S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

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

ACADEMIC YEAR 2019-2020

SEMESTER III

PAPER - I
Title: Physiological Systems in Plants and Animals-I

Course code	Unit	Topic Heading	Credits	L/week
RUSLSc 301	I	Role of Hormone and Homeostatic Mechanisms in Animals and Plants	2	1
	II	Introduction to Nervous System, Animal And Plant Movements and Behaviour		1
	III	Developmental Biology in Plants and Animals		1

PAPER - II
Title: Biochemical Approach to Life Processes in Plants and Animals

Course code	Unit	Topic Heading	Credits	L/week
RUSLSc 302	I	Enzymology	2	1
	II	Carbohydrate Metabolism and Bioenergetics		1
	III	Lipids and Proteins Metabolism		1

PAPER - III

Title: Evolutionary Biology, Biostatistical Approach and Bioinformatics-I

Course code	Unit	Topic Heading	Credits	L/week
RUSLSc 303	I	Evolution and Population Genetics	2	1
	II	Biostatistics		1
	III	Bioinformatics		1

PRACTICALS

Course code	Topic Heading	Credits	L/week
RUSLScP 301	Practicals in Physiological Systems in Plants and Animals-I	1	3
RUSLScP 302	Practicals in Biochemical Approach to Life Processes in Plants and Animals	1	3
RUSLScP 303	Practicals in Evolutionary Biology, Biostatistical Approach and Bioinformatics-I	1	3

SEMESTER III

Paper I

Title: Physiological Systems in Plants and Animals-I

PREAMBLE:
This syllabus compares the diverse Physiological Systems in Plants and Animals for lucid understanding of the subject. This will also help for current trends towards scientific enquiry.

Course Code RUSLSc 301	THEORY	2 Credits Total 45 lectures
Unit I – Role of Hormone and Homeostatic Mechanisms in Animals and Plants		**15 lectures**
Topic No.	Title	No. of lectures
1.	Control systems in homeostasis and components of homeostatic control	2
2.	An overview of cell signalling and biochemical basis of cell signalling - Release and transport of chemical messengers, receptors and communication of signal to target cell.	3
3.	Cell signalling in the nervous system and endocrine system [eg. Amines (catecholamine and thyroid hormones)] – a) Regulation of receptors (up and down regulation). b) Regulation of cell signalling: 1st, 2nd and 3rd order feedback mechanisms.	3
4a.	a) Hormones of Pineal, Hypothalamus, Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal gland, Testis and Ovary.	4
4b.	b) Auxins, Giberillic acid, Cytokinin, Abscisic acid, Ethylene.	3
Unit II – Introduction to Nervous System, Animal And Plant Movements and Behaviour		**15 lectures**

Topic No.	Title	No. of lectures
1.	Human Nervous System – CNS and PNS overview	3
2.	Types of cells: Neuronal, Glial cells, ependymal cells and Schwann cells Role of meninges and CSF Nature of the Nerve Impulse – Resting potential, Action Potential	3
3.	Introduction to types of Synapses and Nerve impulses	2
4.	a) Behaviour in animal-Innate and learned with suitable example. b) Migration in animals.: Physiological aspect (Fat accumulation and thermoregulation).	4
5.	Plant movements –Tropisms, Taxes, Nasties and Kinesis and its Molecular aspects – discuss with suitable examples	3

Unit III – Developmental Biology in Plants and Animals		**15 lectures**
Topic No.	Title	No. of lectures
1.	1. Basis of Sex Determination. (a) Plants: Maize (b) Animals: Role of SRY gene and Aromatase (c) Role of environmental factors – Temperature and Parthenogenesis in insects Eg. Wasp/Honey bee/Ants (d) Plant-animal interaction for reproduction Fig wasp / Gall wasp (e) Sex reversal (f) Alternation of generations in plants Eg. *Adiantum*	5
2.	Ovarian and testicular functions, puberty and regulation of uterine changes in menstrual cycle, menopause, pregnancy, parturition, lactation. Artificial regulation of reproduction: Use of contraceptive methods.	6
3.	1. Microsporogenesis and Megasporogenesis. 2. Types of ovules and fertilization. 3. Development of embryo in monocot and dicot plants.	4

SEMESTER III

Paper II

Title: Biochemical Approach to Life Processes in Plants and Animals-I

PREAMBLE:

To study the biochemical processes in cells and tissues of plants and animals, their regulation and integration to understand the life processes.

Course Code RUSLSc302	THEORY	2 Credits Total 45 lectures
Unit-I: Enzymology		**15 Lectures**
Topic No.	Title	No. of Lectures
1.	Strategies for Isolation and purification of enzymes, measurement of specific activity and purification fold.	2
2.	Classification of enzymes (With an example of each)	1
3.	Effect of pH and Temperature	2
4.	Co-enzymes and co-factors : NAD, FAD, Mn, Mg, Zn and Cu (one example each)	2
5.	Kinetics (Michealis Menten's, Lineweaver Burk plots).	2
6.	Enzyme Inhibitors, Activators and feed-back inhibition.	2
7.	Allosteric enzymes (Kinases in Glycolysis) and their significance in metabolic regulation,	2

8.	Concept of Isoenzymes: LDH	2

Unit-II: Carbohydrate Metabolism and Bioenergetics.		**15 lectures**
Topic No.	Title	No. of lectures
1.	**Carbohydrate Metabolism:** a) Glycolysis – Process and metabolic regulation b) Pentose Phosphate Pathway. c) Citric Acid Cycle: Process and regulation, Importance as a central amphibolic pathway.	8
2.	Electron Transport System: Localisation and Sequence of electron transporters	3
3.	Oxidative Phosphorylation: Mitchell's Chemiosmotic Hypothesis, ATP synthesis, Control of respiration, uncoupling and metabolic poisons	4

Unit III: Lipids and Proteins Metabolism.		**15 lectures**
Topic No.	Title	No. of lectures
1.	**Lipids - Catabolism** : Lipolysis, Role of Carnitine in mitochondrial permeability, Beta– Oxidation of fatty acids and integration into Kreb's cycle, Ketone bodies and their significance	7
2.	**Amino Acids – Catabolism:** Protein Degradation liberating amino-acids', Deamination, Transamination & ammonia disposal by Urea cycle, Decarboxylation & integration into Kreb's cycle	8

SEMESTER III

Paper III

Title: Evolutionary Biology, Biostatistical Approach and Bioinformatics-I.

PREAMBLE:

Human population and the population dynamics are dependent on biological forces and social forces. This syllabus focuses on evolutionary concepts, population studies. The syllabus also deals with fundamentals of Biostatistics and Bioinformatics, which further can also be applied to population studies.

Course Code RUSLSc303	THEORY	2 Credits Total 45 lectures
Unit I – Evolution and Population Genetics		**15 lectures**
Topic No.	Title	No. of lectures
1.	Darwinism: Conceptual arguments for evolution by Natural Selection given by Charles Darwin and Alfred Wallace.	1
2.	Evidences for evolution: Comparative anatomy and embryology, Fossil records and living fossils, Artificial selection.	2
3.	Study of Evolution in context of human genetic diseases. (BRCA –I / Huntington's/ Thalassemia)	3
4.	Populations and allelic frequencies, Hardy Weinberg Equilibrium, change in gene frequencies due to selection, mutation, migration and genetic drift (Founder's effect)	5
5.	Origin of variability, polymorphism, kinds of selection – directional, stabilizing and disruptive, selectionist vs neutralist	4
Unit II – Biostatistics		**15 lectures**
Topic No.	Title	No. of lectures

1.	Probability definition, Laws of Probability	3
2.	Binomial Distribution-Introduction.	1
3.	Poisson Distribution-Introduction.	2
4.	Normal Distribution-Introduction.	2
5.	Bivariate Data, Scatter Diagram and its uses, Karl Pearson's Correlation Coefficient, Spearman's Rank Correlation Coefficient.	4
6.	Regression equations and their uses.	3

Unit-III: Bioinformatics		**15 lectures**
Topic No.	Title	No. of lectures
1.	Introduction to bioinformatics: Concept of information net work: internet, IP address, TCP/IP, FTP, HTTP, HTML and URLs, XML, URI, E-mail, Cloud Platforms	2
2.	Virtual libraries - The European Molecular Biology Network (EMBnet), The National Center for Biotechnological Information (NCBI), EMBL, UniProt, SWISS- prot, Pub Med and its applications.	4
3.	Introduction to general Databases a) Structured b) Semi-structured c) Unstructured d) Basic SQL (Query).	2

4.	Types of Databases:
	  (a) Genome Project
	  (b) Protein Database (PDB/ExPaSy)
	  (c) Species Database (Yeast and Arabidopsis)
	  (d) Structured Database
		7

SEMESTER – III

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 301	PRACTICALS	2 Credits Total 45 lectures
Practicals in Physiological Systems in Plants and Animals-I		
No.	Title	No. of lectures
1.	Good Laboratory Practices.	1
2.	Demonstration of reproductive system and location of endocrine glands in Albino Mouse Male and Female (Virtual Lab).	1
3.	Microtome and preparation of Endocrine gland slides from above dissected specimen or any suitable plant specimen.	4
4.	Study of Histological features of Endocrine glands.	1
5.	A complete study of Frog Embryology (Egg to Tadpole to Adult).	1
6.	Study of Floral parts from the given flower (*Hibiscus* and *Pancretium*) Pollen viability count by trypan blue.	1
7.	Study of microscopic structure of anthers, ovules. Seed structure (Maize and Okra).	1
8.	Study of pollen germination Using *Vinca* flower (*in vitro*).	1

9.	a) Study of pollen germination in *Vinca* (*in Vivo*) b) Tracing the path of the pollen tube along the stylar canal using Aniline blue stain	1
10.	Detection of activity of plant hormones (Dose dependent response).	1
11.	Observation and Study of locally collected Leaf Gall and any other one plant disease.	1

PRACTICAL – II

Course Code RUSLScP 302	PRACTICALS	2 Credits Total 45 lectures
Practicals in Biochemical Approach to Life Processes in Plants and Animals		
No.	Title	No. of lectures
1.	**A. Instrumentation / Technique** - pH metry - Colorimetry - Titration **B- Process / Concept and immediate Relevance** - Extraction, Purification - Analysis / Estimation - GLP(Good Laboratory practices) incorporated into every practical Acid, bases and buffers.	1

2.	pH meter -
	   i. Principle & instrumentation and
	   ii. Determination of pH (titration of Acids/Bases/Buffers/ 'chameleon balls').
	(in FY the student were introduced to the concept of pH measurement of familiar liquids-here tech & details are given-practically understanding buffering using Glycine / titration curve)
		1

3.	Protein precipitation by pH manipulation (Casein from Milk/ Curds) *(From previous experiment and pH manipulation, proteins can be precipitated)*	1
4.	Study of Enzyme activity and Kinetics: Determination of K_M of an enzyme. Urease (from Jack beans) /Lipase/Protease/ (from seeds/ detergents) / amylase source *(Enzyme activity can be detected and estimated - using colorimetry)*	1
5.	Histochemical localization of Enzymes (Acid Phosphatase) *(Enzyme activity can be localized).*	1
6.	**Estimation / Quantitation :** Colorimetric Protein Estimation by Biuret Method. (Enzyme extract / Casein from previous expts) *(Proteins, such as the isolate from experiment 2 can be estimated by colour reaction)*	1

7.	Colorimetric Cholesterol Estimation / total Lipid Estimation from egg. *(Lipid metabolism is an important component of our systems, content can be estimated by colour reaction).*	1
8.	Colorimetric estimation of Inorganic Phosphates by Stannous chloride method. *(Estimation of biologically relevant inorganic ions by colorimetric method)*	1
9.	Titrimetric estimation of Ascorbic acid (Vit C). *(Estimation of biological materials by non-colorimetric method)*	1

PRACTICAL – III

Course Code RUSLScP 302	PRACTICALS	2 Credits Total 45 lectures
Practicals in Evolutionary Biology, Biostatistical Approach and Bioinformatics-I		
No.	Title	No. of lectures
	Biostatistics:	
1.	Correlation (Using serial dilution and OD, Data from Paper II and Using MS EXCEL / Population genetics data).	1
2.	Regression Analysis (Using serial dilution and OD, Data from Paper II and Using MS EXCEL / Population genetics data).	1
3.	Probability testing using suitable example	1
4.	Normal Distribution using suitable example.	1
	Bioinformatics:	
1.	Database searching: Nucleotide, Protein, Species Introduction to ORF- 6 reading frames and sequence annotation- frame translation using suitable software (ex. Bioline)	1
2.	Testing of Hardy-Weinberg law using suitable examples of gene and allelic frequencies -Sex linked (One each).	1
3.	Project proposal based on Bioinformatics/Biostatistics/ Population Genetics / Evolution	2

References

RUSLSc 301

1.Plant physiology
Taiz and Zeiger (5th edition) (2010) Pub : Sinauer Associates.

2. Essential Developmental Biology J.M. W. Slack (2nd edition) (2006)
Pub: Blackwell Publishers

3.Developmental Biology
Scott Gilbert (9th edition) (2010) Sinauer Associates.

4.Fundamentals of physiology - A Human perspective L Sherwood 5th edition (2006)
Pub : Thomson Brooks

5. Embryology of Angiosperms
Bhojwani and Bhatnagar 4th edition (1999) New Delhi Vikas Pub

6. Vander's Human Physiology
Widmaier, Raff, Strand (10th edition,) (2006) Mc Graw Hill Int. Edition.

7. Principles of Animal Physiology
C Moyes and Schulte 2nd edition (2007) Peason Education.

8. Medical Microbiology: A guide to microbial infections . Greenwood, Slack, Peutherer and Barer 17th Ed (2007) Churchill Livingstone

9. Microbiology
Davis, Dulbecco and Ginsberg. (1990)
Lippincott Company, Philadelphia

10. Textbook of Microbiology.
Ananthanarayanan and Panniker 5th Edition (1996).
Orient Longman

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1. Lehninger's Principles of Biochemistry Eds : D.L Nelson and M.M. Cox,
Pub : W. H Freeman Publishers, New York. 4th edition (2005)

2. Biochemistry
Eds : J.M. Berg, J L Tymencko and L. Stryer
Pub : W H Freeman and co., New York. 5th edition (2002)

3. Fundamentals of Biochemistry by Eds : D.Voet , J. G. Voet Pub : John Wiley &Co., New York Pratt 1st ed (2004)
4. Principles of Biochemistry Ed:
Lehninger.A

Pub: CBS Publishers and Distributors, 2nd Edition (1993)

5. Principles of Biochemistry
Eds: Zubay G.L, Parson W.W. and Vance D.E.
Pub: W. C. Brown, First Edition (1995)

6. An Introduction to Genetic Analysis
Ed: Griffiths A.J. et al
Pub: W. H. Freeman (London) Seventh Edition (2000)

RUSLSc 303

1. Strickberger's Evolution – B. Hall and B. Hallgrimsson 4th Edition (2008) Jones and Bartlett Publishers

2. Remarkable Creatures: Epic Adventures in Search of the Origin of Species
Sean B. Carrol, (2009).
Mariner Books,

3. Population Genetics,
M.B.Hamilton, (2009).
Wiely-Blackwell,

4. Population Genetics : A Concise Guide
J.H.Gillespie, (2004)
Johns Hopkins University Press.

5. Methods in Biostatistics of Medical students and Research Workers
B.K.Mahajan, 8th Edition, (2010)
Jaypee.

6. Fundamental concepts of Bioinformatics
Krane and Raymer (2003)
Benjamin Cummings Publication.

7. Exploring Bioinformatics – A Project-based Approach
St. Clair and Visick (2010)
Jones and Bartlett Publishers

8. Bioinformatics for Dummies
Jean-Michel Claverie, Cedric Notredame, 2003,
John Wiley & Sons

Evaluation Pattern

	PAPER	EXAM	TOTAL MARKS
Semester III	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
Semester IV	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

INTERNALS FOR SEMESTER III AND IV				
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/ Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance
III	Written Test	Presentation on topic from syllabus / Visit / Project/ Quiz / Open book test	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	Attendance