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UNIVERSITY OF MYSORE

Estd. 1916

VishwavidyanilayaKaryasoudha
Crawford Hall, Mysuru- 570 005

No.AC2(S)/151/2020-21 Dated:10.10.2022

Notification

Sub:- Syllabus and Examination Pattern of Molecular Biology (UG) (III & IV Semester) with effective from the Academic year 2022-23 as per NEP-2020.

Ref:- 1. Decision of Board of Studies in of Molecular Biology (UG) Meeting held on 27-07-2022.
2. Decision of the Faculty of Science & Technology Meeting held on 15-09-2022.
3. Decision of the Academic Council meeting held on 23-09-2022.

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The Board of Studies in Molecular Biology (UG) which met on 27-07-2022 has recommended & approved the syllabus and pattern of Examination of Molecular Biology Course (III & IV Semester) with effective from the Academic year 2022-23 as per NEP -2020.

The Faculty of Science & Technology and Academic Council at their meetings held on 15-09-2022 and 23-09-2022 respectively has also approved the above said syllabus and hence it is hereby notified.

The syllabus and Examination pattern is annexed herewith and the contents may be downloaded from the University Website i.e., www.uni-mysore.ac.in.

Draft Approved by the Registrar

DeputyRegistrar(Academic)

Deputy Registrar (Academic)
University of Mysore
Mysore-570 005

To:-

1. All the Principal of affiliated Colleges of University of Mysore, Mysore.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS, in Molecular Biology, Manasagangothri, Mysore.
4. The Dean, Faculty of Science & Technology, DoS in Earth Science, MGM.
5. The Director, Distance Education Programme, Moulya Bhavan, Manasagangotri, Mysuru.
6. The Director, PMEB, Manasagangothri, Mysore.
7. Director, College Development Council , Manasagangothri, Mysore.
8. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
9. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
10. Office Copy.

University of Mysore

DEPARTMENT OF MOLECULAR BIOLOGY

MODEL CURRICULUM CONTENTS FOR

III and IV semesters

B.Sc./B.Sc. (Hons)/ Integrated M.Sc. (Five Years) Molecular Biology

Asper NEP 2020

Approved during the Board of studies meeting held on 27th July 2022

27th July 2022

1. Program Structures for the Five Year Integrated Programs in University of Mysore and Yuvaraja's college, Karnataka

Bachelor of Molecular Biology (Basic/Hons.)/Integrated M.Sc.with Molecular Biology as core subject prepared based on Annexure 2 for Model structures (I. Model) for the Under-Graduate Programs in Universities and Colleges in Karnataka with required modifications to suit Five Year Integrated Program

Program structure and syllabus for Second Year (III and IV semester)

III	DSC -5 (4+0+2=6) DSC -6 (4+0+2=6) Total from DSC 5 and 6 is 6+6=12 credits	OE3 (3hrs+0+0) 3 credits	L1-(3),L2-(3) (4 hrs each) 6 credits	----	SEC-2: Artificial Intelligence/ (AI) (1hr+0+2hrs) 2 credits	Physical Education-Sports (0+0+2 hrs) 1 credit	NCC/NSS/R&R (S&G)/Cultural (0+0+2hrs), 1 credit	Total credits 25
IV	DSC -7(4+0+2) DSC -8(4+0+2) Total from DSC 6 and 7 is 6+6=12 credits	OE4 (3hrs+0+0) 3 credits	L1-(3),L2-(3) (4 hrs each) 6 credits	Constitution of India (2hrs+0+0) 2 credits	----	Physical Education -Games (0+0+2hrs) 1 credit	NCC/NSS/R&R (S&G)/Cultural (0+0+2hrs), 1 credit	Total credits 25

Program structure with credits, hours of teaching and marks

Sem.	**Discipline Core (MBDSC) (Credits) (L+T+P)**	**Discipline Elective (DSE) / Open Elective (OEMBDSC) (Credits) (L+T+P)**	**Ability Enhancement Compulsory Courses (AECC),Languages (Credits) (L+T+P)**	Credits	**Skill Enhancement Courses (SEC)**	Hours of teaching	**Credits**	**Total Credits**	IA Marks	Exam Marks
	DSC-5	DSC	4+0+2	6	Microbiology Theory	4	4		40	60
					Microbiology Practical	4	2		25	25
	DSC-6	DSC	4+0+2	6	Biochemistry Theory	4	4		40	60
					Biochemistry Practical	4	2		25	25
	OE -3	OE	3+0+0	3		3	3		40	60

III	AECCL1	AECCL1	3+0+0	3	ML1	4	3		40	60
	AECCL2	AECCL2	3+0+0	3	ML2	4	3		40	60
	SECSB2	SECSB2	1+0+1	2	Artificial Intelligence theory	1	1	**25**	40	60
					Artificial Intelligence Practical	2	1		50	50
	SECVB1	SECVB1	0+0+1	1	Physical Education sports (SEC value based)	2	1			
	SECVB2	SECVB2	0+0+1	1	NCC/NSS/ R&R(S&G)/ Cultural (SEC value based)	2	1			
IV	DSC-7	DSC	4+0+2	6	Developmental and Reproductive Biology Theory	4	4	**25**	40	60
					Developmental and Reproductive Biology Practical	4	2		50	50
	DSC-8	DSC	4+0+2	6	Plant Physiology II and Animal Physiology Theory	4	4		40	60
					Plant Physiology II and Animal Physiology Practical	4	2		50	50
	MBOE -4	OE	3+0+0	3	----	3	3		40	60
	AECCL1	AECCL1	3+0+0	3	ML1	4	3		40	60
	AECCL2	AECCL2	3+0+0	3	ML2	4	3		40	60
	AECC2	AECC2	3+0+0	3	Constitution of India	2	2		40	60
	SECVB1	SECVB1	0+0+1	1	Physical Education sports (SEC value based l)	2	1			
	SECVB2	SECVB2	0+0+1	1	NCC/NSS/ R&R(S&G)/ Cultural (SEC value based)	2	1			

