

Resolution No.: AC/II(18-19).2.RUS7

S.P. Mandali's
RAMNARAIN RUIA AUTONOMOUS COLLEGE



Syllabus for: **F.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
F.Y.B.Sc. LIFE SCIENCES SYLLABUS

ACADEMIC YEAR 2019-2020

SEMESTER I

PAPER - I

Title: Molecular and Cellular studies in Life Sciences

Course code	Unit	Topic Heading	Credits	L/week
RUSLSc 101	I	Biomolecules within living cells I	2	1
	II	Features of Eukaryotic and Prokaryotic cells		1
	III	Cytoskeletal elements and cell wall		1

PAPER - II

Title: Physiological systems, Genetics and Ecology

Course code	Unit	Topic Heading	Credits	L/week
RUSLSc 102	I	Multicellularity in plants and animals	2	1
	II	Plant and Animal Physiology 1		1
	III	Plant and Animal Physiology 2		1

PRACTICALS

Course code	Topic Heading	Credits	L/week
RUSLScP 101	Practicals in Molecular and Cellular studies in Life Sciences	1	3
RUSLScP 102	Practicals in Physiological systems, Genetics and Ecology	1	3

SEMESTER I

PAPER – I

MOLECULAR AND CELLULAR STUDIES IN LIFE SCIENCES

PREAMBLE:

The in-depth concepts in cellular and molecular biology helps to understand the basis of living forms in a much lucid way. This paper deals with the biomolecules, structure and function of plant and animal cells.

Course Code RUSLSc101	THEORY	2 Credits Total 45 lectures
Unit I – Biomolecules within living cells I		15 lectures
Topic No.	Title	No. of lectures
1.	Physiological Role of water: Structure of water molecule, ionic interactions, ionic product of water, concept of pH, buffers and its types, Henderson Hasselbalch equation, significance of water.	2
2.	Amino acids: Classification based on R groups, essential, semi essential and non essential amino acids.	2
3.	Proteins: Classification, Functions, Incomplete and complete proteins, Structural organization- Primary, Secondary, Tertiary, Quaternary levels. One example of each.	6
4.	Nucleic acids: Structure of nucleosides and nucleotides, structure of nucleic acids (A,B,Z forms); the structure of DNA lends itself to its function as hereditary molecule.	5
Unit II – Features of Eukaryotic and Prokaryotic cells		15 lectures
Topic No.	Title	No. of lectures
1.	Microscopy: Prokaryotic cell structure. E.g. <i>E. coli</i> Eukaryotic cell structure. E.g. Yeast (Unicellular)	4

	Evolutionary origin of organelles; the endosymbiont hypothesis –E.g., Chloroplast, Mitochondria.	
2.	Virus: Virus structure, Life cycle of bacteriophage (Lytic and Lysogenic), Plant and Animal virus (One example: TMV and Adeno virus).	4
3.	Microbial growth: Influencing factors, culture media (enriched and minimal), isolation, preservation, life cycle and growth curve of <i>E.coli</i>	4
4.	Cell division: Mitosis and Meiosis with phases in cell division with significance.	3
Unit III – Cytoskeletal elements and cell wall		15 lectures
Topic No.	Title	No. of lectures
1.	Nucleus: Structure and Chromosome packaging, lampbrush and polytene chromosome.	6
2.	Cytoskeletal elements: Microfilaments: Structure and function in striated muscle fibers. Role in cytoplasmic streaming in plants. Microtubules: Structure as in cilia or in flagella, mechanism in movement. Function in mitotic spindle. Intermediate filaments: Structure and function.	6
3.	Structure of cell wall: Bacterial cell wall: Gram positive and Gram negative. Fungal cell wall Plant cell wall: Primary and secondary	3

SEMESTER I

PAPER – II

PHYSIOLOGICAL SYSTEMS, GENETICS AND ECOLOGY

PREAMBLE:

Organizational transitions in body plans of flora and fauna has lead to a large Biodiversity. This paper includes the physiological adaptations for the particular environmental conditions.

Course Code RUSLSc102	THEORY	2 Credits Total 45 lectures
Unit I – Multicellularity in plants and animals		15 lectures
Topic No.	Title	No. of lectures
1.	Overview of Classification of organisms: 5 Kingdom Classification, and the latest system of classification. Bentham Hooker for plants.	3
2a.	Nutrition – Autotrophic nutrition – Importance of photosynthesis in plants and in autotrophic prokaryotes (photosynthetic and chemosynthetic eg. nitrifying bacteria), Cyanobacteria. Macro and micro nutrients for plants.	3
2b.	Nutritional adaptations – involve relationships with other organisms eg. insectivorous plants and symbiotic nitrogen fixation.	2
2c.	Heterotrophic nutrition – ex. holozoic, saprophytic (fungi) and parasitic (Cuscuta, Tapeworm) Holozoic nutrition i) fluid feeders (ex. Mosquito or Housefly) ii) microphagous (ex. Amoeba or Paramecium) iii) macrophagous (mammals)	4
3.	Digestive systems of mammals (each organ of mammalian digestive system has specialized food-processing function) Evolutionary adaptation associated with diet eg. dental, stomach and intestine (ruminant)	3

