protozoa: Paramecium with particular reference to locomotion, nutrition, osmoregulation and reproduction. Life History, pathogenicity and control measures of Trypanosoma, Leishmania and Entamoeba histolytica.	18
Unit-II	Porifera: Sycon with reference to structure, reproduction and development. Canal system and affinities of Porifera. Coelenterata: Aurelia with reference to structure, reproduction and development. Polymorphism in Coelenterata. A brief account of Corals and Coral reefs.	18
Unit-III	Helminthes: Life cycle, pathogenicity and control measures of Fasciola, Taenia solium, Ascaris. Parasitic adaptations in Helminthes.	16
Unit-IV	Salient features and outline classification (upto orders) of various Higher Non-chordate Phyla and related type study and topics as covered under respective Phyla. Annelida: Nereis- External features, excretory organs and	20

	reproduction. Metamerism in Annelida, its origin and significance. Trochophore larva and its significance. Parasitic adaptations in Hirudinaria.	
Unit-V	Arthropoda: Palaemon- External features and reproduction Peripatus: Its distribution and zoological importance. Mollusca: Pila- External features, Organs of Pallial complex and reproduction. A brief account of torsion in Gastropoda. Echinodermata: Asterias- External features. Water vascular system. Mode of feeding and reproduction.	18

Paper- 2<sup>nd</sup>

Units	Topics	No. of Lectures
Unit-I	Prokaryotic and Eukaryotic cells; Ultrastructure of eukaryotic cell; Plasma membrane (Ultrastructure, chemical composition, models of plasma membrane and functions of plasma membrane). Structure and functions of cell organelles: (a) Mitochondria (b) Ribosomes (c) Lysosomes (d) Centrioles (e) Golgi Complex (f) Endoplasmic reticulum. Structure and functions of Nucleus and nucleolus.	18
Unit-II	Cell division – (a) Cell cycle (b) Mitosis (Process of mitosis, mitotic poisons and significance of mitosis), (c) Meiosis (Process of meiosis, structure and functions of synaptonemal complex, significance of meiosis). Eukaryotic chromosomes- Structure, chemical composition, classification and uninematic and multinematic concept of chromosome structure. Structure and functions of polytene and lampbrush chromosomes. Dosage compensation in Drosophila and man; Barr body.	20
Unit-III	Mendel's Laws of dominance, segregation and independent assortment. Linkage: Coupling and repulsion hypothesis, kinds of linkage, chromosome theory of linkage. Crossing over: Types of Crossing over, kinds of crossing over, mechanism and its significance. Determination of sex: chromosome mechanism, genetic balance theory and effects of external environment on sex determination. Sex linked inheritance: Inheritance of X-linked gene (Colour blindness and haemophilia in man), Sex linkage in Drosophila. Mutation: Historical background, chromosomal aberrations and gene mutations.	20
Unit-IV	Introduction to taxonomy and systematics their relationship and significance. Rules of nomenclature- Binomial and Trinomial. Components of classification – Linnean hierarchy. Species concept – species as a category, kinds of species. Taxonomic methodology and tools.	16
Unit-V	Brief concept and evidences of evolution. Lamarckism, Darwinism, Synthetic theory of evolution, Evolution at Molecular level (Evolution of proteins and nucleotide sequences). Variations and Speciation. Evolution of man.	16

Practical-

Topics	No. of Lectures
A complete record of laboratory work will be maintained by every student. The practical work will consist of the following exercises: Study of living animals: Amoeba, paramecium, Euglena, Hydra, and rectal ciliates Study of Nervous-system/General anatomy with the help of charts/models and simulation of Earthworm, Prawn, Pila, Unio.	16
Permanent preparation of Obelia colony: Ovary, setae in situ, pharyngeal and septal nephridium of earthworm, parapodia of Nereis and Heteronereis, gill radula and osphradium of Pila, salivary glands, mouth parts and trachea of cockroach; gill lamina of Unio, statocyst and hastate plate of prawn.	16
Study of permanent slides/museum specimens/models belonging to following phyla: Protozoa: Amoeba, Paramecium, Euglena, Ceratium and Noctiluca. Porifera: T.S. and L.S. of Sycon, Euplectella, Hyalonema and Spongilla. Coelenterata: Medusa of Obelia, larval stages of Aurelia, Physalia, Porpita, Vellela, Tubipora, Millepora, Aurelia, Gorgonium, Pennatula, Alcyonium, Adamsia. Annelida: T.S. of earthworm and Nereis through different body regions. Neries Heteronereis, Arenicola, Chaetopterus,	16
Arthropoda: Mouth parts of insects, Pupa and larva of modquito, Daphnia, Cyclops and larval stages of Crustaceans. Crab, hermit crab, Lepas, Balanus, Astaxus, Squilla, Millipede, Mantis, cricket, stic insect, waterbug, beetle, locust, moth and butterfly, scorpion, spider, kingcrab and Peripatus. Mollusca: Various larval stages, T.S. of Unio through gills; Chiton, Doris, Aplysia, Aeolis, Dentalium, Octopus, Loligo, Sepia, Nautilus, Teredo, Oстера, Pecten. Echiodermata: Various larval stages, T.S. of arm of starfish; Echinus, Ophiothrix, Holothuria, Asteria, Antedon. Study of following with the help of permanent slides/ museum specimens/ models/ Pictures for spotting	16
Study of Parasites: (a) Protozoa: Plasmodium, Monocystis, Trypanosoma, Leishmania, Entamoeba, Giardia. (b) Helminthes: Fasciola, Taenia, Ascaris, Schistosoma and filarial including larval stages. (c) Annelida: Leeches (d) Arthropod: Sacculina, lice, flea, bedbug, tick and mites. (e) Life Cycle of the following:- Entamoeba, T. solium, A. Lumbricoides, F.hepatica ,Schistosoma	16
Cytology exercises: (a) Study of mitosis and meiosis using available material (b) Study of permanent slides showing stages of cell division, giant chromosome, mitochondria, Golgi body etc. Genetics exercises: (i) Experiments on Mendelian and non- Mendelian inheritance. (ii) Study of mutants of Drosophila. Taxonomy and Evolution exercises: (a) Animal collection techniques: (b) Appliances such as cyanide bottle, aspirator, insect nets, fishing nets, Berlese funnel, Spreading board. (c) Kinds and use of taxonomic keys. (d) Study of evolution of man with the help of Model/chart.	16

Books Suggested-

- 1- Animal diversity (Non Chordata):-E.L. Jordan, Dr. P.S.Verma, R.L. Kotpal.
- 2- Cell Biology, Genetics, Taxonomy and Evolution:- Dr. P.S.Verma, V.K. Agarwal.
- 3- Practical: Dr. P.S.Verma.

## Shree Ram Singh Dhoni Govt. Degree College Jainti (Almora)

### Teaching Plan (Dept. Of Zoology)

Year	Subject	Paper title		No. of lectures		Max. marks	
		Paper First	Paper Second	Theory	Practical	Theory	Practical
B.Sc 2 <sup>nd</sup>	Zoology	Animal Diversity – II (Chordata), Developmental Biology and Palaeontology	Microbiology, Molecular Biology & Elementary Biotechnology	180	100	100	50

**Programme Outcome** – 1. Exposure to diversity in animal groups (vertebrates), and applied zoology. 2. The working principles, design guidelines and experimental skills associated with different fields of zoology such as genetics and cell biology, Entomology, physiology, Developmental biology, histology, biochemical techniques etc.

**Programme Specific Outcome:-** 1. To provide Knowledge of various animals from primitive to highly evolved forms and its complexity. 2. To foster curiosity in the students for Zoology & understand potential of various branches of Zoology. 3. To equip students with laboratory skills as well as field based studies to become an successful entrepreneur. 4. To highlight biodiversity and its need of conservation. 5. To make aware about ways of conservation and sustainability. 6. To inculcate knowledge and make successful career in zoology. 7. To inculcate research attitude and aptitude among students. 8. To conduct basic and applied research which has societal and environmental value.

Paper- 1<sup>st</sup>

Units	Topics	No. of Lectures
Unit-I	Salient features and outline classification (up to order) of various Lower chordate groups. Protochordata: Salient features body organisation, systematic position and affinities of Balanoglossus, Hardmania and Amphioxus. Agnatha: External features of Petromyzon. Pisces: Scales and fins in fishes. Migration in fishes. Parental care in Fishes. Amphibia: General characters and affinities of Gymnophiona . Parental care in Amphibia.	18

Unit-II	Salient features and outline classification (up to order) of various Higher chordate groups. Reptilia A brief knowledge of extinct reptiles. Poisonous and non- poisonous snakes. Poison apparatus of snake. Snake venom and anti-venom. Adaptive radiation in reptiles. Aves: Flightless birds and their distribution. Flight adaptations in birds. Mammalia: General organisation, distribution and affinities of Prototheria, Adaptive radiation in aquatic mammals.	18
Unit-III	Gametogenesis: Spermatogenesis and Oogenesis. Types of eggs. Fertilization: Types of fertilization, approximation of gametes, capacitation, acrosome reaction, formation of fertilization membrane, egg activation and blockage to polyspermy. Cleavage: Types of cleavage and chemical changes during cleavage, totipotency. Blastulation and gastrulation in frog and chick. Fate maps, their formation and significance.	16
Unit-IV	Foetal membranes: Their formation and functions in chick. Retrogressive metamorphosis: As exhibited by an ascidian. Regeneration: Morphallaxis and Epimorphosis, Blastema and its significance, mechanisms as exhibited by invertebrates (Hydra and Planaria) and Vertebrates (Limb regeneration in Amphibia). Placentation in mammals.	20
Unit-V	Kinds of fossils and their significance. Formation of fossils. Methods for determining the age of fossils. Geological time scale. Palaeontological history of horse.	18

Paper- 2<sup>nd</sup>

Units	Topics	No. of Lectures
Unit-I	Introduction to microbiology: Types of microbes, typical structure of a bacterium, (Gram positive and Gram negative bacteria), phages and viruses. Pathogenic microbes: Mycobacterium, Rickettsia, Actinomycetes and Mycoplasma. A brief knowledge of HIV: Modes of transmission and control. Industrial microbiology: Dairy products, fermented food, alcoholic beverages, microbial spoilage. Introductory account of antibiotics.	18
Unit-II	Nucleic acids (DNA & RNA): DNA chemistry, nucleosides, nucleotides, polynucleotide chain, Watson and Crick DNA double helix model, identification of genetic material (DNA-as genetic material). RNA-chemistry, genetic and non-genetic RNAs. Elementary knowledge of genetic code. Expression of gene-protein synthesis.	20
Unit-III	Origin and definition, scope and importance, Restriction enzymes and cloning techniques used in recombinant DNA technology. DNA fingerprinting. Biochips. A Brief knowledge of PCR and its significance.	20

Unit-IV	Introductory knowledge of the application of following biological techniques: (a) Spectrophotometry (b) Chromatography (Paper and thin layer) (c) Electrophoresis (Agarose and PAGE) (d) Microscopy (Light and compound of microscopy, Phase contrast microscopy) (e) A Brief knowledge of PCR machine (Thermal cycler) and its significance.	16
Unit-V	Data collection- Random and non-random sampling, data tabulation and data presentation (Graph, Histogram, Scatter diagram), Concept of mean, mode, median and of standard deviation and standard error. Elementary knowledge of computers: Organisation of computer, input and output devices. Elementary idea of biological databases: Protein and nucleotide data bases.	16

Practical-

Topics	No. of Lectures
A complete record of laboratory work will be maintained by every student. The practical work will consist of the following exercises: Lower and Higher Chordate diversity: Protochordata: Study of permanent slides of Amphioxus and Balanoglossus passing through different body regions, Doliolum, Salpa, Oikopleura. Museum specimens of Herdmania, Ciona and Balanoglossus. Cyclostomata: Museum specimens of Petromyzon and Myxine.	13
Fishes: Dissections only with the help of Simulations, charts/models of general anatomy, afferent and efferent branchial arteries, cranial nerves and internal ear of Scoliodon. Preparation of permanent slides of ampulla of Lorenzini, placoid, Cycloid and ctenoid scales. Study of permanent slides of shark T.S. passing through different body regions and different kinds of scales of fish.	13
Museum specimens of Sphyrna, Pristis, Torpedo, Trygon, Acipenser, Polypterus, Hippocampus, Exocoetus, Anguilla, Echineis, Diodon, Protopterus, Synaptura and Chimaera. Amphibia: Dissections only with the help of Simulations, charts/models of cranial nerves, hyoid apparatus, brain and columella of frog. Study of museum specimen of Salamandra, Proteus, Amphiuma, Nectures, Siren, Ambyostoma, Axolotl larva. Rhacophorus, Alytes, Hyla, Pipa and Bufo.	12
Study of skeleton of frog and permanent histological slides of Amphibia. Reptilia: Study of the skeleton of Varanus. Study of museum specimen of following: Varanus, Heloderma, Hemidactylus, Phrynosoma, Chameleon, Draco, Calotes, Cobra, Pit-viper, Pitless –viper, Rattle snake, Krait, Dhaman, Typhlops and marine snake; Alligator, Crocodile, Gavialis, Turtle and tortoise. Aves: Permanent preparation of filoplume and down feather. Study of the skeleton of fowl. Study of museum specimens of Psittacula, Corvus, Pavo, Bubo, and model of Archaeopteryx.	13
Mammalia: Dissection only with the help of Simulations, charts/models of the general anatomy and blood vascular system of a mammal. Study of the skeleton	12

of rabbit. Study of the museum specimens of Tachyglossus and Ornithorynchus (models) Pangolin, Funambulus, Pteropus, Hedgehog and Loris.	
Developmental biology: Study of the permanent slides of the chick embryos (whole mounts) and those showing the embryology of frog. Palaeontology: Study of different Era/Periods of Geological Time scale based on charts & models. help of Model/chart.	12
Molecular Biology and Elementary Biotechnology: Application and function of - a. Laminar flow b. Autoclave c. Elisa reader d. PCR machine e. Refrigerated centrifuge f. Transilluminator g. Calculation regarding mean, median, SD and SE from given data. h. Preparation of histogram and pie diagram with the help of data provided.	13
Microbiology: (i) Cleaning of glassware and sterilization (ii) Preparation of liquid and solid media for cultivation of bacteria (iii) Preparation of media for the culture of fungi. (iv) Isolation of microorganisms from soil. (v) Gram staining of bacteria (vi) Micrometry of microorganisms	12

#### Books Suggested-

- 1- Animal Diversity (Chordata): E.L. Jordan, Dr. P.S. Verma.
- 2- Developmental Biology: Gilbert: Development Biology Sinauers Ass. Publ. Massachusetts
- 3- Palaeontology : P.C. Jain, M.S. Anantharaman
- 4- Microbiology : CK Jayaram Paniker.
- 5- Molecular Biology : Nitin Suri
- 6- Elementary Biotechnology: Pranav Kumar.

## Shree Ram Singh Dhoni Govt. Degree College Jainti (Almora)

### Teaching Plan (Dept. Of Zoology)

Year	Subject	Paper title		No. of lectures		Max. marks	
		Paper First	Paper Second	Theory	Practical	Theory	Practical
B.Sc 3 <sup>rd</sup>	Zoology	Ecology, Animal Behaviour and Applied Zoology	Animal Physiology, Biochemistry, Histology and Toxicology	180	100	100	50

**Programme Outcome** – 1. Students pursuing th is course should have detailed studies of the various disciplines of the zoology subject and the other branches of zoology such as Genetics, Animal physiology, Molecular biology, Biochemistry, Microtechnique, Nonchordate and Chordate, Developmental Biology, Histology, cell biology, Biodiversity, Medical entomology, parasitology, Genetics etc. 2. The practical course intends to inform students about Animal



systematic, animal diversity and applied zoology field such as Fisheries, Apiculture, Sericulture etc.

**Programme Specific Outcome:-** 1. To provide Knowledge of various animals from primitive to highly evolved forms and its complexity. 2. To foster curiosity in the students for Zoology & understand potential of various branches of Zoology. 3. To equip students with laboratory skills as well as field based studies to become an successful enterpreuner. 4. To highlight biodiversity and its need of conservation. 5. To make aware about ways of conservation and sustainability. 6. To inculcate knowledge and make successful career in zoology. 7. To inculcate research attitude and aptitude among students. 8. To conduct basic and applied research which has societal and environmental value.

Paper- 1<sup>st</sup>

Units	Topics	No. of Lectures
Unit-I	Definition and scope of Ecology. Environmental Factors: Abiotic factors, biotic factors, edaphic factors. Concept of ecosystem with reference to pond ecosystem. Energy flow in ecosystem. Pyramids of number, biomass and energy. Food chain- grazing and detritus, Food web and trophic levels.	18
Unit-II	Biosphere: Hydrosphere, Lithosphere and Atmosphere. Biogeochemical cycles: Carbon and Nitrogen cycles. Population: Definition and characteristics: density, natality, mortality, migration, emigration and immigration, growth and growth-curves. Dispersion and aggregation. Negative and positive interactions including commensalism, mutualism, predation, competition and parasitism.	18
Unit-III	Biodiversity: Conservation and management of biodiversity. Brief introduction to the concept of protected areas- Sanctuary, National Parks and Biosphere Reserves. IUCN and Red data book. Pollution and its control: Air, Water, Soil pollution, Green house effect, Global warming, Climate change, Acid rain, Ozone layer depletion. Bio-accumulation and Biomagnifications.	16
Unit-IV	Patterns of behaviour: Stereotype innate behaviour: Kinases, Taxes and Reflexes. Concepts of (i) Fixed action patterns (FAPs) (ii) Sign stimulus or releasers and (iii) Innate releasing mechanism, Instinctive behaviour. Learned behaviour: Habituation, Conditioned reflexes, Selective learning , Insight learning, Imprinting and Birds songs. Communication: Chemical, Visual, Auditory, Electric and tactile, Dance language of honey bees, Biological clocks. Bird migration. Introduction to Socio-biology.	20
Unit-V	Introduction to: (a) Pisciculture: Cultivable fishes. (b) Sericulture: Bombex mori, types of silk worm and its rearing. (c) Apiculture: Types of honey bees, typical honey and culture of Apis mellifera and natural enemies. (d) Lac culture (e) Pearl culture (f) Piggery (g) Poultry (h) Vermiculture Bionomics and control measures of the common pests of fruits (Papilio demoleus and Quadraspidiotus perniciosus), Vegetables (Thrips tabaci and Aulacophora	18

	foveicollis) and stored grains ( <i>Callosobruchus chinensis</i> and <i>Trogoderma granarium</i> ). Polyphagous pests (Locust and Termites). Pest management including insect pest control and integrated pest management.	
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Paper- 2<sup>nd</sup>

Units	Topics	No. of Lectures
Unit-I	Nutrition: Food constituents, intracellular and extracellular digestion, Digestion and absorption of carbohydrate, fat and protein in mammals. Respiration: Pulmonary ventilation, respiratory pigments, gaseous transport and control of respiration in mammals. Blood vascular system: Haemopoiesis, composition and functions of blood, blood coagulation. A brief account of immunity. Types of heart, origin and conduction of heart beat.	18
Unit-II	Muscular System: Mechanism of muscle contraction. A brief idea of tetanus and fatigue. Nervous system: Transmission of nerve impulse through axon and synapse. Excretion: Concept of ammonotelic, ureotelic and guanotelic animals, urine formation in mammal.	20
Unit-III	Endocrine system: A brief knowledge of the structure and hormonal functions of the glands- Pituitary, Thyroid, Pancreas, Adrenal, Testis and Ovary. Elementary knowledge of the Dwarfism, gigantism, acromegaly, diabetes insipidus, Goitre, Cretinism, Myxoedema, Diabetes mellitus and Addison's disease. Introduction to biological molecules: Carbohydrates, Protein and Lipids (structure, classification and significance). Enzymes, Vitamins and Minerals.	20
Unit-IV	Histology: Structure of epithelium, connective tissue, cartilage, bone, smooth,, striped and cardiac muscles, and nervous tissue. Histological structure of liver, lung, pancreas, kidney and gonads of rabbit.	16
Unit-V	Introduction and brief history of toxicology: General principles of toxicology. Environmental toxicology (kinds and sources of toxic agents- animal toxins, plant toxins, pesticides, metals and food additives). Dose response relationship: Frequency and cumulative responses, determination of T <sub>lm</sub> values, L <sub>d50</sub> , L <sub>c50</sub> , margin of safety, threshold limits.	16

Practical-

Topics	No. of Lectures
Ecology: Estimation of the pH of water/ soil sample. Determination of dissolved oxygen and carbon dioxide in water sample. Study of adaptations in animals inhabiting different ecological environments. Study of wild animals with the help of stuffed preparations/ models/ charts/ photographs.	16

Animal behaviour: Study of different kinds of behaviour with the help of photographs.	12
Applied Zoology: Specimens / slides of Apis, silk moth, Lac insect, phytoparasitic nematodes, major carps. Study of life cycles and control measures of insects of economic impotence (Stored grains pests, pest of fruits and vegetables); and study of structural organization of Bee hive. Picture of commercially important varieties of poultry and cattle.	18
Animal Physiology / Biochemistry: (i) Preparation of haemin crystals from human blood (ii) Determination of clotting and bleeding time (iii) Counting of RBCs in human blood (iv) Counting of WBCs in human blood (v) Determination of haemoglobin percentage in human blood (vi) Qualitative identification of carbohydrate, protein and lipoid. (vii) Analysis of urine for identification of sugar, albumin, ketone bodies, etc. (viii) Study of the action of salivary amylase on starch. Page 15 of 15 (ix) Study of endocrine glands and related disorders with the help of slides/photographs/ charts/ models.	20
Toxicology: Calculation of LC50 with the help of data provided. Study of behavioural responses (in fish, insects or any other locally available animal ) to some important toxicants.	16
Histology: Study of the permanent slides of cartilage, bone, epithelium, connective tissue, nervous tissue, blood, striped and unstriped muscles, liver, kidney, lungs, pancreas, pituitary, thyroid, and adrenal of mammals. Preparation of smooth and striped muscles.	18

#### Books Suggested-

- 1- Ecology, Animal Behaviour and Applied Zoology: V.K. Agarwal
- 2- Animal Physiology, Biochemistry, Histology and Toxicology: Dr. P.S. Verma