III semester

DSC-5	4+0+2 credits	Microbiology Theory	4 hrs	4 credits
		Microbiology Practical	4 hrs	2 credits
DSC-6	4+0+2 credits	Biochemistry Theory	4 hrs	4 credits
		Biochemistry Practical	4 hrs	2 credits

Microbiology – Theory - Credits – 4 56hrs

Course objectives:

- To equip the students to gain knowledge about microbes in human health and the environment in many ways.
- This course paper emphasizes to acquire knowledge about microbial diversity and their interactions among themselves, and with the environment and biological systems under various conditions.
- To address the relevance of microbiology in other disciplines.
- To impart practical skills in concepts of Microbiology.

Course outcome:

- Student will understand Koch's postulates which is the basic requirement to study plant, animal and human diseases.
- Students will learn how to identify and isolate pure cultures, maintenance and preservation of different microbes.
- Students will acquire the skills to qualify for broad range of positions in academic and research institutions in different discipline to increasing need for skilled scientific manpower with an understanding of research involving microorganisms to contribute to application, advancement and impartment of knowledge in the field of microbiology and molecular biology globally.
- The laboratory training will empower them to prepare for careers in broad range fields.

Microbiology – theory syllabus 4 credits 56 hours

UNIT I

A brief history: Discovery of microorganisms-contributions of Antony van Leeuwenhoek, Theory of spontaneous generation and biogenesis. Contributions of Edward Jenner, Louis Pasteur, Joseph Lister, Robert Koch, Metchnikoff, Beijerinck, Ivanowsky, Alexander Fleming,

Selman Waksman. Recent developments in Microbiology. Branches of Microbiology, Microscopy, simple, compound and electron microscopy.

Sterilization: Physical methods- dry heat-hot air oven, incineration, moist heat-autoclave, tyndallisation. Filtration- Types of filters. Laminar airflow. Radiation method- UV radiation

Chemical methods: Definition of disinfectants, antiseptics, sanitisers;

Microbicides- Bactericide, virucide, fungicide and sporicide; microbial static and fungistatic agents; use and mode of action of alcohols, aldehydes, halogens, phenols, heavy metals. 14hrs

UNIT II

Staining: Types of stains, simple staining, negative staining, differential staining (Gram's staining and acid fast), endospore and flagella staining.

Culturing of Microbes: Media types. Pure culture techniques: Serial dilution, pour plate, spread plate and streak plate, cultural characteristics. Preservation of pure cultures: subculturing, mineral oil overlay and lyophilisation. Microbial culture collection centers (ATCC, MTCC, ITCC).

Viruses: Classification Based on morphology. Nucleic acids and host, role of ICTV, structure of TMV and T4 phage, Replication of T4, Economic importance. 14hrs

UNIT III

Bacteria: Classification (based on morphology and flagella); Bergey's manual (in brief), Structure: pili, capsule, cell wall (structure and chemical composition of gram+ve and gram-ve bacteria), plasma membrane (including mesosomes), cytoplasmic inclusions, nuclear material, Endospores. Reproduction; Vegetative, fission, budding. Genetic recombination- conjugation, transformation, transduction. Economic importance.

Cyanobacteria: Morphology/structure and economic importance -Type Study: Spirulina, Anabaena.

Mycoplasma and phytoplasmas: Importance and general characters, Ultrastructure and reproduction. Diseases caused by the Mycoplasma and phytoplasmas 14hrs

UNIT IV

Microbial nutrition: Major nutritional types of microorganism (Based on energy, electron and carbon sources); nutritional requirements (Macro and Micronutrients, growth factors); uptake of nutrients- passive, facilitated, active (Binding-protein type), group translocation (PTS and TAT system).

Microbial growth: Generation time, growth curve, factors affecting growth, measurement of growth (cell number-counting chambers e.g.Haemocytometer).