Unit II – Plant and Animal Physiology 1		15 lectures
Topic No.	Title	No. of lectures
	TRANSPORT AND CIRCULATION	
1.	Translocation in plants: Transport of water and inorganic solutes – transpiration, stomatal function and regulation, role of proton pumps and factors affecting ascent of xylem sap. Transport of organic solutes – mechanism and its regulation.	3
2.	Circulation in animals: i) Animals without a circulatory system eg Hydra and jellyfish ii) Open and closed circulatory system eg. insects vs worms	2
3.	Vertebrate circulatory system: Heart; single and double circulation. Specific adaptations – mammals at high altitudes and diving mammals. Cardiovascular system in health and disease –hypertension and atherosclerosis and the role of exercise.	4
4.	Respiration and Gaseous Exchange: Gaseous exchange in small animals (across surface) and cutaneous respiration in frogs. Gaseous exchange in plants – Stomata and Pneumatophores (to be dealt in practicals) Gaseous exchange in invertebrates – trachea in insects, book lungs in scorpion Gaseous exchange in vertebrates – gills and lungs	6
Unit III – Plant and Animal Physiology 2		15 lectures
Topic No.	Title	No. of lectures
1.	Excretion and Osmoregulation: In plants – water and salt regulation under normal and stressed conditions In animals – Phylogenetic review of organs and processes -	8

	<p>contractile vacuole, flame cells, nephridium, malpighian tubules, kidney and skin in man</p> <p>Concept of osmoregulation and processes associated with osmoregulation (ultrafiltration, selective re-absorption, secretion, acid-base regulation)</p> <p>Nitrogenous excretory products (ammonotelism, ureotelism and uricotelism)</p>	
2.	<p>Support and Locomotion: Support in plants – herbaceous and woody plants</p> <p>Types of skeletons – hydrostatic (nematodes), exoskeleton (arthropods/molluscs) and endoskeletons (vertebrates-axial and appendicular skeleton and joints E.g., Human)</p>	7

SEMESTER – I

PRACTICALS

Practical application of theory content in the syllabus and to have a hands on experience for a project based learning.

PRACTICAL – I

Course Code RUSLScP 101	PRACTICALS	2 Credits Total 45 lectures
Practicals in Molecular and Cellular studies in Life Sciences - I		
No.	Title	No. of lectures
1.	Good Laboratory practices: An introduction to Laboratory discipline and GLP, SOP (in detail) and Instrument safety GLP Handling Biological/ Blood and hazardous chemical. Documentation and validation, Industry purpose. Survey of the organization of laboratory instruments, chemicals and glassware. Lab safety (instruments and chemicals) [incorporated into every practical].	2
2.	Introduction to Elementary microbial techniques : Sterilization & Disinfection Air microflora Microbial Staining technique and Microscopy Comparative study of samples from 5 different sources to check gram positive and gram negative bacteria - Butter milk, tap water, sewage water, food Item, soil, rotten – effect of heat using Monochrome Staining Gram Staining Cell wall staining	5

3.	<p>Micrometry Eukaryotic cells and Microscopic measurements: Staining of onion peel / plant cells to reveal structure and organization of cells Micrometry - Using the microscope to measure size of cells / nucleus/ different pollen grains</p>	3
4.	<p>Effect of temp on movements in plants and animals using any system: Cytoplasmic streaming in Vallisnaria and Hydrilla Culturing and observation of feeding in Paramecium from Hay infusion (students must be demonstrated how to develop a culture) Source- vermicompost / cowdung)</p>	2
5.	<p>Preparation of solutions of a given chemical compound - Molar and percentage solutions – Concept and calculations only</p>	4
6.	<p>Molecular biology and Biochemistry: Isolation and Detection of DNA (by observing spools) from Onion/ cauliflower/ broccoli/ any other convenient, cost - effective system. DPA detection optional / demonstration.</p>	5
7.	<p>Histochemistry and enzymology: Localization of Proteins and Nucleic acids from the following or any other convenient system Proteins of peas / cockroach muscles DNA and RNA from onion peel using methyl green pyronin staining.</p>	5
8.	<p>Instrumentation and techniques: Calibration of the pH Meter with standard buffer pH4 and pH9.2 as per GLP Checking of pH for common foodstuff e.g. Milk/cola drink/Lime juice or any other relevant sample.</p>	3
9.	<p>Microscopy: Principles of light and Fluorescent Microscopy, Electron Microscopy-Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Study of Electron Micrographs as listed below: Mitochondria Lysosomes Basement membrane/ junctions Cilia Both normal and pathological</p>	5
10.	<p>Cell division: Determining effect of colchicine / mitotic inhibitor /environmental pollutant / mitotic activator on mitosis in onion root tip by calculating mitotic index</p>	5

11.	Meiosis from <i>Tradescantia</i> (demonstration/ Photograph)	3
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PRACTICAL – II

Course Code RUSLScP 102	PRACTICALS	2 Credits Total 45 lectures
Practicals in Physiological systems, Genetics and Ecology - II		
No.	Title	No. of lectures
1.	Gaseous exchange in plants – Stomata and Pneumatophores	3
2.	Salt excretion in Avicennia-salt glands.	3
3.	Study of Tissues : Plant Tissues – Temporary mounting/ observation of permanent slides of Mounting of Dicot / Monocot stomata (structure and function)	5
4.	Hematology: Differential count of WBCs using Giemsa/ Lieishman stain	2
5.	Diversity of Life: Five Kingdom Classification New system of classification currently used for plants and animals Field study to at least one site: To understand flora and fauna, visit to a national park a century or pond or lake or marine ecosystem. To prepare a field report to be duly certified Any Industrial Visit or Invited Guest lecture with reference to FYBSc Life-Science Syllabus	5
6.	Study of Mouth parts in insect and Comparative assessment of mouth parts: Preparation of fresh mount of; Piercing and sucking type- eg Mosquito Sponging type- eg Housefly Biting and Chewing type- eg Cockroach (if available)	5
7.	Mounting of nephridium of earthworm and permanent slide of kidney.	3

REFERENCES:

RUSLSc 101

1. Cell Biology, Genetics, Molecular biology, Evolution and Ecology
P.S. Verma and V.K. Agarwal
Publishers : S. Chand and Co.Ltd., (2009)
2. Becker's World of the Cell: International Edition – 8th Edition
Jeff Hardin Gregory Paul Bertoni, Lewis J. Kleinsmith
Publishers: Pearson Dorling Kinderflay India / Pearson India (2011)
3. Life: The Science of Biology,
William K Purves, D. Sadava, G. H. Orians and H.C. Heller 7th Edn. (2003)
Sinauer Associates
4. Molecular Cell Biology – 7th Edition
Ed: Harvey Lodish, Arnold Berk, Chris A. Kaiser and 5 more (2012) Pub:
Macmillan
5. Molecular Biology of the Cell
Ed: Bruce Alberts, Alexander Johnson, Julian Lewis , David Morgan , Martin Raff, Keith Roberts, Peter
Walter 5th Edition (2007) or 6th Edition (2014)
Pub: Garland Science
6. Essential Cell Biology
Ed: Bruce Alberts, Dennis Bray, Karen Hopkin and Alexander Johnson (2009) 3rd Edition Pub:
Garland Science
7. Fundamentals of Biochemistry
Ed: Voet. and Voet 4th edition, (2010)
Pub: John Wiley and Sons
8. Lehninger Principles of Biochemistry Ed:
D.L. Nelson, 5th edition, (2008) Pub: CBS
Publishers and Distributors
9. Principles of Biochemistry
Ed: Zubay G.L, Parson W.W. and Vance D.E. 1st edition (1995) Pub: W. C. Brown

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1. Biological Science, Taylor, Green and Stout., 3rd edn. Ed. R. Soper .(2005)
Cambridge Univ. press
2. An Introduction to Genetic Analysis Ed: Griffiths A.J. et al (2000)
Pub: W. H. Freeman(London) Seventh Edition
3. Comparative Animal Physiology, Philip C.Withers,(1992),
Saunders College Publishing House.
4. Biology A Modern Introduction, B.S.Beckett (1994),
GCSE Edn. Oxford Univ. Press.
5. Essentials of Human Genetics, S.M.Bhatnagar, M.L.Kothari & L.A.Mehta, (1994),
Orient Longman's Publication.
6. Cell Biology, Genetics, Molecular biology, Evolution and Ecology – P.S. Verma and V.K. Agarwal
(2009)
Publishers : S. Chand and Co.Ltd.,
7. Biological Science : - Scott Freeman (2004)
Pub: Benjamin Cummings Publishing Company
8. Principles of Anatomy and Physiology 10th edition (2003)
Gerard J. Tortora and Sandra R. Grabowski
John Wiley & Sons, Inc.

Evaluation Pattern

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

INTERNALS FOR SEMESTER I AND II				
Paper	20 mks	08 mks	07 mks	5 mks
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 / Visit / Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance