Resolution Number: 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 UG
Program: S.Y.B.Sc. (Major) Life Science

Program Code: RUSLSc

(As per the guidelines of National Education Policy 2020

For **Academic year 2024-25**)

(Choice based Credit System)

Course Code: RUSLSc.O201

Course Title: Physiological Systems in Plants and Animals-I

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	Students will gain insights about following;
CO 1	Students will understand as to how the physiological systems in the human body attain homeostasis.
CO 2	Explain the Central nervous system(CNS) and peripheral nervous system (PNS). Understand the concept of action potential and resting membrane potential in Nerve Impulse. Explain the role of synapse in nerve impulse.
CO 3	Understand and compare different plant movements. To find its role in plant growth by designing an experiment to observe different plant movements
CO 4	Explain the Behaviour studies in animals with suitable examples. Compare between innate and learned behaviour. Elaborate on physiological aspects such as fat accumulation and thermoregulation during migration in animals
CO 5	Explain alternation of generation in plants. Elaborate on the role of environmental factors in sex determination in animals. Discuss the importance of plant and animal interaction sex determination. Basis of sex determination in plants and animals.
CO 6	Discuss physiology and explain the importance of hormones in menstrual cycle , pregnancy, parturition and menopause.
CO 7	Explain the importance of different types of ovules in plants. Compare microsporogenesis and megasporogenesis.

Course Code: RUSLSc.O202

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

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	Students will gain insights about following;
CO1	To classify enzymes, specificity reactions of enzymes,
CO2	To explain models of enzyme action, enzyme kinetics and inhibition reactions, allostery, isoenzymes.
CO3	To propose a strategy to isolate and purify enzymes, compare different techniques of purification.
CO4	To explain the applications of enzymes in industry and medicine.
CO5	To describe the pathways of catabolism of carbohydrates, proteins and lipids and to evaluate bioenergetics in catabolism of carbohydrates and lipids.
CO6	To correlate and integrate metabolism of all biomolecules into the TCA cycle, and then the electron transport chain and thus summarize the sequences involved in cellular respiration and energy generation.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
		S.Y.BSc. LIFE SCIENCE (Theory)	
RUSLSc.O301		**Physiological Systems in Plants and Animals-I**	**3 Credits Total 45 lectures**
	I	**Role of Hormone and Homeostatic Mechanisms in Animals and Plants** Control systems in homeostasis and components of homeostatic control. Cell signalling in the nervous system and endocrine system [eg. Amines (catecholamine or thyroid hormones)] – Regulation of cell signalling: 1st, 2nd and 3rd order Up and Down Regulation.. Hormones of Pineal, Hypothalamus, Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal gland, Testis and Ovary. Plant Hormone- Auxins, Gibberellic acid, Cytokinin, Abscisic acid, Ethylene.	**15 Lectures**
	II	**Introduction to Nervous System, Animal And Plant Movements and Behaviour** Human Nervous System – CNS and PNS overview. Types of cells: Neuronal, Glial cells Role of meninges and CSF Nature of the Nerve Impulse – Resting potential and Action Potential. Introduction to types of Synapses and Nerve impulses. Behaviour in animals ; Migration in animals.: Physiological aspect (Fat accumulation and thermoregulation). Plant movements – Tropisms, Nasties – overview and its molecular aspects with suitable examples	**15 Lectures**
	III	**Developmental Biology in Plants and Animals** 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	**15 Lectures**

		insects Eg. Wasp/Honey bee/Ants (d) Plant-animal interaction for reproduction Fig wasp / Gall wasp (e) Sex reversal Alternation of generations in plants Eg. *Adiantum.* 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. 1. Development of embryos in monocot and dicot plants.	
RUSLSc. O302		**Biochemical Approach to Life Processes in Plants and Animals-I**	**3 Credits Total 45 lectures**
	I	**Enzymology** Strategies for Isolation and purification of enzymes, measurement of specific activity and purification fold. Classification of enzymes (With an example of each). Effect of pH and Temperature. Coenzymes and cofactors : NAD, FAD, Mn, Mg, Zn and Cu (one example each). Kinetics (Michealis Menten, Lineweaver Burk plots). Enzyme Inhibitors, Activators and feed-back inhibition. Allosteric enzymes (Kinases in Glycolysis) and their significance in metabolic regulation. Concept of Isoenzymes: LDH.	**15 Lectures**
	II	**Carbohydrate Metabolism and Bioenergetics.** 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. Electron Transport System: Localisation and Sequence of electron transporters. Oxidative Phosphorylation: Mitchell's Chemiosmotic Hypothesis, ATP synthesis, Control of respiration, uncoupling and metabolic poisons.	**15 Lectures**

	III	**Lipids and Proteins Metabolism.** 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. Amino Acids – Catabolism: Protein Degradation liberating amino-acids', Deamination, Transamination & ammonia disposal by Urea cycle, Decarboxylation & integration into Kreb's cycle.	**15 Lectures**
		PRACTICALS	**2 Credits/** **Total 30 lectures**
RUSLScP. O301	**I**	**Practicals in Physiological Systems in Plants and Animals-I** 1. Good Laboratory Practices. 2. Demonstration of reproductive system and location of endocrine glands in Albino Mouse Male and Female (Virtual Lab). 3. Microtome and preparation of Endocrine gland slides from above dissected specimen or any suitable plant specimen. 4. Study of Histological features of Endocrine glands. 5. A complete study of Frog Embryology (Egg to Tadpole to Adult). 6. Study of Floral parts from the given flower accessory to essential whorls hibiscus ,vinca, canna, monocot. 7. Detection of activity of plant hormones (Dose dependent response).	
RUSLScP.O 301	**II**	**Practicals in Biochemical Approach to Life Processes in Plants and Animals- I** 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. 2. pH meter - a) Principle & instrumentation and b) Determination of pH (titration of Acids/Bases/Buffers/ 'chameleon balls'). *(in FY the students were introduced to the concept of pH measurement of familiar liquids- here tech & details are given- practically understanding buffering using Glycine / titration curve).* c) Phosphate buffer preparation using Henderson Hasselbalch equation d) Glycine titration 3.Protein precipitation by pH manipulation (Casein from Milk/ Curds) *(From previous experiments and pH manipulation, proteins can be precipitated).* 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).* 5.Histochemical localization of Enzymes (Acid Phosphatase) *(Enzyme activity can be localized).* 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).* 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).* 8.Titrimetric estimation of Ascorbic acid (Vit C). *(Estimation of biological materials by non-colorimetric method)*	

References

	RUSLSc.O201

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
6	Vander's Human Physiology Widmaier, Raff, Strand (10th edition,) (2006) McGraw Hill Int. Edition.
7	Principles of Animal Physiology C Moyes and Schulte 2nd edition (2007) Pearson 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, Phi
10	Textbook of Microbiology. Ananthanarayanan and Panniker 5th Edition (1996). Orient Longman.
	RUSLSc.O302
1	1. Lehninger's Principles of Biochemistry Eds : D.L Nelson and M.M. Cox, Pub : WH 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)

Modality of Assessment

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1.	Written Test	20
2.	Presentation on topic from syllabus / Quiz / Open book test	10
3.	Presentation on any journal article/ newsletter/ book review/ conference/ guest lecture	10
	TOTAL	**40**

B) External Examination- 60%- 60 Marks

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Theory question paper pattern:

Paper Pattern:

Q.	Options	Marks	Based on
Q1	Answer any 2 questions out of 3 questions	16	Unit I
Q2	Answer any 2 questions out of 3 questions	16	Unit II
Q3	Answer any 2 questions out of 3 questions	16	Unit III
Q4	Short notes on topics of all 3 units; Answer any 3 out of 5;	12	Unit I, II, III
	Total	**60**	

Practical Examination Pattern:

A) Internal Examination: 40%- 40 Marks

Particulars	Marks
Journal	05
Experimental tasks	15
Total	**20**

B) External Examination: 60%- 60 Marks

Semester End Practical Examination:

Particulars	Marks
Main question to perform Experimental task/Estimation/ dissection/Bioinformatics statistical analysis project work	20
Identifications	10
Total	**30**

Overall Examination & Marks Distribution Pattern

Semester III

Course	301			302			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100

Course Code: RUSLSc.E211
Course Title: Physiological Systems in Plants and Animals-II
Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	Students will gain insights about following;
CO 1	Adaptive mechanism in plant and animal to extreme environmental condition
CO 2	Regulation of energy stores and various eating disorders.
CO 3	To describe defense mechanisms in plants and animals.
CO4	To differentiate between innate and adaptive immunity and describe them.
CO 4	Explain epidemiology, aetiology, pathology, diagnosis, therapy and preventive measures and vaccines for different diseases

Course Code: RUSLSc.E212

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

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	Students will gain insights about following;
CO 1	To explain the anabolic pathways in carbohydrate, lipids and proteins
CO 2	To compare non- cylclic and cyclic photosynthetic pathways. To justify how photorespiration is a wasteful process and to review how C4 plants circumvent it.
CO 3	Understand the role of different enzymes in replication of DNA. Compare between the prokaryotic and eukaryotic replication process.
CO 4	Explain the transcription and translation process in prokaryotes and regulation of gene expression in prokaryotes.
CO 5	Compare transcription and translation process in eukaryotes. Understand the concept of post translational modifications in eukaryotes

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
		S.Y.BSc. LIFE SCIENCE (Theory)	
RUSLSc.E 211		**Physiological Systems in Plants and Animals-II**	**2 Credits Total 45 lectures**
	I	**Adaptive Mechanisms to Environmental Changes** Adaptations in plants to extreme thermal conditions. Adaptations in animals to extreme thermal conditions. Fever, Hyperthermia, heat exhaustion and heat stroke. Thermogenesis: shivering and nonshivering thermogenesis, Hyperthermia induced by pyrogens. Regulation of energy stores: control of food intake, Role of Leptin, Ghrelin and Kisspeptin. Eating disorders: Anorexia and Bulimia Nervosa, Obesity, Diabetes.	**15 Lectures**
	II	**Homeostasis during infections** Innate Immunity and Adaptive Immunity. Mechanisms of Innate Immunity – In invertebrates (hemocytes) and in Vertebrates. (Physical and Physiological barriers, Phagocytosis and inflammation). Mechanisms of adaptive immunity-T and B cells. (Mode of Recognition of Antigens). Virulence factors and toxins: virulence factors, exotoxins, enterotoxins, endotoxins. Host factors in infection: host risk factors, innate resistance. Biomolecules such as secondary metabolites, surface protectants and enzymes in plants. Parasite escape mechanisms in infection.	**15 Lectures**
	III	**Diseases in plants and animals (with respect to epidemiology, aetiology, pathology, diagnosis, therapy, preventive measures and vaccines giving the current status)**	**15 Lectures**

		Vector borne Diseases– Malaria, Dengue or Chikungunya. **Viral Disease**-AIDS, Herpes, CoronaVirus. **Bacterial Diseases**- Tuberculosis or Typhoid , Leprosy **Fungal Diseases**– Ringworm or Candidiasis, Psoriasis. **Helminthic Diseases**– Filariasis. **Diseases in Plants:** Tobacco Mosaic Virus, Crown gall bacterial infection, Puccinia fungal infection with crops.	
RUSLSc .E212		**Biochemical Approach to Life Processes in Plants and Animals- II**	**2 Credits Total 45 lectures**
	I	**Anabolism of Biomolecules** Anabolism of Carbohydrates: a) Gluconeogenesis b) Glycogen synthesis Anabolism of Lipids: a) Fatty acid biosynthesis b) Cholesterol and prostaglandin biosynthesis. Anabolism of Amino acids: a) Transamination and its significance b) Glutamine synthesis Synthesis of purines & pyrimidines with Significance. Photosynthesis, Light reaction and Calvin cycle Photorespiration in plants: C3 and C4 plants	**15 Lectures**
	II	**Molecular Biology studies in prokaryotes** DNA replication in prokaryotes. Transcription in Prokaryotes Translation in prokaryotes Regulation of gene expression and its significance: Operon model (Lactose / Tryptophan)	**15 Lectures**
	III	**Molecular Biology studies in eukaryotes** DNA Replication in Eukaryotes Transcription in Eukaryotes and Post Transcriptional modifications Translation in Eukaryotes and post translational modification	**15 Lectures**
		PRACTICALS	**2 Credits**

			30 Lectures
RUSLSc P.E211		**Practicals in Physiological Systems in Plants and Animals-II** 1.Extraction and detection of Plant alkaloids, saponines, tannins and volatile oils. 2.Alkaloid separation by TLC. 3.ABO Blood typing. 4.Total RBC count using a Hemocytometer. 5.Principle and working on home pregnancy test slide / Widal Test- Qualitative. 6.Streak plating (T, Pentagon and Quadrant –Any 2) to isolate microorganisms from a mixed culture using differential media. 7.Antibiotic sensitivity of microorganisms (Plant extract, Tetracycline/ Gentamicin). 8.Study the effect of tobacco extract or caffeine or any other plant extract on heart beat of Daphnia.	
RUSLSc P.E211		Practicals in Biochemical Approach to Life Processes in Plants and Animals- II. : A. Instrumentation / Technique (I / T) (1) PAGE (Demonstration). Chromatography – Paper, Thin layer, Column. B. Process / Concept and immediate Relevance (C and R) - Extraction, Purification - Analysis / Estimation GLP(Good Laboratory practices) incorporated into every practical Separation / Extraction techniques 1.Extraction and Detection of RNA/Ribose Sugars. C, T *(Extraction of nucleic acid and detection by colour reaction)* 2.Chromatography of Sugars – Circular Paper **C, T** *(Separation of carbohydrates and detection by colour reaction)* 3.Thin Layer Chromatography for separation of Plant Pigments.(Slide technique) **C,T,R** *(Separation techniques for charged, uncharged materials based on solvent partition)* 4.Solvent Extraction of Lipids. **C, T, R** *(Extraction of lipid and proportional estimation by weight)*	

		5.Column Chromatography of Proteins / Pigments. **I, C, T***(Separation technique for proteins/ other materials based on charge/size)* 6.Protein separation by PAGE (Demonstration) **I, C** *(Separation techniques for charged materials based on electrophoretic mobility)* 7.Interpretation of pathological reports based on biochemical analysis.	

	RUSLSc.E211
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
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	RUSLSc.E212
1	1. Lehninger's Principles of Biochemistry Eds : D.L Nelson and M.M. Cox, Pub : WH Freeman Publishers, New York. 4th edition (2005)
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Practical Examination Pattern:

C) Internal Examination: 40%- 40 Marks

Particulars	Marks
Journal	05
Experimental tasks	15
Total	**20**

D) External Examination: 60%- 60 Marks

Semester End Practical Examination:

Particulars	Marks
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Overall Examination & Marks Distribution Pattern

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Practicals	20	30	50	20	30	50	100
