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**S.P. Mandali's**  
**RAMNARAIN RUIA AUTONOMOUS COLLEGE**



Syllabus for: **T.Y. B.Sc**

Program: **B.Sc. Life Science**

Course Code: **LIFE SCIENCE (RUSLSc)**

(Semester based credit and grading system with effect from academic year 2017-18)

**RAMNARAIN RUIA AUTONOMOUS COLLEGE  
T.Y.B.Sc. LIFE SCIENCES SYLLABUS**

**ACADEMIC YEAR 2019-2020**

**SEMESTER V**

**PAPER - I**

**Title: Genetics and The Immunology - I**

<b>Course code</b>	<b>Unit</b>	<b>Topic Heading</b>	<b>Credits</b>	<b>L/week</b>
<b>RUSLSc501</b>	<b>I</b>	<b>The Genetic material</b>	<b>2.5</b>	<b>1</b>
	<b>II</b>	<b>Mechanisms of Inheritance and variation in Prokaryotes</b>		<b>1</b>
	<b>III</b>	<b>Overview and cells and organs of immune system</b>		<b>1</b>
	<b>IV</b>	<b>Antigen recognition and Effector Mechanisms</b>		<b>1</b>

**PAPER - II**

**Title: Developmental Biology and Neurosciences - I**

<b>Course code</b>	<b>Unit</b>	<b>Topic Heading</b>	<b>Credits</b>	<b>L/week</b>
<b>RUSLSc502</b>	<b>I</b>	<b>Concepts of Developmental Biology</b>	<b>2.5</b>	<b>1</b>
	<b>II</b>	<b>Animal Development</b>		<b>1</b>
	<b>III</b>	<b>Introduction to behaviour and the nervous system</b>		<b>1</b>
	<b>IV</b>	<b>Overview of the Cellular organization of the nervous system</b>		<b>1</b>

**PAPER - III**

**Title: Biotechnology and Genetic Engineering - I**

<b>Course code</b>	<b>Unit</b>	<b>Topic Heading</b>	<b>Credits</b>	<b>L/week</b>
<b>RUSLSc503</b>	<b>I</b>	<b>Fermentation technology – Principles</b>	<b>2.5</b>	<b>1</b>
	<b>II</b>	<b>Fermentation technology - Food and Beverage Production</b>		<b>1</b>
	<b>III</b>	<b>Gene Cloning – Principles</b>		<b>1</b>
	<b>IV</b>	<b>Gene Cloning – Technology</b>		<b>1</b>

#### **PAPER - IV**

**Title: Ecology, Conservation Biology, Assessment and Management - I**

<b>Course code</b>	<b>Unit</b>	<b>Topic Heading</b>	<b>Credits</b>	<b>L/week</b>
<b>RUSLSc504</b>	<b>I</b>	<b>Introduction to Fundamentals of Environmental sciences</b>	<b>2.5</b>	<b>1</b>
	<b>II</b>	<b>Biodiversity of India</b>		<b>1</b>
	<b>III</b>	<b>Pesticides and Toxicology Management</b>		<b>1</b>
	<b>IV</b>	<b>Sustainable Development and Citizens Awareness</b>		<b>1</b>

## **PRACTICALS**

<b>Course code</b>	<b>Topic Heading</b>	<b>Credits</b>	<b>L/week</b>
<b>RUSLScP501</b>	<b>Practicals in Genetics and The Immunology - I</b>	<b>1.5</b>	<b>3</b>
<b>RUSLScP502</b>	<b>Practicals in Developmental Biology and Neurosciences – I</b>	<b>1.5</b>	<b>3</b>
<b>RUSLScP503</b>	<b>Practicals in Biotechnology and Genetic Engineering – I</b>	<b>1.5</b>	<b>3</b>
<b>RUSLScP504</b>	<b>Practicals in Ecology, Conservation Biology, Assessment and Management – I</b>	<b>1.5</b>	<b>3</b>

**SEMESTER V**

Course Code	Title	Lectures
<b>RUSLSc 501</b>	<b>GENETICS AND IMMUNOLOGY 1</b>	<b>2.5 Credits</b>
		<b>(60 Lectures)</b>
<b>UNIT – I: The Genetic material:</b>		<b>15 Lectures</b>
<b>1.1 Introduction - Discovery of the genetic:</b>		<b>2 Lectures</b>
Griffith's experiment of 1928; Avery, McLeod and McCarty's experiment of 1944; Hershey-Chase's experiment of 1952; and Fraenkel-Conrat and B. Singer's experiment of 1956. *To be given as Assignment/Presentations.		
<b>1.2 Molecular aspects:</b>		<b>4 Lectures</b>
Sequence complexity of DNA -Unique and repetitive sequences of DNA; Denaturation kinetics and 'CoT' value; Satellite DNA		
<b>1.3 Genomes:</b>		<b>1 Lecture</b>
1.3.a <u>Structural organization of a prokaryotic genome</u>		<b>3 Lectures</b>
1.3.b <u>Structural organization of a eukaryotic genome</u> Higher orders of chromosome packing; 'C value paradox';		
<b>1.4 Gene regulation in eukaryotes</b>		<b>1Lecture</b>
1.4.a Chromatin condensation,		<b>2Lectures</b>
1.4.b Modification and remodelling by acetylation and methylation		<b>2Lectures</b>
1.4.c Transcriptional regulation (promoters and enhancers and Transcription Initiation complex, GAL4-UAS system)		

