Resolution No. - AC/II(23-24).2.RUS7

S. P. Mandali's

Ramnarain Ruia Autonomous College

(*Affiliated to Mumbai University*)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for Discipline Specific Course (DSC)

Program: F.Y.B.Sc. Life Science

Program Code: RUSLSc

(As per the guidelines of National Education Policy 2020-
Academic year 2024-25)

(Choice based Credit System)

Graduate Attributes

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

GA	GA Description **A student completing Bachelor's Degree in Science program will be able to:**
GA 1	Demonstrate an understanding of biological systems across microorganisms, plants and animals. To develop necessary laboratory skills and analytical methods.
GA 2	Employ critical thinking and scientific knowledge to design experiments, record observations, analyse data and interpret results. They can further build their career in research.
GA 3	Create an awareness of environmental issues, biological diversity, and how we can make a positive impact on it.
GA 4	Inculcate scientific temperament and generate problems solving approaches in students when they integrate themselves in the larger society.
GA 5	Develop necessary laboratory skills and analytical methods.

PROGRAM OUTCOMES

PO	Description A student completing Bachelor's Degree in Science program in the subject of Life Science will be able to:
PO 1	To be able to describe the biomolecules and metabolic processes, compare developmental processes and physiological systems in plants and animals, neuroendocrine system, short term and long-term memory, learning and behaviour, neurological disorders, biological evolution, human evolution of thought process, which allows for curiosity, and enhances learning process ahead.
PO 2	To be able to describe interspecific interactions in the ecosystem, Plant Tissue Culture techniques and its significance in agriculture, germplasm conservation and secondary metabolites, and Animal Tissue Culture techniques, Fermentation Technology and its role in industry and society
PO 3	To be able to explain DNA Cloning, use of cloning vectors like *E. coli* plasmids, cosmids, phagemids, viral vectors, significance of restriction enzymes, apply Mendel's laws, gene regulation in prokaryotes and eukaryotes, defence mechanisms in plants and animals, innate and adaptive immune system.
PO 4	Apply Biostatistics to analyse, Probable Chance of Occurrence, Normal Population, Student's t-test, Correlation and Regression analysis, Chi-Square test, data analysis for project work
PO 5	Skills-Perform assays to identify, purify, quantify, immobilize proteins/enzymes using techniques like Centrifugation, Electrophoresis and Chromatography, dissection of animals, protocols to handle preserved animals, working in aseptic conditions, use and maintaining of diagnostic kits, pedigree analysis in humans, karyotyping in plants
PO 6	Environment and Sustainability- to analyse the local biodiversity at residential sites of students and the changes occurring in the biodiversity and to conserve the same, awareness about implementation of Laws Regulations, citizens awareness to oppose under the aegis of NGO

PO 7	Ethics- awareness of plagiarism in scientific work, acknowledging/ citing the work, lab ethics in handling biological materials and chemicals, to be able to apply professional and ethical principles, minimize waste and ethical waste disposal
PO 8	Communication skills- to be able to communicate clearly through presentations as well as document, write effective reports or communicate and work in a team
PO 9	Project Management- to be able to write SOPs for instruments, design experiments, analyse data, work in a team, a scientific way of thinking, a diverse approach to scientific enquiry towards an idea.
PO 10	Life Long Learning- to be able to learn independently and adapt to changing needs of the society

CREDIT STRUCTURE BSc

Semester	Subject 1		Subject 2	GE/ OE course (Across disciplines)	Vocational and Skill Enhancement Course (VSC) & SEC	Ability Enhancement Course (AEC) / VEC/ IKS	OJT/FP/CEP/CC /RP	Total Credits
	DSC	DSE						
1	4		4	4	VSC-2 + SEC -2	AEC- 2 (CSK) + VEC- 2 (Env Sc.) + IKS-2		22
2	4		4	4	VSC-2 + SEC-2	AEC-2 (CSK)+ VEC-2 (Understanding India)	CC-2	22
Total	8		8	8	8	10	2	44
Exit option: award of UG certificate in Major with 44 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								
3	Major 8		Minor 4	2	VSC-2	AEC-2 MIL	FP -2, CC-2	22
4	Major 8		Minor 4	2	SEC-2	AEC-2 MIL	CEP-2, CC-2	22
Total	16		8	4	4	4	8	44
Exit option: award of UG Diploma in Major with 88 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								
5	DSC 12	DSE 4	Minor 2		VSC-2		CEPFP-2	22
6	DSC 12	DSE 4	Minor 2				OJT-4	22
Total	24	8	4		2		6	44
	Exit option: award of UG Degree in Major with 132 credits or Continue with Major for Honors/ Research							

Course Title: Molecular, Cellular and Physiological studies in Life Sciences I

Course Code: RUSLSc. O101

Type of Course: Discipline Specific Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Explain structures and functions of amino acids, proteins, nucleic acids, nucleus and nuclear membrane, giant chromosomes, lampbrush chromosomes, functions of cytoskeletal elements.
CO2	Describe plant cell wall, bacterial cell wall and fungal cell wall, eukaryotic and prokaryotic cells, different microbial media, microbial preservation techniques.
CO3	Understand the evolutionary significance of Physiological system in animal
CO4	Differentiate between essential nonessential amino acids, complete, incomplete proteins, different forms of DNA, Distinguish between different phases in cell cycle and cell division.
CO5	Compare different cell wall types, compare different phases of microbial growth

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUSLSc.O101		**Molecular, Cellular and Physiological studies in Life Sciences I**	**3 Credits/ 45 Lectures**
	I	**Biomolecules within living cells I** **Amino acids:** Classification based on R groups, essential, semi essential, and non-essential amino acids. **Proteins:** Classification, Functions, Incomplete and complete proteins, Structural organization- Primary, Secondary, Tertiary, Quaternary levels. One example of each. **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. **Features of Eukaryotic and Prokaryotic cells** Prokaryotic cell structure. Eukaryotic cell structure **Virus:** Virus structure: Plant and Animal virus (One example: TMV and Adenovirus, Coronavirus) **Structure of cell wall:** Bacterial cell wall, Plant cell wall: Primary and secondary.	**15 Lectures**
	II	**Genetics I** **Mendelian Inheritance:** Concept of homozygous, heterozygous, phenotype, genotype, alleles; Mendel's Laws and Mono & Dihybrid ratios with problems, chi square –for 3:1 and 1:1 ratios. Use sickle cell anemia as an example to explain the concept of genes. **Chromosomal inheritance:** Sutton's hypothesis, sex-linked inheritance, study of human pedigrees (e.g. Sex linked dominant and recessive; autosomal dominant & recessive)	
	III	**Plant and Animal Physiology, Ecology in Life Sciences I**	**15 Lectures**

		Translocation in plants: Transport of water and inorganic solutes – transpiration, stomatal function and regulation. Transport of organic solutes – mechanism and its regulation. **Circulation in animals:** Animals without a circulatory system eg. Hydra and jellyfish Invertebrate Circulatory system with example Vertebrate circulatory system Heart; single and double circulation. Specific adaptations – mammals at high altitudes and diving mammals. **Animal Behaviour** Basic behavioural patterns – taxis, tropism, reflex, instinct & conditioned behaviour Environmental studies - to be dealt with as an assignment.	
		PRACTICALS	**1 Credit Total 15 lectures**
RUSLScP.O101		**Molecular, Cellular and Physiological studies in Life Sciences – I (PRACTICAL I)**	
		1. Good Laboratory practices: An introduction to Laboratory discipline and GLP, SOP (in detail) and Instrument safety GLP Handling Biological/ Blood and hazardous chemicals. 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.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 - Buttermilk, tap water, sewage water, food Item, soil, rotten – effect of heat using Monochrome Staining Gram Staining. Cell wall staining **3.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. **4.Effect of antitranspirants on stomatal movements**. (1 monocot and 1 dicot). **5.Histochemistry:** Localization of Proteins and Nucleic acids from the suitable system Proteins of peas / cockroach muscles DNA and RNA from onion peel using methyl green pyronin staining **6.Cell division**: Mitosis and Meiosis phases in cell division and its significance Determining effect of colchicine / mitotic inhibitor /environmental pollutant / mitotic activator on mitosis in onion root tip by calculating mitotic index 7.**Study of Plant Tissues:** Temporary mounting/ observation of permanent slides of Mounting of Dicot /Monocot Stem, Root. **8. Molecular biology and Biochemistry:** Isolation and Detection of DNA (by observing spools) from Onion or any other DPA detection optional / demonstration.	

REFERENCES:
RUSLSc,O101

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.

Course Title: Molecular, Cellular and Physiological studies in Life Sciences I

Course Code: RUSLSc.E111

Type of Course: Discipline Specific Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Understand native flora and fauna through field visits.
CO 2	Differentiate between essential nonessential amino acids, lipids, and different forms of carbohydrates.
CO 3	Explain the concept of homozygous, heterozygous, phenotype, genotype and alleles.
CO 4	Explain the Mendelian laws, monohybrid and dihybrid ratios with problems and chromosomal inheritance.
CO 5	Understand how interspecific interactions at ecological level and distribution of the population can be related to biodiversity visits.
CO 6	Study the different physiological systems and ecological adaptations.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUSLSc.E111		**Molecular, Cellular and Physiological studies in Life Sciences II**	**3 Credits/ 45 Lectures**
	I	**Biomolecules within living cells II** **Lipids:** Classification, structures function and properties of lipids (simple, derived and complex with one example each) **Carbohydrates:** Structure of Monosaccharides, Disaccharides, Oligosaccharide, polysaccharides Animal and plant source starch, glycogen, cellulose and chitin. **Cell membrane:** Membrane models: Unit membrane and Fluid Mosaic Model of Singer and Nicholson. Membrane junctions: Tight, gap, desmosomes, septate. Membrane Transport: Diffusion, osmosis, passive and active transport, endocytosis and Exocytosis.	**15 Lectures**
	II	**Genetics II** **Modifications of Mendel's laws and Mutations** **Modification of Mendel's laws:** Gene interactions: incomplete dominance, codominance Multiple genes; Multiple alleles: Blood group; Epistasis; Linkage: Sex limited; sex influenced. **Mutations:** Point Mutations Chromosomal aberrations: Structural: deletion, duplication, inversion, translocation. Numerical: euploidy & aneuploidy (e.g. Downs, Turners. Klinefelter's, Cri- du-chat)	**15 Lectures**
	III	**Physiology and Ecology II** **Excretion and Osmoregulation:** In plants – water and salt regulation under normal and stressed conditions In animals – contractile vacuole, flame cells, nephridium, malpighian tubules, kidney and skin in man Nitrogenous excretory products (ammonotelism, ureotelism and uricotelism) Support and Locomotion: Types of skeletons – hydrostatic, exoskeleton and endoskeletons	

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
		Respiration and Gaseous Exchange: Gaseous exchange in plants – Stomata and Pneumatophores. Gaseous exchange in invertebrates – trachea in insects, book lungs in scorpion Gaseous exchange in vertebrates – gills and lungs **Ecological Adaptations:** plants (any two) and animals (any two) Biological clocks and rhythms	
		PRACTICALS	**1 Credit Total 15 lectures**
RUSLScP.E111		**Practicals in Molecular, Cellular and Physiological studies in Life Sciences II**	
		1.Localization of Carbohydrates and Lipids; Starch grains of Potato / of seeds and other tubers Fat bodies of Cockroach/Drosophila/lipids of groundnut. **2.Hematology:** Differential count of WBCs using Giemsa/ Lieishman stain. **3.Diversity of Life:** Five Kingdom Classification (Outline) Classification of Animal **4. Soil analysis:** Edaphic factors Texture, water content, soil organisms **5. Gaseous exchange & Excretion in plants** – Stomata in dicot monocot and Pneumatophores . **6. Excretion in plant**: salt glands in mangrove plant **7. Study of Barr Body** **9. Biostatistics:** Measures of central tendency – (Mean, Median, Mode) Standard Deviation (data from experiments done in	

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
		class or Field study data can be used for biostatistics). **10. Field study to at least one site:** To understand flora and fauna, visit 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	

REFERENCES:

RUSLSc.E111

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) Gerad J.Tortora and Sandra R.Grabowski, John Wiley &Sons. Inc.

Modalities of Assessment

Discipline Specific Course - (3 Credit Theory Course for BSc)

A) Internal Assessment 40% - 30 Marks

Sr No	Evaluation type	Marks
1	Class Test	20
2	Project / Assignment / Presentation	10
	TOTAL	**30**

B) External Examination (Semester End) 60%- 45 Marks

Semester End Theory Examination:

1. Duration – The duration for these examinations shall be of **One hour 30 Minutes**.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
1	Answer any 3 out of 4 (5 marks each)	15	Unit 1
2	Answer any 3 out of 4 (5 marks each)	15	Unit 2
3	Answer any 3 out of 4 (5 marks each)	15	Unit 3
	TOTAL	**45**	

C) Practical Examination Pattern: Total Marks 25

External Examination: 25 Marks

Semester End Practical Examination:

Question	Options	Marks
1	Main question to perform Experimental task / Estimation / Biostatistical analysis	12
2	Identification	08
3	Journal	05
	TOTAL	**25**
