SOLAPUR UNIVERSITY, SOLAPUR

M.Sc. (Zoology) Part II Syllabus W.E.F. June 2012

(SEMESTER- III & IV)

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Paper Code No.	Paper No.	Title of paper	Total Marks
SEMESTER III			
301	IX	Molecular Cytogenetics	100
302	X	Wild life and Conservation Biology	100
303	XI	Comparative Animal Physiology	100
304	XII	Biochemistry	100
305	V	Practical based on Paper IX and X	100
306	VI	Practical based on Paper XI and XII	100
SEMESTER IV			
401	XIII	Animal Biotechnology	100
402	XIV	Applied Zoology	100
403	XV	Environmental Biology and Toxicology	100
404	XVI	Zoo keeping and Animal House Management	100
405	VII	Practical based on Paper XIII and XIV	100
406	VIII	Practical based on Paper XV and XVI	100

As a part of practical 406 (VIII) a research or project on the topics related is to be submitted in the form of Two hard copies and in CD format. The project shall carry 50 marks. Both external and internal examiners shall assess the project in the form of ten point scale. The details of assessment system shall be provided by the Chairman to the examiners.

Paper IX- Molecular cytogenetics

1	Fine structure of gene Prokaryotic and Eukaryotic genome organization Metaphase chromosome. Structure of chromatin, centromere,. telomere and its maintenance. Heterochromatin and euchromatin. Coding and noncoding sequences, Satellite DNA, amplificationand rearrangements.	5
2	Dosage compensation of sex determination in *Caenorhabditis elegans*, Drosophila and human	3
3	Imprinting of genes, chromosomes and genomes.	2
4	Genome analysis C value paradox, detailed account of various models of prokaryotic genomes, viral genomes, Eukaryotic genomes organization of genes in organelle genomes. Molecular analysis of genomic DNA in yeast. Transposable elements in genetic regulation. Genome analysis – humans Yeast, microbial genomes	5
5	Microbial genetics Bacterial chromosomes, Bacteriophages- types, structure and morphology of T_4 phage. Morphogenesis Lysogeny and lytic cycle in bacteriophages, Host cell restriction, Complementation, Molecular recombination, DNA ligases, Topoisomerases, gyrases, Methylases, Nucleases, Restriction endonucleases, Plasmids and bacteriophage based vectors for cDNA and genomic libraries.	5
6	Human cytogenetics: Techniques in human chromosome analysis. Molecular cytogenetic Approach. Human karyotype, banding, nomenclature. Chromosome based heritable diseases in human for example Sickle cell anaemia, PKU, thalassemia and glucoma.	5
7	Cytogenetic implications and consequence of structural and numerical alterations of chromosome. Cytogenetic effects of ionizing and non-ionizing radiation	5
8	Genetics of cell cycle: Genetic regulation of cell division in yeast and eukaryotes. Molecular basis of cellular check points.	5
9	Molecular cytogenetic techniques Automated karyotyping, Chromosome painting. DNA sequencing. Application of RFLP in forensic , disease prognosis, genetic counselling and pedigree analysis.	5

Books Recommended

1. Molecular Biology of the Gene- J.D. Watson, N.H. Hopkins, J.W. Roberts et al The Benjamin/Cummings Pub. Co. Inc., California
2. Molecular Cell Biology- J. Darnell, H Lodish and D. Baltimore Scientific American Books, Inc, USA.
3. Molecular Biology of the Cell -B. Alberts , D. Bray. J. Lewis < J.D. Watson . Garland Publishing Inc. New York
5. Molecular Biology and Biotechnology- A comprehensive desk reference . R.A. Meyers (Ed) VCH Publishers, Inc New York
6. Genes- VI/VII Benjamin Lewin Oxford University Press UK
7. Introduction to Practical Molecular Biology- P.D. Dabre, John Wiley and Sons Ltd., New York
8.Cell Physiology Molecular Dynamics - Henry Tedeschi (2003) .Running Text Book available on Web link Only
9. Essentials of Human Genetics- (1990) Orient Longmans Ltd. Bombay.

Paper- X Wild life and Conservation Biology

1	Ecosystem and community	2
2	Definition and Characteristics of community, classification of communities, composition of community, structure / stratification of community, community metabolism and stability, habitat and Niche	5
3	Ecological succession Ecotypes, ecotone, age effect and ecological indicators	4
4	Factors affecting ecosystem and community structure a. Natural factors: Earthquakes, Tsunami, Volcanoes, landslides and Cyclones. b. Intracommunity factor- competition, antagonism, predation and disease. c. Anthropogenic factors introduction of exotic species, urbanization, industrialization, sports and tourism. Habitat loss and its effect on wild life. Patch formation, discontinuous distribution. Breaking of food chain	7
5	Quantitifying community diversity: Indices of diversity, species rare fraction curves, estimating the total number of species, species area curve, species abundance distributions	4
6	Conservation of nature and natural resources	5
7	Traditional conservation practices, agricultural practices, fishing methods etc.	5
8	Modern conservation practices, Reserve forests, Sanctuaries, National parks, Biosphere reserves, Biodiversity hotspots etc., Captive breeding of endangered species	4
9	Indian forest acts, Indian wild life act, red data book and TRAFIC, Earth Summit and agenda, environment impact assessment (EIA)	4

Reference Books

1. Biodiversity - E.O. Wilson (1988) National Academies Press
2. Ecological Methods with particular reference to the study of insect Populations - Sothwood T.R.E.
3. The Oxford Anthology of Indian Wild life- Vol I Hunting and Shooting
4. The Oxford Anthology of Indian Wild life- Vol II Watching and Conserving
5. Endangered Animals in India and Their Conservation- Nair S.M.
6. Animal Kingdoms : Wild Sanctuaries of the World -English M.A.
7. Sanctuary Asia - Bimonthly Journal

Paper- XI- Comparative Animal Physiology

1	Feeding mechanism and its regulation. Food and diet specificity. Comparative physiology of digestion and nutrition.	4
2	Physiology of respiratory pigments in different phylogenetic groups. Circulation of body fluids and its regulation. pH regulation of body fluids.	4
3	Patterns of nitrogen excretion among different animal groups. Osmoregulation in freshwater and marine fishes. Desert adaptations of osmoregulation.	4
4	Thermoregulation in Poikilotherms, Homeotherms . Hibernation	4
5	Communication in bees.	2
6	Chromatophores and its regulation. Role of chromatophores	2
7	Physiology of light reception and visual perception.	2
8	Physiology of contractile elements – actin, actomyosin, myofilaments, microtubules, myosin, voluntary and involuntary muscles, Cardiac muscle physiology. Role of isoenzymes (LDH) in cardiac physiology.	4
9	Physiology of sleep and anaesthesia.	2
10	Control of reproductive mechanism in amniotes. (Reptiles, Birds and Mammals) and their reproductive cycles.	4
11	Physiology of nervous system with reference to neurohormone regulation in mammals.	4
12	Neurotransmitters major sense organs and receptors, Homeostatis (neural and hormonal), Bioluminiscence.Circadian Rythms.	4

Reference Books

1. Comparative Animal Physiology -C.L. Prosser. W.B. Sounders and Company
2. General and comparative physiology- W.S. Hoar
3. Animal Physiology: Adaptations and Environment- Schmidt-Nielsen. Cambridge
4. Chemical Zoology- Academic Press Edited by Florkin and Sheer 7 Volume series
5. Physiology of Mammals and other vertebrates- Marshall and Hughes
6. Chemical Zoology- Ed. Florkin and Sheer B.T. Academic Press Vol. 1-10.
7. Text Book of Medical Physiology- Guyton , Prism Publishers Bangalore 2004 Ed
8. Comparative Physiology -B.T. Sheer

Paper- XII- Biochemistry

1	Structure and role of carbohydrates, lipids, proteins, nucleic acids (A-, B-, Z-, DNA, t-RNA), micro-RNA.	6
2	Oxidative phosphorylation, energy conservation and release. Cyclic AMP-its structure and role. Bioenergetics, biological energy transducers. Concept of free energy, Redox potential. Thermodynamic principles of biology. Hydrogen bonding, energy rich bonds,	6
3	Glycolysis, TCA cycle, glycogen breakdown and synthesis, inter conversion of hexoses and pentoses. Amino acid metabolism, coordinated control of metabolism Biosynthesis of purines and pyrimidines, oxidation of lipids,	7
4	Biosynthesis of fatty acids, triglycerides, phospholipids and steroids and Beta oxidation of lipids.Metabolic regulation during hypoxia.	2
5	Classification and nomenclature of enzymes. co-enzymes, isoenzymes, allosteric enzymes, ribozyme, abenzymes enzyme activators, inhibitors, mechanism of enzyme catalysis	7
6	Enzyme kinetics:Michaelis- Menten equation. Regulation of enzyme activity by non-genetic mechanisms. negative and positive cooperativity	5
7	Metabolic engineering, site directed mutagenesis and enzyme engineering,	5
8	Immobilized enzymes and their applications.	2

Reference Books

1. Biochemistry of Plants and Animals- Mallette M.E.
2. Cell Physiology and Biochemistry- Mcelroy W.D.
3. Biochemistry- D. Voet and J.G. Voet ,J. Wiley and Sons (Pearson)
4. Biochemistry-Mathews C.K. , Holde K.E. Pearson Education
5. Nature of Enzymology- R.L. Foster
6. Enzyme Biotechnology- Tripathi G.
7. Basic Separation Techniques in Biochemistry (1998)- Okotore R.O. New Age Internationals New Delhi.
8. Fundamental Lab Techniques in Biochemistry and Biotechnology (1998) Ninfa A.J. and Ballou O.P. Fitzgeralf, Science Press Bethesba
9. Leningers principles of Biochemistry- Nelson and Cocks (2001) Mac Millan and Co.
10. Modern Experimental Biochemistry- Boyer and Rodney (2001) Benjamin Cunnings NY.
11. Biochemistry Methods- Vote D. and Vote J.G. John Wiley USA (2004)

Practical – V

1	Human karyotype analysis from photographs, Types of chromosomes,	
2	FISH technique	
3	Barr body identification and staining	
4	Examples of Mendelian inheritance of human genetical diseases	
5	Pedigree analysis of human population.	
6	Community sampling, quadrate sampling for plants- relative abundance distribution,	
7	Community sampling for animals- relative abundance distribution	
8	Plaster cast methods for Pug mark identification	
9	Identification and survey methods of wild life.	
10	Hair, antlers, teeth, skin, hide, skull, bones, ivory identification of wild life.	
11	Case studies of habitat loss and wild life protection act. Data collection in practical hand book expected.	
12	Excursion Tour	
13	Any other practical set by the department.	

Practical -VI

1	Study the Oxygen consumption of aquatic animals under stress.	
2	Respiratory pigments their analysis and oxygen carrying capacity.	
3	Estimation of blood urea.	
4	Ammonia estimation in body fluids (suitable invertebrate – crab/earthworm)	
5	Colorimetric estimation of glucose	
6	Colorimetric estimation of protein.	
7	Enzyme separation by $MgCl_2$ gradient methods.	
8	Isozyme LDH separation by Electrophoresis.	
9	Demonstration of Blood gas analyzer.	
10	Peritoneal and membrane dialysis. (Experiment may be designed with egg membrane).	
11	Estimation of fat soluble / water soluble vitamins	
12	Colorimetric estimation of lactose in milk.	
13	Preparation of casein.	
14	Electrophoresis of proteins	
15	Comparison of RBC and WBC in different groups of vertebrates and under different environmental conditions.	
16	Any other practical set by the department.	

Paper- XIII- Animal Biotechnology

1	Cell and tissue culture. Primary cultures, cell line, cell clones, somaclonal variations, micropropagation , somatic embryogenesis, Haploidy, protoplast fusion, and somatic hybridization, Cybrids, Gene transfer methods. Transgenic biology, Allelopathy.	7
2	Genetically engineered animals and hybridoma technology.	2
3	Principles and techniques of nucleic acid hybridization, and cot curves. Sequencing of proteins and nucleic acids. Computerized models to study. Southern, Northern and Western blotting techniques. Polymerase chain reaction. Methods for measuring nucleic acid and protein interactions. FISH and GISH	7
4	Regulation of gene expression in pro and eukaryotes. Attenuations, operon concept. DNA methylation, Hetero chromatization, transposition, , regulatory sequences, transecting factors, Environmental regulation of gene expression.	6
5	Organization of transcriptional units : Mechanism of transcription of prokaryotes and eukaryotes, RNA processing (capping, polyadenylation, splicing, introns and exons), Ribonucleoproteins, Structure of mRNA, Genetic code and protein synthesis.	6
6	Cell diversification in early embryo, Stem cells and stem cell therapy. Totipotency and pleuripotency, Embryonic stem cells. Renewal of stem cells – epidermis, Haemopoietic stem cells Stem cell disorders, Blood cell formation, Bone marrow transplant/ Placental (cord) blood protocol.	6
7	Principles and methods of genetic engineering and Gene targeting, Application in agriculture, health, medicine and industry.	4
8	Ethical issues in human cloning and biotechnology. Biosafety regulations.	4

Reference Books

1. Guidelines for Human Embryonic Stem Cell- Research National Academies Press (2005)
2. Stem Cells and Future Regenerative Medicine- (2002) National Academies Press
3. Animal Cell Culture A Practical Approach- Ed, John R.W. Masters IRL Press
4. Cell Culture Handbook “Sigma”. -(Available with the help of Internet Search Sigma Website)
5. Concepts of Genetics- Klug W.S. Cummings M.R. (2005)Pearson Education , Delhi
6. Discovering Genomics, Proteomics and Bioinformatics- Campbell A.M. and Heyer L.J. Pearson Education (2004)
7. Biotechnology Emerging trends -Selvin J. and Others, Biotech Books Delhi (2003)
8. Cellular Interaction and Immunology- (1994) Open University Netherlands University of Greenwich, UK.

Paper- XIV- Applied Zoology

1	Reproductive technology- collection and cryopreservation of gametes. Semen analysis, Ovulation induction, Fertility control, amniocentesis, IVF sterility and its treatment. Gamete intrafallopian transfer, Surrogate pregnancy and gestational carrier. Fertility control in male and female. Modern trends in contraception. Hormonal assay. Cancer and reproductive tract infections.	8
2	Immunology. History, Overview, and scope.	2
3	Antigen antigenicity, cells and tissue immune system. Innate immunity Humoral immunity, , B lymphocytes, Immunoglobulins, organization and expression of Ig genes	4
4	Cell mediated immunity, T lymphocytes, Major Histocompatability complex. Class I and II molecules. HLA system in human.	3
5	Development of polyclonal sera, monoclonal antibody production and characterization, Vaccines against communicable and infectious diseases. Conventional and genetically engineered vaccines. DNA vaccines, Immunological tolerance.	5
6	Blood bank protocols: Blood matching, separation blood cells, plasma and serum. Blood cell Routine tests of blood for hepatitis and ELISA.	6
7	Biological warfare and its control. Common methods of biological warfare. Resistance mechanism against biological warfare.	2
8	Vermitechnology- importance of vermiculture, vermiwash, vermicompost. Earthworms as protein source.	4
9	Important human and veterinary parasites (Protozoa and Helminths). Molecular basis of host parasitic interaction.	6

Reference Books

1. Animal Health at Cross Roads : Preventing Detecting and Diagnosing Animal Diseases (2005)
2. IVF Protocol -(Wikipedia) The Free Web Encyclopaedia
3. Biotechnology Research in Age of Terrorism- National Research Council (2004) National Academies Press
4. Earthworms-Their Ecology and Relationship with Soils and Land Use- Lee K.E.
5. Modern Immunology - Dasgupta
6. Biology of Earthworms- Edwards C.A. and Lofty J.R.
7. Vaccines
8. Blood Transfusion Merck manual (Available on Internet)
9. Immunology-Roitt I.M. / Brostoff J.

Paper- XV- Environmental biology and toxicology

1	Concept and dynamics of ecosystem, components, food chain and energy flow, productivity and biogeochemical cycles, Types of ecosystems, Population ecology and biological control, Lotic and lentic.	4
2	Limnology -ecology, lakes, ponds and water dams. Agricultural land ecosystem problems	2
3	Kinds of aquatic habitats (fresh water and marine), Distribution of and impact of environmental factors on the aquatic biota, Productivity, mineral cycles and biodegradation in different aquatic ecosystems, Biology and ecology of reservoirs.management of green house and polyhouse. Induced pisciculture	5
4	Environment pollution in terms of air, water, soil, noise . Legislation and Indian standards of pollution levels. Causes and effects of pollution. Radiation and thermal pollution. (Case studies : Chernobyl and three mile island. Minamata disease , Methyl Isocyanates poisoning in Bhopal) Remedial measures.	5
5	Case studies of urban trash management. Carbon credits.Solid waste management. Litter and plastic waste management.. Biological indicators of pollution	5
6	Industrial pollution their control with reference to textile, sugar and dairy industries.	2
7	Conservation of natural resources. Rain water harvesting system. Water recycling. Waste water management	2
8	Toxicology- Classification of toxicants, toxic agents, mode of action. Pesticides, metals, Toxic agents in house hold use. Soil toxicants. Carcinogens used in industries. Food additives in the form of food colours and preservatives. Indian standards.	5

Reference Books

1. Introduction to Animal Ecology and Environmental Biology- Singh H.R.
2. Earthworms Their Ecology and Relationships with soil and Land use (1985)- Lee K.E. Academic Press , New York
3. Toxicology of Insecticides (1985)- Matsumura Fumio Plenum Press New York
4. Drugs and Cosmetics (1977) -Jacob T. Foods, Macmillan Comp Delhi
5. Text Book of Environmental Science Purohit/Shammi/ Agrawal (2005 reprint) Student Edition Jodhpur
6. Environmental Biology - Eric Bharucha UGC Press Hyderabad 2005
7. Environmental Toxicology- Satake M, Mido Y and others (2001) Discovery Publishers Delhi.
8. Environmental Medicine- Andrew Pope and David Rall (1995) National Academies Press
9. Environmental Challenges in Chemistry- in 21st Century Report on Workshop on Environment (2003) National Academies Press
10. Forging a Poison Control System Committee on Poison Control System US (2004)

Paper- XVI- Zoo keeping and Animal house management

1	Introduction , Scope, policy of Zoo keeping.	4
2	Management – Animal behaviour in captivity. Ethical issues - Zoo architecture, Natural habitats, Exhibit design	5
3	Housing, feeding, breeding, behaviour in crocodile, lizards, snakes and tortoises. Snake identification venom and antivenin.	5
4	Housing, feeding, behaviour, in water and land birds. Enclosure design. Diurnal and nocturnal birds. Management of grain eater and birds of prey. Flightless birds.	5
5	Housing, feeding, behaviour in common zoo mammals like monkeys, racoons, rabbits, wild cats, ungulates, grazing mammals . Elephant and camel management.	5
6	Veterinary services in zoo. Common disease in zoo reptiles, birds and mammals. Diseases and prevention of zoo diseases.	4
7	Public awareness programmes in a zoo. Zoo as conservation recreation, research and educational institute. Permanent displays in zoo	4
8	Documentation permissions, visitor rules regulations and surveillance in a zoo. Accidents, fire fighting, first aid to the zoo animals and visitors.	4
9	Animal house management. _ rodent management growth, maintenance, housing, feeding, disinfection procedures in animal house. Taxidermy and its applications.	4

Reference Books

1. Animal Care and Management at the National Zoo Review Smithsonian Institute's National Zoological Park (2005) National Academies Press
2. An Introduction to Animal Behaviour , (1997)Cambridge . New York
3. Rodents Laboratory Animal Management : National Academies Press 1996
4. Animal care and Management at the National Zoo : Smithsonian Institute's National Zoological Park Interim Report (2004)
5. PJC Zoo Animal Technology On line (Free website)
6. Taxidermy .net
7. Animal Health at the cross roads Preventing Detecting and Diagnosing Animal Diseases (2005) National academies Press

PRACTICAL- VII

1	Preparation of cell culture media for animal cell culture /	
2	Culture methods of microbiology	
3	Isolation of pure cultures	
4	Media preparation.	
5	Microbial analysis of vermicompost.	
6	DNA estimation in cells	
7	Experiments in induction of fish / frog oocytes.	
8	Hormone assay	
9	Separation of serum antibodies	
10	Estimation of serum antibodies	
11	Ovulation protocols	
12	One week actual lab work in IVF clinic and in reputed blood bank is expected.	
13	Any other practical set by the department.	

Practical-VIII

1	Estimation of residual pesticides in water, soil and vegetables.	
2	Residual pesticides in fodder and milk.	
3	Water analysis for hardness, detergents, toxicants, colouring agents , nitrates and chlorates.	
4	Effect of toxicants on aquatic animals.	
5	Record of Pollutants of the city.	
6	Air sampling methods for dust and fibres.	
7	Design of cattle and poultry food for zoo mammals and birds.	
8	Construction of animal House	
9	Common Zoo diseases and their remedies. Identification and diagnosis	
10	To prepare ethogram of various zoo animals	
11	Any other practical set by the department.	
12	Visit of a Sea Shore/ grass land or pond for hydro biological/ food chain study in a grass land. Or Visits to polyhouse, sericulture, Apiculture, water reservoir.	
13	**Project:** A project as apart of practical examination of 406 (VIII) is expected. The project is worth 50 marks. Two hard copies and a power point presentation and a CD of the project is to be submitted during practical examination. A project may be selected under the guidance of the supervisor at beginning of the year to get sufficient time for visits data Collection and Presentation.	