<p><b><u>UNIT – II: Mechanisms of Inheritance and variation in Prokaryotes</u></b></p> <p><b><u>2.1 Genetic recombination in Bacteriophages:</u></b>  2.1.a Life Cycle of lytic and lysogenic phages;  2.1.b Complementation in phages (Intra- and Inter-genic);  2.1.c Recombination mapping – Two- and three- factor crosses,</p> <p><b><u>2.2 Genetic recombination in Bacteria:</u></b>  2.2.a The processes of:  Conjugation  Transformation  Transduction  2.2.b Mapping the genome by each method.  Numerical examples and problem solving</p>	<p><b><u>15 Lectures</u></b></p> <p><b>1 Lecture</b>  <b>2 Lectures</b>  <b>2 Lectures</b></p> <p><b>5 Lectures</b></p> <p><b>5 Lectures</b></p>
<p><b><u>UNIT – III Overview and cells and organs of immune system</u></b></p> <p><b><u>3.1. Overview of the Immune system - Innate Vs Adaptive Immunity</u></b>  3.1.a Innate immunity *To be given as Assignment/Presentations.  i) Anatomical, Physiological, Phagocytic, Inflammatory barriers  ii) Concept of Apoptosis vs Necrosis  iii) Concept of PAMP, PRR and TLR</p> <p>3.1.b Cells and organs of the immune system  i) <u>Primary and secondary lymphoid organs</u>  ii) Cells Myeloid cells- structure and functions  Lymphoid cells  NK cells</p> <p><b><u>3.2 Recognition of antigens</u></b></p> <p>3.2.a <b>Antigen-antibody interactions</b>  i) Antigen-Specificity, avidity, affinity, immunogenicity  ii) Antibody-Structure, Functions and variations  iii) Monoclonal and polyclonal antibodies (Hybridoma Technique)  iv) Organization and expression of Immunoglobulin genes  v) Antigen-antibody interactions –Cross reactivity, Precipitation, Immuno-electrophoresis, Agglutination, Radioimmunoassay, ELISA, Immunofluorescence</p>	<p><b><u>15 Lectures</u></b></p> <p><b>4 Lectures</b></p> <p><b>4 Lectures</b></p> <p><b>1 Lecture</b>  <b>2 Lectures</b>  <b>1 Lecture</b>  <b>2 Lectures</b>  <b>1 Lecture</b></p>

<b><u>UNIT – IV Antigen recognition and Effector Mechanisms</u></b>	<b><u>15 Lectures</u></b>
<b><u>4.1 Recognition of antigens.</u></b>	
4.1.a <b>Major Histocompatibility Complex</b>	
i) MHC-I and MHC-II molecules.	<b>1 Lecture</b>
ii) MHC allelic polymorphism	<b>1 Lecture</b>
iii) MHC restriction	<b>1 Lecture</b>
iv) Antigen processing and presentation-endogenous and exogenous pathways	<b>2 Lectures</b>
<b><u>4.2 Maturation and activation of Lymphocytes</u></b>	<b>4 Lectures</b>
4.2.a B- cell maturation, Activation and Differentiation	
4.2.b T- cell maturation, Activation and Differentiation and T- cell receptor	
<b><u>4.3 Immune Effector Mechanisms</u></b>	
4.3.a <b>Cytokines</b> - - IL-1, IL-2, IL-4, IFNs and TNFs	<b>1 Lecture</b>
4.3.b <b>Complement</b>	<b>2 Lectures</b>
i) Classical, alternate and lectin pathways and comparison	
ii) Biological consequences of complement activation	
iii) Complement fixation tests	
4.3.c <b>Cell-mediated effector responses</b>	<b>3 Lectures</b>
Cell-mediated cytotoxicity of T cells	
Role of TH1, TH2, TH17 and Tc cells	

<b>Course Code</b>	<b>Title</b>	<b>Lectures</b>
<b>RUSLSc 502</b>	<b>DEVELOPMENTAL BIOLOGY AND NEUROSCIENCES I</b>	<b>2.5 Credits (60 Lectures)</b>
<b><u>UNIT 1 : Concepts of Developmental Biology :</u></b>		<b><u>15 Lectures</u></b>
1.1 History and basic concepts in development- *To be given as assignments		<b>1 Lecture</b>
1.2 Sea Urchin : Mosaic vs. Regulative Development		<b>1 Lecture</b>
1.3 Dictyostelium : acquisition of multicellularity		<b>3 Lectures</b>
1.4 Drosophila : mutation series and early development.		<b>2 Lectures</b>
1.5 Chick and amphibians : fate maps and chimeras.		<b>2 Lectures</b>
1.6 Zebra fish : in situ hybridization and trace gene expression.		<b>1 Lecture</b>

<p><b>1.7 Arabidopsis as the model System</b></p> <p>1.7.a Life cycle of Arabidopsis – sporophytic and gametophytic generation, Fertilization and embryo development, Formation of meristems (root and shoot),</p> <p>1.7.b Formation of different organs – leaf, flower, androecium [including development of anthers, pollen grain, pollen tube etc.] and gynoecium [development of pistil - up to formation of embryo sac],</p> <p>1.7.c. Double fertilization, seed formation. [Eventual formation of fruit],</p> <p>1.7.d. Role of Homeotic genes specifying parts of a flower</p> <p>1.7.e Plant genome project (Arabidopsis and rice)</p>	<p><b>1 Lecture</b></p> <p><b>1 Lecture</b></p> <p><b>1 Lecture</b></p> <p><b>1 Lecture</b></p> <p><b>1 Lecture</b></p>
<p><b><u>UNIT II : Animal Development :</u></b></p> <p>2.1.a Amphibian development- Introduction , Germ cell and Fertilization</p> <p>2.1.b Cleavage, Morula and blastula.</p> <p>2.1 .c Gastrulation. *To be given as Assignment/Presentations.</p> <p>2.2 Chick development –</p> <p>2.2.a Introduction, Germ cells and Fertilization,</p> <p>2.2.b Cleavage, Morula and blastula,</p> <p>2.2.c Gastrulation.</p> <p>2.3.d Neurulation. - neural induction, Neural tube formation in amphibians and Chick</p> <p>2.4 Organogenesis – Eye OR limb</p> <p>2.5 Neural Crest Cells</p>	<p><b><u>15 Lectures</u></b></p> <p><b>2 Lectures</b></p> <p><b>1 Lectures</b></p> <p><b>1 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>1 Lectures</b></p> <p><b>1 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>3 Lecture</b></p> <p><b>2 Lectures</b></p>
<p><b><u>UNIT III : Introduction to behavior and the nervous system:</u></b></p> <p>3.2 General organization of nervous system :</p> <p>3.2.a Invertebrate Nervous system: Organization of neurons in brain and ganglia of Invertebrates Nerve net, nerve plexus and ganglionated nervous system e.g. hydra, starfish and earthworm.</p> <p>3.2.b Vertebrate nervous system: Central Nervous System and Peripheral Nervous system. Functional organization of the human central nervous System</p>	<p><b><u>15 Lectures</u></b></p> <p><b>3 Lecture</b></p> <p><b>4 Lecture</b></p>



3.3.c Subdivisions of the CNS – Spinal cord, the medulla, the pons, the cerebellum, the midbrain, the diencephalon, and the cerebral hemispheres.	<b>4 Lectures</b>
3.3.d Various lobes of the Brain- Fore brain, mid brain and spinal cord, lobes of The brain and their functional familiarization e.g., motor areas somatosensory, emotions. Limbic System, Memory and Hypothalamo – Hypophysial Axis.	<b>4 Lectures</b>
<b><u>UNIT – IV Overview of the Cellular organization of the nervous system</u></b>	<b><u>15 Lectures</u></b>
4.1 Chemical Basis of Neural transmission- Introduction Ionic basis of resting membrane potential: Donann’s equilibrium experiments, Nernst’s potential Goldman’s equation, Sodium –Potassium pump.	<b>5 Lectures</b>
<b>4.2 Action Potential &amp; propagation of Action Potential –</b>	
4.2a Synaptic potential and synaptic integration [Electrical and Chemical Synaptic Potential] Excitatory Post Synaptic Potential (EPSP), Inhibitory Post Synaptic Potential (IPSP)	<b>2 Lectures</b>
<b>4.3 Neuro – muscular junctions</b>	<b>1 Lecture</b>
<b>4.4 Synapse and synaptic transmission.</b>	
4.4a Synapse: Structure, Types – chemical and electrical, Neurotransmitters – General Introduction Biosynthesis, physiological role, pharmacological significance, (examples of one agonist and one antagonist for each neurotransmitter mentioned below.	<b>2 Lecture</b>
4.4.b Acetylcholine (Nicotinic and muscarinic receptors).	<b>5 Lectures</b>
4.4.c Dopamine (D1 and D2 receptors).	
4.4.d GABA and Glutamate	
4.5 Neuropeptide (Endorphin and Enkephalin).	

<b>Course Code</b>	<b>Title</b>	<b>Lectures</b>
<b>RUSLSc 503</b>	<b>BIOTECHNOLOGY AND GENETIC ENGINEERING 1</b>	<b>2.5 Credits (60 Lectures)</b>
<b><u>Unit I</u></b> <b>Fermentation technology – Principles</b>		<b><u>15 Lectures</u></b>
1.1 History and development of Food & Fermentation Technology *Presentation		<b>1 Lecture</b>
1.2 Fermentation technology & Instrumentation *Presentation		<b>1 Lecture</b>
1.3.a Principles of microbial growth,		<b>1 Lecture</b>
1.3.b Screening (primary & secondary)		<b>1 Lecture</b>
1.3.c Strain improvement (mutation & selection using auxotrophy & analogue Resistance		<b>2 Lecture</b>
1.4 The Bioreactor / Fermenter & accessories (Stirred tank & Airlift)		<b>2 Lectures</b>
1.5 Media design for fermentation (include molasses, corn steep liquor)		<b>2 Lecture</b>
1.6 Downstream processing (use ex of Penicillin and an enzyme? for cell Disruption		<b>1 Lecture</b>
1.7 Instrumentation: Principles and technique of Centrifugation, Spectrophotometry & Chromatography		<b>4 Lecture</b>
<b><u>UNIT II</u></b> <b>Fermentation technology - Food and Beverage Production</b>		<b><u>15 Lectures</u></b>
2.1 Batch vs Continuous fermentation		<b>2 Lectures</b>
2.2 Technological aspects of industrial production of		<b>1 Lecture</b>
2.2.a Cheese		<b>2 Lectures</b>
2.2.b Beer		<b>2 Lectures</b>
2.2.c Vinegar		<b>2 Lectures</b>
2.2.d Single Cell Protein		<b>2 Lectures</b>
2.2.e Mushroom,		<b>2 Lectures</b>
2.2.f Yoghurt		<b>2 Lectures</b>
2.2.g Wine		
2.3 Food quality assurance: Regulatory & social aspects of food biotechnology		<b>2 Lectures</b>
<b><u>UNIT III</u></b> <b>Gene Cloning – Principles</b>		<b><u>15 Lectures</u></b>
3.1 Introduction to the history of Gene cloning *Presentation		<b>1 Lecture</b>

<p><b>3.2 Methods in Molecular Biology : Molecular cloning methods</b></p> <p>3.2.a Cutting and joining DNA molecules: DNA ligase, Homopolymer tailing, Adaptors, Linkers, Use of Alkaline Phosphatase.</p> <p>3.2.b Role of Restriction enzymes, Type I, II ,III, patterns of DNA cutting by restriction enzymes</p> <p>3.2.c Restriction Mapping – concept and numerical problems</p> <p><b>3.3. Vectors: The cloning vehicles</b>  Vectors for gene cloning ( Plasmids, Bacteriophages as vectors example</p> <p>3.3.a M13 vector, cosmid as vector.</p> <p>3.3.b Plasmids and other advanced vectors.</p> <p>3.3.c pBluescript II.</p> <p>3.3.d Expression of Insulin and somatostatin gene in <i>E.coli</i> using pBR322.</p>	<p><b>2 Lectures</b></p> <p><b>3 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>1 Lecture</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p>
<p><b><u>Unit IV</u></b></p> <p><b>Gene Cloning – Technology</b></p> <p><b>4.1.Cloning of genes</b></p> <p>4.1.a Isolation of cloning vectors, selection of gene cloning organisms, isolation of desired DNA to be cloned</p> <p>4.1.b. Identifying a specific clone with a specific probe, construction of recombinant DNA, transformation, culture and isolation of recombinant DNA from non recombinant one</p> <p>4.1.c Chromosome walking, jumping and painting and Shot gun cloning</p> <p>4.1.d Making genomic and cDNA libraries in <i>E. coli</i></p> <p><b>4.2. cDNA technology</b></p> <p>4.2.a Isolation of mRNA, cDNA synthesis, cloning of double stranded cDNA in plasmid or phase vector, screening a library with nucleic acid probe to find a clone.)</p> <p>4.2.b Polymerase chain reaction : An alternative to cloning (Method , limitations of PCR, Application of PCR, Reverse transcriptase PCR)</p>	<p><b><u>15 Lectures</u></b></p> <p><b>1 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>1 Lecture</b></p> <p><b>1 Lecture</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p>

<b>4.3. Methods of expressing cloned genes</b> 4.3.a Expression of vectors 4.3.b Screening and selection of the desired clone : i) Immunological method ii) Nucleic acid hybridization method iii) Hybrid arrest and Hybrid release method (HART and HRT)		<b>1 Lectures</b>  <b>1 Lectures</b>  <b>2 Lectures</b>
<b>Course Code</b>	<b>Title</b>	<b>Lectures</b>
<b>RUSLSc 504</b>	<b>ECOLOGY, CONSERVATION BIOLOGY, ASSESSMENT AND MANAGEMENT-1</b>	<b>2.5 Credits (60 Lectures)</b>
<b>Unit I Introduction to Fundamentals of environmental science</b>		<b>15 Lectures</b>
<b>1.1 Natural resources:</b>		
1.1.a Ecosystem and Human needs: Resource depletion and pollution, Dwindling Biodiversity, consumers versus resource crunch(with suitable examples from developed and developing countries)		<b>2 Lectures</b>
1.1.b Sustainable Development: As defined by United Nations World Commission on Environment and Development.		<b>2 Lectures</b>
<b>1.2. Ecosystem dynamics:</b>		
1.2.a Ecosystems and concept of biotic communities, food web food chain, Energetic of interaction between biotic and abiotic components, Energy flow, primary and secondary productivity, Ecological Pyramids.		<b>3 Lectures</b>
1.2.b Chemical cycling C, N, P,S,O, H <sub>2</sub> O		<b>6 Lectures</b>
1.2.c Primary succession (soil formation) and secondary succession		<b>2 lectures</b>