Strain improvement methods: recombination, mutagens, protoplast fusion, r-DNA technology, selection of strains: Enrichment technique. 14hrs

Microbiology Practical - 2 Credits, 56 hrs

Course outcome:

Students will develop the skills of

1. Bacterial and fungal staining techniques
2. Knowledge of cyanobacterial practical applications
3. Preparation of various microbiological media
4. Pure culturing and Single colony isolation and preservation of cultures, growth curve plotting, disc diffusion technique which are needed for many biotech industries based on microbes

Microbiology Practical syllabus

1. Study of microbiological tools (inoculation loop, spreader, spatula, swabs), equipments (laminar airflow chamber, hot air oven, incubator, autoclave/ pressurecooker, filtration unit, colony counter) and microscopes
2. Staining: Simple staining and negative staining, Differential (Gram's staining). Measurement of dimensions of microorganisms using micrometer.
3. Observation of bacterial motility by hanging drop method. Study of the Cyanobacteria: *Spirulina*, *Anabaena.*
4. Preparation of media-nutrient broth, nutrient agar, potato dextrose agar, Czapekdoxagar, Mac Conkey's agar.
5. **6,** 7. Study of pure culture techniques: serial dilution, pour plate, spread plate, streakplate, point inoculation to Petri plate and agar slant.
8. Single Colony isolation, Maintaining pure culture-preparation of glycerol stocks
9. Study of plaque formation

10, 11. Effect of temperature and pH on the growth of microorganism

12. Measurement of growth using - spectrophotometer and Haemocytometer (Yeast cells)
13. Effect of disinfectants, antiseptics and antibiotics on the growth of microorganisms.
14. Display of photographs (Scientists)/charts (related to viruses, Mycoplasma etc.,) studied in the theory.

References:

1. Pelczar,M.J., Jr,.Reid R.D. and Chan, E.C.S. 1993. Microbiology. Mc-Graw Hill Inc. New Delhi.
2. Sullia, S.B. and Shantharam, S. 1998. General Microbiology. Crawford and MH Publishing Co. Pvt. Ltd., New Delhi.
3. Prescott, L.M., Harley, 1.P. and Klein, D.A. 1996. Microbiology. WMC Brown Publishers. New Delhi.

Biochemistry – Theory – 4 Credits, 56 hrs

Course objectives:

- To study the basics of biomolecules like sugars, amino acids, fatty acids, and nucleosides.
- To gain knowledge about the structures and functions of vitamins.
- To study the influence and role of structure in reactivity of biomolecules.
- To study the classification, functions, and application aspects of biomolecules.
- To train students to appreciate the salient features of biomolecules in the organization of life.
- To study the significance and methodology involved in isolation and characterizing major biomolecules including nucleic acids.

Course outcome:

- Students will understand in detail about structures, types, and classifications of fundamental biomolecules like amino acids, sugars, fatty acids, and nucleotides.
- The students will have a thorough understanding on the structural and functional role of biomolecules in the living system.
- Students will understand the properties of carbohydrates, proteins, lipids, nucleic acids, and their importance in biological systems.

- The students will be able to understand the chemical properties and three-dimensional structure of the biological macromolecules in relationship to their biological function.
- They will also gain knowledge about the isolation and identification methods of macromolecules.
- Students will understand the metabolic and physiological role, their deficiency disorders and therapeutic functions associated with vitamins.

Biochemistry – Theory syllabus

UNIT I

Carbohydrates: Definition, empirical formula, Classification and examples, monosaccharides - Trioses, Tetroses, Pentoses, and Hexoses. Aldo and Keto sugars, structure (open chain, ring and boat conformations). Amino sugars, sialic acid, muramic acid and uronic acids, Stereochemistry of Glucose – d and l, D and L, anomers, epimers and diastereomers, mesocompounds, racemic mixtures.

Disaccharides: Lactose, Maltose and Sucrose, structure and functions.

Polysaccharides -Homopolysaccharides and heteropolysaccharides - starch, cellulose, glycogen, hyaluronic acid, chondroitin sulphate, chitin, xylans, bacterial cell wall polysaccharides, glycoproteins –types, blood group polysaccharides **14 hrs**

UNIT II

Amino acids: Classification, structure and stereo chemistry, Zwitter ionic form, essential amino acids, unusual amino acids and non-protein amino acids.

Proteins: Peptide Bond - Features of the peptide bond, naturally occurring peptides – glutathione, enkaphalins and endorphins, chemical synthesis of peptides - Merrifield's solid phase synthesis.

Determination of Amino Acid Composition: Acid and base catalysed hydrolysis, separation and quantification, Determination of N and C terminal residues.

Determination of structure of proteins: Primary structure: sequencing strategies, N-terminal and C-terminal, sequencing methods. Automated sequenators. Determination of disulphide bond position. Secondary and super secondary structure: helix forming amino acids, helix breakers, tertiary and quaternary structures, Ramachandran Plot, overview of protein purification and criteria of purity. 3D Structure: Myoglobin, hemoglobin, Collagen, Chymotrypsin, Keratin

Factors Responsible for Protein folding: Anfinsen's experiment. Weak forces of interaction. Denaturation and renaturation of proteins.

14 hrs

UNIT III

Lipids: Classification and biological role, Iodine number, acid value and their significance. Fatty acids -nomenclature, physiochemical properties, essential fatty acids, rancidity, acylglycerols-saponification. Phosphoglycerates -occurrence, physiochemical properties and function, sphingolipids-. Glycolipids - Occurrence, classification, gangliosides and cerebrosides, alkyl & alkenyl lipids. Plant and animal waxes – their composition and roles. Soaps and detergents, cleaning action of soap. Cholesterol – occurrence, structure & role.

Biologically active lipids: Eicosanoids - prostaglandins, thromboxane, leukotrienes, structure, nomenclature, occurrence and role. Platelet activating factors, ceramide, sphingolipid derivatives - structures and function, Isoprostans and Lipoxins.
Vitamins: Classification, structure & biological importance, coenzyme forms, provitamins, anti-vitamins, hyper and hypovitaminosis 14 hrs

UNIT IV

Nucleic acids: Purines and pyrimidines -Structure and properties. Nucleosides and nucleotides sugars. Isolation of DNA and RNA from biological sources (microbes, plants and animals). Purification of nucleic acids, physiochemical properties of nucleic acids, Melting of DNA, Tm, factors affecting Tm, Cot curve, and classification of DNA based on Cot curve. Chargaffs rule.

Secondary structure of DNA: Watson and Crick model B , A and Z DNA, other models of DNA structure. Secondary structure of tRNA clover leaf model. Other secondary structural features in DNA - stem loop structure. Palindromic sequences – Cruciforms. 14hrs

Biochemistry Practical - 2 credits, 56 hours

Course objectives:

- To study the basics of biomolecules like sugars, amino acids, fatty acids, and nucleosides.
- To gain knowledge about the structures and functions of vitamins.
- To study the influence and role of structure in reactivity of biomolecules.
- To study the classification, functions, and application aspects of biomolecules.
- To train students to appreciate the salient features of biomolecules in the organization of life.
- To study the significance and methodology involved in isolation and characterizing major biomolecules including nucleic acids.

Course outcome:

- Students will develop the skills and knowledge of analysis of different sugars and starch in a given sample
- Students will develop the skills and knowledge estimation methods proteins and Amino acids
- Students will develop the skills and knowledge of working with lipids
- Students will develop the skillsof estimation of Ascorbic acid in Biological source.
- Students will develop the skillsof extraction of lactose and casein in milk.
- Students will develop the skillsof estimation of Inorganic Phosphate, DNA, RNA
- All these skills are helpful for students to join diagnostic labs or biotech industry

Biochemistry Practical Syllabus

1. Qualitative analysis of monosaccharides (Glucose/ fructose).
2. Qualitative analysis of disaccharides (Lactose/maltose/sucrose) and polysaccharide starch.
3. Qualitative analysis of Amino acids : color reactions and Quantitative estimation of proteins by Biuret Method.
4. Estimation of Proteins by Lowry's Method, Determination of acid value of lipids
5. Determination of saponification value of lipids and Determination of Iodine value of lipids
6. Estimation of Ascorbic acid in Biological source by DNPH Method.
7. Isolation and estimation of lactose from milk. (Qualitative Benedict's reagent)
8. Estimation of Reducing sugars by Hegedorn-Jensen's Method.
9. Estimation of Inorganic Phosphate by Fiske-Subbarow's Method.
10. Extraction of starch from potato and determination of purity by DNS method.
11. Isolation of DNA from spinach leaves.
12. Estimation of DNA by Diphenylamine Method.
13. Estimation of RNA by Orcinol Method.
14. Extraction and estimation of Casein from Milk

References:

1. Conn E.E. and Strumpf P.K. Outlines of Bio-chemistry. Wiley Eastern Limited.
2. Voet D, Voet J.G. Biochemistry. Ed. John Wiley & Sons. New York.
3. Lehninger AL., Nelson JR., and Cox MM. 1993.Principles of Biochemistry.CBS Publishers, New Delhi.
4. White, Handier and Smith. Principles of Biochemistry Tata McGraw Hill.
5. Cantorow& Trumper. Clinical Biochemistry. Saunders.
6. Stryer L 1996. Biochemistry. WH Freeman &Company.
7. Plummer D. T. 1987. An introduction to practical Biochemistry. Tata Mc Graw Hill
8. Creighton T 1987 Protein Structure: A Practical Approach Oxford University Press.
9. Greenwood, C. T. (1970) in The Carbohydrates (Pigmon, W., & Horton, D., Eds.) Vol. IIB, pp 471-513, Academic Press.
10. Adams R.L.P., Knowles J.T., Leader D.P.,1992. The Biochemistry of the Nucleic Acids, 11th edition, Chapman &. Hall, London,
11. Devlin T. M.(ed). Text Book of Biochemistry with Clinical Correlations. 4th Edition. - Wiley-Liss.
12. Garrett. R.H. and Grisham. C.M. Biochemistry. 2ndEdition..Saundes College Publication.
13. Metzler. D.E. Biochemistry - The Chemical Reactions of Living Cells. 2nd Edition.Vo Harcourt - Acqoleric Press.
14. West and Todd. Text Book of Biochemistry. 1998. Macrillian.
15. Zuby G.L., 1988. Biochemistry. (second ed.). MacMillan, New York.
16. Mainwaring et al. Nucleic acid Biochemistry and Molecular Biology. Blackwell.
17. Smith et al. 1983.Principles of Biochemistry. General Aspects. Mc Graw Hill.

QUESTION PAPER:THEORY EXAMINATION
(Applicable to DSC courses of III and IV semesters Papers)
5-Year Integrated M.Sc. Course in Molecular Biology
_____ Semester
Title of the Paper:_____

Time: 2 hours **Max. Marks: 60**

Instructions: Draw neat and labelled diagrams wherever necessary

PART-A

1. Define/Explain any five of the following:
(2 questions from each unit) **2x5=10**

a.

b.

c.

d.

e.

f.

g.

h.

PART-B

Answer any four of the following (Internal Choice)
(Internal choice should be from the same unit) **5x4=20**

2.

3.

4.

5.

PART-C

Answer any three of the following:
(One question from each unit) **10X3=30**

6.
7.
8.
9.

Scheme of Discipline Core (DSC) Practical evaluation
5-Year Integrated M.Sc. Course in Molecular Biology

Max. Marks: 50marks

(Practical test/Viva/MCQ/written test based on Practical concepts: 20 marks + Record :05 marks + Practical examination : 25 marks)

Scheme of Practical Examination
III Semester – Microbiology

Time: 03 hours /**as per NEP regulation**

1. Demonstrate the experiment A giving principle, procedure and result/stain the given material Positive/negative/gram staining techniques 10 marks
   (Demonstration:2 marks, Principle:2 marks, Procedure:5 marks, Result: 1marksSerial dilution /Pour plates/spread plates/streak plates/point inoculation/effect of antibiotics; staining preparation of slide:5marks , Principle:1 mark, procedure: 3marks; result: 1 mark)
2. Conduct / plot the graph from given related to a given microorganism and write the generation time
   (Hanging drop: set up: 2 marks; procedure: 3 marks: diagram and results: 2 marks) 07 marks
   (Procedure and graph plotting: 3 marks: coment: 2 marks: generation time calculation: 2 marks)
3. Write critical comments on C, D, E and F 4 X 2 = 08 marks
   C Instruments/tools: As per practical syllabus
   D and E: Photographs/Charts studied in the practical class
   F. Experimental result streak, point inoculation / effect of antibiotic, temperature pH, slope culture

(**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

Scheme of Discipline Core (DSC) Practical evaluation
5-Year Integrated M.Sc. Course in Molecular Biology

Max. Marks: 50marks

(**Practical test/Viva/MCQ/written test based on Practical concepts**: 20 marks +**Record** :05 marks + **Practical examination** : 25 marks)

Scheme of Practical Examination
III Semester –Biochemistry

1. Write the principle and procedure for the experiment mentioned 05M
   (principle:2marks, procedure:5 marks, Tabular colum:2marks, Result:1mark)
2. Conduct the major experiment 10M
   (Principle: 1marks, Procedure: 2 marks, Standardization: 1 marks, Tabular colum:1 mark, graph: 2 marks, Results: 3 marks)
3. Conduct the minor experiment 06 M
   (Principle:1marks: Procedure and conducting: 3 marks, reporting:2marks)
4. Identify and comment on A, B 2x2=4 M

   a.

   b.

(**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

IV semester

DSC-7	4+0+2 credits	Reproductive and Developmental Biology Theory	4 hrs	4 credits
		Reproductive and Developmental Biology Practical	4 hrs	2 credits
DSC-8	4+0+2 Credits	Plant Physiology II and Animal Physiology Theory	4 hrs	4 credits
		Plant PhysiologyII and Animal Physiology Practical	4 hrs	2 credits

Reproductive and Developmental Biology Theory - 4 Credits, 56 hrs

Course objectives:

- To impart knowledge on gametogenesis, fertilization and development in mammals.
- To understand the cytology of parthenogenesis and cloning.
- Developmental biology provides the basis for understanding of processes and mechanisms of development of both plant and animals.
- To teach the importance of developmental biology in agriculture and food sectors.
- To impart practical skills in concepts of Developmental Biology

Course outcome:

- Students will understand the early and post embryonic development in animals.
- Students will acquire knowledge of molecular events in fertilization.
- Students will be able to understand the processes of gastrulation.
- Students will acquire knowledge on microsporogenesis, megasporogensis and development of male and female gametophyte in plants.
- It helps the students to understand the development of plants and animals at cellular and embryonic level.
- Applications of embryology is understood as experimental embryology which has agricultural relevance.

Reproductive and Developmental Biology – Theory syllabus

UNIT I

An introduction to reproductive and developmental biology

Microsporangium, Microsporogenesis and Male gametophyte in Angiosperms: Development and structureof the microsporangium, wall layers (special emphasis on the anther tapetum and its, functions); Microsporogenesis; development of male gametophyte/pollen; Concept of malegerm unit; pollen shedding; pollen morphological features; Palynology and its scope.

Megasporangium, Megasporogenesis and Female gametophyte in angiosperms: Structure and morphological types of ovules; Ovular structures; Megasporogenesis; development of monosporic, bi-sporic and tetrasporic types, structure, organization and nutrition of femalegametophyte. 14 hrs

UNIT II

Fertilization in angiosperms: Pollination in brief, types, contrivances for pollination, liver mechanism(pollination in ficus). A general account of pollen-pistil interaction; obturator; polyspermyandhetero-fertilization.

Endosperm: Developmental types; endosperm haustoria; ruminate and composite endosperm.

Embryo: structure and development of Dicot and Monocot embryos; embryonal suspensor.

Polyembryony: Types, causes, experimental induction and significance. Structure of monocot and dicot seed and seed coat structure and their useful products

Apomixis- A general account.

Embryology in relation to taxonomy with reference to the following taxa Loranthaceae, Gentianaceae, *Trapa* and *Exocarpus*. 14 hrs

UNIT III

Gametogenesis: Spermatogenesis and Oogenesis in mammals. Types of eggs based on quantity and distribution of yolk, egg membranes.

Fertilization: i. Details of the process with reference to sea urchin - approach of gametes,fertilizin and antifertilizin,gamones and its role, activation, penetration, reaction of the eggand amphimixis. Monospermy and Polyspermy (physiological and pathological), significanceof fertilization. ii. Fertilization in mammals: molecular events in fertilization.

Early Development:

Cleavage: Cytoskeletal mechanisms, patterns of embryonic cleavage - holoblastic,meroblastic, radial, spiral rotational and superficial types with examples.

Gastrulation: Gastrulation types, Organiser phenomenon- potencies of the dorsal lip of theblastopore of amphibian gastrula. **Brachet's**experiment, experiment of **Spemann** and**Mangold**.**Induction**-chemical nature of organizer -parts of organizer -theories of organizer phenomenon. Competence, determination and differentiation.Primary germ layers and their derivatives 14 hrs

UNIT IV

Development in mammals: Blastocyst implantation – types; placentation – types; embryonicstem cells and their significance.

Post embryonic development: brief description of metamorphosis, regeneration and ageing

Parthenogenesis and cloning: Cytology of natural parthenogenesis - arrhenotoky, thelytoky(amictic and apomictic) and cyclical parthenogenesis with examples. Artificial

parthenogenesis -Loeb's and Batailon's experiments with principles of activation and regulation.Significance of parthenogenesis. 14 hrs

Developmental Biology Practical - 4 Credits, 56 Hrs

Course objectives:

To impart skills /and knowledge of

- Studying ovule of different flowers
- Observation of microsporogenesis and micro gametogenesis in plants
- Study of endosperms of seeds
- Mounting of embryos
- Structure of seeds and seed coat
- Sperms, eggs of different animals, developmental stages of frog, chick
- Placenta of rat, sheep and human

Course outcome:

Students will develop the skills and knowledge of :

- Studying ovule of different flowers
- Observation of microsporogenesis and micro gametogenesis in plants
- Study of endosperms of seeds
- Mounting of embryos
- Structure of seeds and seed coat
- Sperms, eggs of different animals, developmental stages of frog, chick
- Placenta of rat, sheep and human

Developmental Biology – Practical syllabus

1. Microsporogenesis and structure of mature anther and Structure of Microspore. Mounting of Microspores and pollinia.
2.Male gametophytedevelopment and structure of male gametophyte and Pollen viability test by hanging drop method
3. Ovule and its structure. Types of ovules and placentationand Megasporogenesis-Developmental stages of embryo sac development. Structure ofmatureembryosac
4. Endosperm - types of endosperms. Mounting of endosperm (*Cucumis*, Coconut)
5. Development of embryo- structure of mature embryo and mounting of mature embryo
6. Seed and its structure. Endospermic and non-endospermic seeds. Dicot embryo(*Cicer*) and Monocot seed(Maize), Study of seed coat structure and exposure to their useful products such as rice bran oil.
7.Study of dormancy time of different type of seeds and techniques to break dormancy.
8. Different types of eggs -insect egg. Frog's egg, Hen's egg and Graffian follicle.
9. Different types of sperms -of grass hopper, frog and a mammal, abnormal sperm detection.

10, 11, Frog Development: Cleavage stages, blastula (section) gastrula (yolk plug stage) andneurula (section).
12. Chick embryo: 18 hrs, 24 hrs (W .M. and section), 36 hrs and 48 hrs (W.M.).
13.Study of development in Hen's egg: Window technique -demonstration.
14. Study of placenta of rat (gross and section) sheep and Human

References:

1. Balinsky B.I. 1981. An Introduction to Embryology. W. B. Saunders Co.
2. Bodemer C. W. 1968. Modern Embryology. Holt Rinehart and Winston.
3. Huttener A. F. 1967. Fundamentals of Embryology of vertibrate. Macmillan Publishers.
4. Jangir O. P. 1996. a manual of developmental biology. Agro-botanical publications.
5. Bhojwani S. S. and Bhatnagar S. P. 1978. The embryology of angiosperms. Vikas PublishingHouse, Bangalore.
6. Raghavan V. 2000 Developmental Biology of Flowering Plants. Springer Verlag.

Plant Physiology II and Animal Physiology - 4 credits 56 hours

Course objectives:

- To give students a greater understanding of the physiological processes, plant responses and environmental factors affecting growth and development.
- To identify the physiological factors that regulates growth and developmental processes of plants.
- To provide a comprehensive overview of physiological systems in a well-organized and concise manner to understand the interaction between animal and its environment.
- To understand physiology and functions of the body parts in regulation of metabolic processes like temperature and hormones etc.
- To impart practical skills in concepts of Animal Physiology.

Course outcome:

- Students will gain knowledge about various plant hormones and their applications in horticulture .
- Students will be able to integrate and apply their knowledge of plant physiology for analytical thinking and solving practical problems experienced in agricultural systems.
- This course helps students to understand the biological processes that occur in animal life at various levels of organization such as cells, organ system and complete animal.

- It provides notable clear and detailed account of physiological principles of different physiological processes such as digestion, excretion, respiration, circulation in animals , their adaptations to environments.
- It enables comprehensive understanding of endocrine and reproduction systems.
- Students will gain basic knowledge of physiology and related disorders/ diseases; this will open up opportunities in a wide variety of research areas.

Plant Physiology II and Animal Physiology Theory syllabus

Unit I

Plant growth hormones: Definition, biochemistry, biosynthesis, storage and transport, Mechanism of action & Physiological roles of Auxins, Gibberlins, cytokinins, Ethylene and Polyamines. Brassinosteroids, effect on growth & development, Abscissic acid, Morphactins, Jasmonic acid, Salicylic acid and Expansins. Horticultural importance of growth hormones

Phytochrome: Discovery, structure and physiological function of phytochrome.Molecular mechanism of action of photoreceptors

Nitrogen fixation: Nitrogen cycle, Mechanism of biological nitrogen fixation, symbiotic and non-symbiotic, nitrogenase complex, nodule formation and nod factors, Role of leghaemoglobin, nif genes and hup genes.

Secondary metabolites: Terpenes, Phenolic compounds, Nitrogen containing compounds and induced plant defense against herbivores and Plant defense against pathogens **14 hrs**

Unit II

Digestion: Digestion and absorption of Carbohydrates, proteins and fats. Role of gastro intestinal hormones in digestion, anti nutritional factors

Excretion: End products of nitrogen metabolism. Functional architecture of Kidney. Formation of urine. Mechanism of urine concentration. Hormonal control of urine formation.

Respiration: Types of respiration. Mechanism of pulmonary respiration in man. Transport of O2 and CO2. Respiratory pigments, respiratory quotient and oxygen toxicity.

Adaptation: Adaptation to extreme environment - Desert, high altitude and salt tolerance.

Circulation: Components of blood, Hemoglobin, Types of hemoglobin, clotting of blood - Mechanism and factors involved in clotting, Lymphatic system, Blood related disorders - Hemophelia, Sickle cell anemia, Thalassemia. Types of Criculation, structure of heart, conduction of heart beat, Blood pressure, Factors affecting blood pressure. **14 hrs**

UNIT III

Sensory Physiology: Structure of a neuron, types of nerve cells, machanism of conduction of nerve impulse, synaptic transmission, neurotransmitters, neuromuscular transmission, Autonomic nervous system - distribution and functions. Mechanism of sensory transduction.

Endocrine System: Endocrine System in Man, Structure of hypothalamus, hormones of hypothalamus - GRH, Somatostatin, TRH, CRH, GnRH. Pituitary structure, Hormones of anterior, posterior and median lobes and their actions. Proopiomelanocortins. Brief structure, hormones and their actions of thyroid, parathyroid, Pineal and islets of Langerhans. Pituitary target organ feedback.

Muscle Contraction: Types of muscles - striated, non-striated and cardiac. Structure of skeletal muscle, Mechanism of skeletal muscle contraction, Muscle fatigue. **14 hrs**

UNIT IV

Thermoregulation: Effect of Temperature on biological system. Temperature relations of Poikilotherms and homeotherms, acclimation and acclimatization to cold and heat. Neuronal basis of thermoregulation.

Physiology of reproduction: Hormonal control of testicular and ovarian functions. Estrous and menstrual cycle, implantation, gestation and partiurition.Modern trends in reproduction – Invitro fertilization, cloning, sperm bank, artificial insemination, test tube baby. **14 hrs**

Plant Physiology II and Animal Physiology - Practical 2 credits, 56 hours

Course objectives:

- To give students practical skills on physiological processes, affecting growth and development especially on application of plant hormones
- To give skills of extraction of plant metabolites.
- To impart laboratory diagnosis skills and its basic understanding related to various parameters of urine analysis and blood analysis
-

Course outcome:

- Students will develop practical skills on physiological processes, affecting growth and development especially on application of plant hormones and this will help the students apply when they go to the field
- Students will develop the skills of extraction of plant metabolites and this will help them to use in industry if they are join such profession.

- Students will develop diagnosis skills and its basic understanding related to various parameters of urine analysis and blood analysis. This will help the students to join diagnostic laboratories for their jobs.

Plant Physiology II and Animal Physiology Practical syllabus

1. Extraction and estimation of Indole Acetic acid from plant samples
2. Effect of cytokinin on delaying of leaf senescence
3. Estimation of Ethylene (demonstration)
4. Extraction and estimation of any one of the plant metabolites studied in theory : Terpenes,
5. Phenolic compounds, Nitrogen containing compounds (ex: phenol compounds,solanine etc) Estimation of any one of the antinutritional factors: Trypisn inhibitor/cynogens/phytic acid/Gossypol

6, 7,8. Urine analysis: Normal constituents: Organic: Urea, uric acid, creatinine, amino acid; Inorganic: Cl, SO_4, P

9,10,. Qualitative analysis of urine for abnormal constituents- Glucose, Albumin, Ketone bodies, Bile salt

11,12 Quantitative analysis – Titrableacidity, creatinine, urea, & Sulphate

13,14 Blood analysis: Blood glucose , Uric acid

QUESTION PAPER:THEORY EXAMINATION
(Applicable to DSC courses of III and IV semesters Papers)
5-Year Integrated M.Sc. Course in Molecular Biology
_____ Semester
Title of the Paper:_____

Time: 2 hours **Max. Marks: 60**

Instructions: Draw neat and labelled diagrams wherever necessary

PART-A

1. Define/Explain any five of the following:
(2 questions from each unit) **2x5=10**

a.

b.

c.

d.

e.

f.

g.

h.

PART-B

Answer any four of the following (Internal Choice)
(Internal choice should be from the same unit) **5x4=20**

2.

3.

4.

5.

PART-C

Answer any three of the following:
(One question from each unit) **10X3=30**

6.
7.
8.
9.

Scheme of Discipline Core (DSC) Practical evaluation
5-Year Integrated M.Sc. Course in Molecular Biology

Max. Marks: 50marks

(**Practical test/Viva/MCQ/written test based on Practical concepts**: 20 marks +**Record** :05 marks + **Practical examination**: 25 marks)

Scheme of Practical Examination
IV Semester – Reproductive and Developmental Biology

Time: 03 hours **Practical examination**: 25 marks

1. **Identify two given plant Reproductive and developmental biology materials** 2x2=04marks
   (Identification: 1 mark; Reasons with labelled diagram: 1 mark; Any two materials from plant materials one from animal specimens)
2. **Estimation of pollen viability/mounting of pollenia/ pollen grains of two flowers/endosperm of Cucumis** 04 marks
3. **Identify the two plant reproductive and developmental biology slides.** 2x2=4 marks
   (Identification with reasons: 1-mark, Labelled diagram: 1 mark)

4. Demonstrate window technique and write the procedure 05 marks
(Demonstration: 3 marks; procedure: 2 marks)
3. **Identify the 2 animal reproductive and developmental biology slides .**2x4=8 Marks
   (Identification: 2 marks; diagram:2 marks)

Note: Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

Scheme of Discipline Core (DSC) Practical evaluation
5-Year Integrated M.Sc. Course in Molecular Biology

Max. Marks: 50marks

(**Practical test/Viva/MCQ/written test based on Practical concepts**: 20 marks +**Record** :05 marks + **Practical examination** : 25 marks)

Scheme of Practical Examination
IV Semester – Plant Physiology II and Animal Physiology

1. Write the principle and procedure for the experiment mentioned 05M

(principle:2marks, procedure:5 marks, Tabular colum:2marks, Result:1mark)

2. Conduct the major experiment 10M
   (Principle: 1marks, Procedure: 2 marks, Standardization: 1 marks, Tabular colum:1 mark, graph: 2 marks, Results: 3 marks)
3. Conduct the major experiment 06 M

   (Principle:1marks: Procedure and conducting: 3 marks, reporting:2marks)
4. Identify and comment on A, B 2x2=4 M

   a.

   b.

(**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

Program Articulation Matrix for III and IV semesters

This matrix lists only the core courses. Core courses are essential to earn the degree in thatdiscipline/subject.Theyincludecoursessuchastheory,laboratory,project,internshipsetc

Semester	Course	PO addressed	Pedagogy	Assessment pattern
III	Microbiology theory	PO-1,PO-3,PO-4	1.The course is taught using traditional chalk and talk method using through examples and exercises. 2. power point presentations, audiovisual method 2. Students are encouraged to use resources available on open sources	The assessment is done using continuous assessment through written test seminars, and peer discussions and /viva

III	Microbiology Practical	PO-1,PO-3,PO-4,PO-5	The course is taught using autoclave, laminar airflow, colorimeter, micrometer and hemocytometer. Visit to see different types of microscopes available in any of one the institutes located in Mysore. Various specimens, field visits and use of Microscopes and slides also are adopted. Chalk and talk, digital presentations, experimentations.	Assessment Through practical experiments and lab records and /viva
III	Basic Biochemistry Theory	PO-1,PO-3,PO-4	1.The course is taught using traditional chalk and talk method using through examples and exercises. 2. power point presentations, audiovisual method 2. Students are encouraged to use resources available on open sources	The assessment is done using continuous assessment through written test, viva-voce, seminars, and peer discussion s.
III	Basic biochemistry Practicals	PO-1,PO-3,PO-4,PO-5	The course is taught using related experiments using relevant instruments like colorimeter, spectrophotometer, centrifuge, lab visits and use of Microscopes and slides, Chalk and talk, digital presentations and will be taken to diagnostic laboratory to expose the techniques in field.	Assessment through Experiments and record evaluation
IV	Reproductive and Developmental biology Theory	PO-1,PO-3,PO-4	1.The course is taughtusingtraditionalchalkand talk method usingthroughexamples and exercises. 2. power point	The assessment is done using continuous assessment through written test seminars,

			presentations audiovisual method 2.Studentsareencouragedto use resources availableon opensources	and peer discussion s and /viva
IV	Reproductive and Developmental biology Practical	PO-1,PO-3,PO-4,PO-5	The course is taught using related specimens, and use of Microscopes, centrifuges, Haemocytometer, microtome machine and slides, Chalk and talk, digital presentations	Assessment Through practical experiments and lab records and /viva
IV	Plant Physiology II and animal Physiology theory	PO-1,PO-3,PO-4	1.The course is taughtusingtraditionalchalkand talk method usingthroughexamples and exercises. 2. power point presentations audiovisual method 2.Studentsareencouragedto use resources availableon opensources	The assessment is done using continuous assessment through written test seminars, and peer discussion s and /viva
IV	Plant Physiology II and animal Physiology Practicals	PO-1,PO-3,PO-4,PO-5	The course is taught using related experiments using relevant instruments like colorimeter, spectrophotometer, centrifuge, lab visits and use of Microscopes and slides, Chalk and talk, digital presentations	Assessment Through practical experiments and lab records and /viva

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