<b>UNIT II</b>	<b>15 Lectures</b>
<b>2.1. Biodiversity and Habitats:</b>	<b>2 Lectures</b>
2.1.a Biomes of the world: climate, vegetation and Geographical distribution pattern. Tropical biomes, desert, temperate, taiga and tundra biome.	
2.1.b Biological diversity of India: Indian Bio-geographic Zones, climate and its impact on biodiversity.	<b>2 Lectures</b>
<b>2.2 Indian flora and fauna</b>	<b>2 Lectures</b>
2.2.a Indian forest and vegetation types: diversity of flora and fauna. Endangered, Endemic and Extinct Species of India: Threatened species Role of NGO's (BNHS), (CBD), (UNEP), (COP), categories of IUCN, (EBSA), threatened species of plants and animals in India and their reasons, Red data books.	<b>1 Lecture</b>
2.2.b Environmental biotechnology: Role of biotechnology in conservation of species, in-situ and ex-situ conservation.	<b>1 Lecture</b>
2.2.c Wildlife management and conservation: Wild life management: Goals and Strategies., Human land-use and wildlife management, role of local communities in wildlife management initiatives., Impact of Ecotourism	<b>2 Lectures</b>
<b>2.3 Marine life</b>	
2.3 a Conservation of coastal habitats – a new approach eg. Maharashtra	
2.3.b Biodiversity conservation: Global agreements and national concerns. RAMSAR sites	
* Endangered, Endemic and Extinct Species of India <b>to be given as student assignment.</b>	<b>5 Lectures</b>
<b>2.4. Population and consumption Dynamics with special reference to Human:</b>	
2.4.a Energy and food production (grains, Livestock, aqua culture): Green revolution, Blue revolution. Nutrition: micro and macro nutrition, Ecological costs of food production.	
2.4.b Politics and economics of Hunger, GM foods and their environmental concerns eg . <i>Bt</i> Brinjal	
2.4.c International Treaty on Plant Genetic Resources for food and Agriculture (ITGR) Intellectual Property Rights (IPR), Biopiracy (e.g., Neem/Basmati), Seed Bank	
2.4.d Human impact on climate: Ozone layer, green house effect, Methane, carbon dioxide.	
2.4.e Carbon footprints.	

<p><b><u>UNIT III</u></b></p> <p><b>3.1. Pest and pesticides:</b></p> <p>3.1.a Basic introduction about Pests, Pesticides and Environment Pesticide toxicity: Bioaccumulation and Biomagnification and</p> <p>3.1.b Bioremediation of OP pesticide, persistence, resistance and pollution health of farmers. Biological pest control: predators parasites, and pathogens. Genetically Engineering and pest control,</p> <p>3.1.c Bioremediation of OP pesticide: using Bacillus Sps. ( eg. Malathion Pesticide)</p> <p>3.1.d Phytoremedian of Organochlorine pesticide (Chloropyrifos) using plants</p> <p>3.1.e Pesticide regulation: eg. Endosulphan issue.</p> <p><b>3.2. Toxicology Management.</b></p> <p>3.2.a Toxicology : Basic concepts, toxicity and its impacts, industrial toxicants and hazardous materials, toxic and hazardous waste management, measurement of toxicity, TLM and lethality studies, *Only in brief.</p> <p>3.2.b Limitation of Toxicological studies: Comparison of animal toxicological models and Toxicity in Humans.</p> <p>3.2.c Human clinical trials: Concept of Clinical trial phases - I, 2, 3 and 4.</p> <p>3.2.d Ethical issues of clinical trials: e.g. Thalidomide, Human Papillomavirus vaccine trials.</p>	<p><b><u>15 Lectures</u></b></p> <p><b>1 Lecture</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>1 Lecture</b></p> <p><b>3 Lectures</b></p> <p><b>2 Lectures</b></p> <p><b>1 Lectures</b></p> <p><b>1 Lecture</b></p>
<p><b><u>Unit IV</u></b></p> <p><b>4.1 Sustainable Development</b></p> <p>Ecological and economical growth factor for sustainable development, integrating environmental concerns in economic decisions.</p> <p>Economic cost of environmental degradation. Costs benefit analysis</p> <p><b>4.2 Awareness of citizen on environmental legal provisions:</b></p> <p>(i) Constitutional Provisions for environment (ii) Legislative power relating to environmental law (iii) General laws relating to environment.</p>	<p><b><u>15 Lectures</u></b></p> <p><b>7 Lectures</b></p> <p><b>4 Lectures</b></p> <p><b>4 Lectures</b></p>

## Semester V

### Practicals

#### Course code: RUSLScP 501

[Practicals Based on RUSLScP 501, Credits -1.5, Lectures- 60]

#### Genetics

<u>I) Experiments to be performed by students:</u>	<u>Expected learning outcomes</u>
1. Extraction of chromosomal DNA from chicken liver / goat spleen	I, C,T,R
2. Streak plating of saliva on two different media	C,T,R
3. Viable count for enumeration of bacteria by –Bulk seed method	C,T,R
4. Viable count for enumeration of bacteria by - Surface spread method	C,T,R

#### Demonstration experiments:

5. a) Study of <i>Drosophila</i> mutants from specimen / slides / photographs	C,R
b) Collection and observation of virgin <i>Drosophila</i> females for setting up of genetic crosses.	C,R
6. Study of UV-Visible Spectrophotometer	C,R
*Video presentation and GD	

#### Immunology

<u>I) Experiments to be performed by students:</u>	
1. Study of ABO Blood groups and quantitative Coomb's Test.	C, R.
2. Study of Isohemagglutinin titre in blood.	C, R.
3. Quantitative Widal Test.	C, R.

#### Demonstration experiments:

4. a) Dissect and expose the lymphoid organs of rat / photograph	C, R.
b) Study of Thymus, Spleen, and Lymph node tissue sections	C, R.
c) Observation of Blast cells in bone marrow of any mammal from slides / photographs.	C, R.

**Course code: RUSLScP 502**

**[Practical Syllabus Based on RUSLScP502, Credits: 1.5, Lectures : 60 ]**

- 1) Temporary mount of chick embryo.
- 2) Cytochrome C- oxidase activity in a developing chick embryo. C, T

**Plant Developmental Biology**

- 1) Root and shoot development in sections of plant. I,C,T,R. eg. *Scoparia dulces*/beans/any other.
- 2) Role of GA in seed germination. C,T

**Neurobiology**

- 1) Differential staining of white and grey matter of vertebrate brain.
- 2) Dissection & display of Nervous system in invertebrates – earthworm / cockroach or any other suitable animal C,T,R
- 3) Dissection & display of Nervous system in vertebrates – chick brain/goat brain or any other suitable system C,T ,R
- 4) Study of chick embryo for identification of fore, mid & hind brain areas ( Refer above Developmental Biology Practical no.1)
- 5) Study of Permanent slides of: C,R
  - a) Medullary nerve fibre:
  - b) TS of Spinal cord
  - c) Hodgkin and Huxley model
  - d) Electron micrographs of neural tissue
  - e) Animal Behaviour – Innate and Learned

**Demonstration Experiments (Any two of the following)**

Study of the Nervous system of Sepia with special reference to Giant axon and stellate ganglia  
T,C,R.

Mammalian brain – eg. Goat brain

Programmed cell death in limb bud using Janus Green B stain (in chick embryo).C, T,R



**Course code: RUSLScP 503**

**[Practical Syllabus Based on RUSLScP 503, Credits: 1.5, Lectures: 60]**

1. Extraction of enzyme: (Amylase from sweet-potato / salivary amylase / egg white lysozyme or any other convenient enzyme)
2. Purification of enzyme: Above enzyme extract used for purifying by salting-out method
3. Determination of - i) enzyme activity ii) specific activity.
4. Determination of the effect of pH and Temperature on Enzyme activity (Amylase / any other convenient enzyme).
5. Determination of the  $K_m$  of amylase/any other convenient enzyme.
6. Immobilization of Enzyme (Amylase/any other convenient enzyme) using hen egg-white / alginate method and assay its activity.
7. Enzyme Activity staining / Zymogram of Amylase using starch agar plates.
8. Non-denaturing Poly Acrylamide Gel Electrophoresis of *E.coli* extract / Serum proteins / Saliva / Egg white any other suitable sample/Amylase

**Course Code : RUSLScP 504**

**[Practical Syllabus Based on RUSLScP 504 Semester V Credits : 1.5, Lectures : 60 ]**

Note: I – Instrumentation, C - Conceptual understanding, T – Technical skill, R – Relevance to daily life.

1. A visit to aquatic ecosystem and methods for water and plankton collection/ Plankton identification and quantification from river / lake water samples **(CTR)**
2. Identification of minimum 5 plants and animals that form mangrove ecosystem, pneumatophores vivipary adaptations eg., *Kandelia kandel*, *Heritiera littoralis*  
Visit to Godrej mangrove **(CTR)**
2. Vegetation studies by line, quadrates and belt transect methods and their analysis. **(CT)**
3. Preparation of media for microbial culture, Isolation and culturing of microbes from Soil / water samples ( Fungal /Bacterial /Algal organism) . **(CTR)**
4. Study of fecundity from the given sample of freshwater/marine fish **(CTR)**
5. Isolation and culturing of Rhizobium from the given sample. **(CTR)**
6. Analysis of soils for pH, moisture, soil types. **(CTR)**
7. Water analysis for physicochemical characteristics: (any three) **(CTR)**  
Salinity/Acidity/Alkalinity/BOD/DO/COD/Copper

## Semester V: Text Books and References

### RUSLSc 501: References books

#### Units I and II Genetics

1. Principles of Genetics by Snustad and Simmons 4<sup>th</sup> edn. John Wiley and sons 2006.
2. I Genetics; A Molecular approach by Peter Russel 2<sup>nd</sup> edn. Pearson 2006.
3. I Genetics; A Mendelian approach by Peter Russel 2<sup>nd</sup> edn. Pearson 2006.
4. Introduction to Genetic Analysis by Griffiths et al 8<sup>th</sup> edn Freeman and co. 2005.
5. Genes IX by Benjamin Lewin; Jones and Bartlett publishers, 2008.
6. Principles of Gene Manipulation and Genomics by S. B. Primrose and R. M. Twyman 7<sup>th</sup> edn., Blackwell publication, asianedn Oxford publishers 2007.
7. Concepts of Genetics W. S. Klug and M. R. Cummings 7<sup>th</sup> edn. Pearson 2003.
8. Concepts of Genetics W. S. Klug, M. R. Cummings, C. A. Spencer 8<sup>th</sup> edn. Pearson 2006.
9. Human Molecular Genetics by Tom Strachan and Andrew Read, 3<sup>rd</sup> edn. Garland Science pub. 2004.
10. Principles of Genetics by R. Tamarin 7<sup>th</sup> edn 2002

#### Units III and IV Immunology

11. Immunology 5<sup>th</sup> edn. R.A.Goldsky, T. J. Kindt, B. A. Osborne, J. Kuby 2003.
12. Immunology: The immune system in health and disease 6<sup>th</sup> edn. C. A. Janeway, P. Travers, M. Walport, M. Shlomchik Garland Science Pub. 2005.
13. Cellular and Molecular Immunology, 2<sup>nd</sup> edn. A. K. Abbas, A. H. Litchman, 5<sup>th</sup> edn 2000.
14. Basic Immunology: Functions and disorders of the immune system, 2<sup>nd</sup> edn. A. K. Abbas, A. H. Litchman, 2<sup>nd</sup> edn 2004.
15. Roitt's Essential Immunology 11<sup>th</sup> edn. Blackwell publication 2006.
16. Immunology 7<sup>th</sup> International edn. D. Mole, J. Bronstoff, D. Roth, I. Roitt, Mosbey Elsevier publication, 2006.
17. An Introduction to Immunology C. V. Rao Narossa Publishers 2002.
18. Gene cloning and DNA analysis T.A. Brown Wiley Publishing House.

### RUSLSc 502: REFERENCE BOOKS

#### UNIT I and II Developmental Biology (Latest editions recommended)

1. Instant Lecture Notes- Developmental Biology  
R.M.Twyman, Viva Books Private Limited, New Delhi, Latest Edition ( First Edition – 2001)
2. Developmental Biology  
T.Subramaniam, Narosa publishing Hopuse, Mumbai, Latest Edition ( First Edition-2002)
3. Principles of Development  
L. Wolpert, R. Beddington, J. Brockes, T. Jesell and P. Lawrencel Oxford University Press.
4. Developmental Biology. W.A. Miller Springer – Verlag.
- 5.. Molecular Biology 3rd Ed.,

H.Lodish, D.Baltimore, A.Berk, S.L. Zipurski, P.Matsudaira and J. Darnell. Scientific American Book, W.H. Freeman, N.Y.

6. Molecular Biology of the Cell 3<sup>rd</sup> Edition.

B. Alberts, D. Bray, J.Lewis, M. Raff, K. Roberts and J.D.Watson. Garland Publishing Inc., N T and London.

7. 5. Plant Cell and Tissue Culture I. Vasil and T.A. Thorpe. Kluwer Academic Publishers.

8. Practical Zoology 2<sup>nd</sup> Edition. K.C. Ghone and B. Manna. New Central Book Agency Publishers.

9. Developmental Biology 4<sup>th</sup> edition. S.F. Gilbert. Sinauer Associates Inc. Publishers.

10. Pollen Analysis 2<sup>nd</sup> edition. P.D.Moore, J.A.Webb and M.E. Collinson Blackwell Scientific Publishers.

11. Pollen Biology – A laboratory manual (1992) K.R. Shivanna and N.S. Rangaswamy, Narosa Publishing, Calcutta.

11. Developmental Biology 2<sup>nd</sup> edition, L.W.Browder, Saunders College Publishing Co.

12. An Introduction to Embryology 5<sup>th</sup> Ed B. I. Ballinsky' Saunders, College Publishing Co.

13. Developmental Biology – Patterns, Problems and Principles. J. W. Saunders. J. R. MacMillan Publishing Co.,

14. An Introduction To the Embryology of Angiosperms. P. Maheshwari.

16. An Atlas Of Descriptive Embryology 2<sup>nd</sup> ed. W.W.Mathews. MacMillan Publishing Co.

15. Essential Developmental Biology – A Practical Approach Ed C.D. Stern and P.W.H. Holland. Oxford University Press

### **UNIT III and IV – Neurobiology ( Latest Editions Recommended).**

17. Neuroscience: Exploting the brain M.F.Baer, B.W.Connors&M.A.Paradiso, William & Wilkins, Baltimore, Latest Edition (First Edition1996)

18. Neurobiology 3<sup>rd</sup> edition G.M. Shepherd Oxford University Press.

19. Principles Of Neural Science. E.R.Kandel, J.H.Schwartz and T.M. Jessel. Prentice Hall Internation.

20. Instant Notes – Neurosciences, A.Longstaff Viva Books Pvt Ltd., New Delhi, 2002
21. Text Book Of Medical Physiology A.C.Guyton and J.E.Hall Saunders College Publishers.
22. Elements Of Molecular Neurobiology C.U.M. Smith J Wiley and Sons Publishers, N.Y.
23. An Introduction to Molecular Neurobiology Z.W. Hall Sinauer Associates Inc. Publishers.
24. Ion Channels – Molecules in Action D. J. Aidley and P.R. Stanfield. Cembridge University Press.
25. Comparative Neurobiology J. P. Mill Edward Arnold Publishers.
26. Physiology Of the Nervous Systems D Ottoson, McMillan Press.

### **RUSLSc 503: REFERENCE BOOKS**

1. Principles of gene manipulation and Genomics by Primrose and Twyman, 7<sup>th</sup> edition, Blackwell publishing (2006)
2. Molecular Techniques in Biochemistry and Biotechnology by S Shrivastava (2010) Pub. New central book Agency (P) Ltd
3. Molecular Biology by Robert Weaver, second edition Pub Mc Graw Hill (2003 )
4. Text book of cell and Molecular Biology by Ajoy Paul Pub Books and Allied (P) Ltd. Second edition (2009)
5. Cell and molecular biology by sp Vyas and Mehta (2011) CBS pub and Dist Pvt Ltd.
6. Industrial Microbiology. L.E.Casida (2003) New Age International (P) Ltd.
7. Industrial Microbiology. Prescott And Dunn's (2004) Chapman & Hall.
8. Industrial Microbiology. A H PATEL (2005) Macmillan India.

### **RUSLSc 504: REFERENCE BOOKS**

1. Misra and Pandey (2011), “Essential environmental studies ‘’, Ane Books
2. Martens (1998),”Health and climate change ‘’, Earth Scan
3. Saxena (1998), “Environmental Analysis of soil and air”, Agrobotanica
4. Chakraborti (2005),”Energy efficient and environment friendly technologies for rural development ‘’, Allied Publishers
5. Dash M C (2004) “Ecology, chemistry and Management of environmental Pollution ‘’,Mac Millan India
6. Nayak ,Amar(2006) ”Sustainable sewage water Management ‘’,Mc Millan India
7. Dolder, Willi (2009), “Endangered animals, Parragon
8. Gupta P K (2000),” Methods in environmental Analysis ‘’,Agrobio (India)

9. Fumento, Michael (2003), "Bioevolution : How biotechnology is changing our world" , California encounter Books
10. Kapur (2010) "Vulnerable India " , SAGE
11. Jacob, Miriam(2004) , " Silent Invaders" , Orient Longman
12. Mc Cafferty (1998) , "Aquatic Entomology " , Jones and Barlett
13. Subramnyam (2006), "Ecology " , 2<sup>nd</sup> ed. Narosa
14. Dilip Kumar, Rajvaidya (2004), " Environmental Biotechnology " , APH
15. Sharma and Khan (2004), " Ozone Depletion and Environmental Impacts" ,  
Pointer publishers

## EXAMINATION PATTERN FOR TYBSc

### T.Y.BSc

	PAPER	EXAM	TOTAL MARKS
Semester V	I	Theory	60
		Theory Internals	40
		Practicals Internals	20
		Practicals Final	30
	II	Theory	60
		Theory Internals	40
		Practicals Internals	20
		Practicals Final	30
	III	Theory	60
		Theory Internals	40
		Practicals Internals	20
		Practicals Final	30
	IV	Theory	60
		Theory Internals	40
		Practicals Internals	20
		Practicals Final	30

<b>INTERNALS FOR SEMESTER V</b>				
<b>Paper</b>	<b>20 mks</b>	<b>08 mks</b>	<b>07 mks</b>	<b>5 mks</b>
I	Written Test	Presentation on topic from syllabus / Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance
II	Written Test	Presentation on topic from syllabus / Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance
III	Written Test	Presentation on topic from syllabus / Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance
IV	Written Test	Visit / Project / Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance