Center for Animal Sciences

M.Sc. Program in Life Sciences (Specialization: Animal Sciences)

Semester – IV

Course Code	Course Title	L (hr)	T (hr)	P (hr)	Cr
	Core Courses*				
LAS.514	Stem Cell Biology & Regenerative Medicine	2	1		3
LAS.515	Animal Models of Disease & Research	2			2
	Research				
LAS.599	Research Project (Part – II)			32	16
	Total Credits				**21**

L: Lectures; T: Tutorial; P: Practical; Cr: Credits; *Compulsory Courses

Examination Pattern

A: Continuous Assessment: Based on Objective Type Tests (10 Marks), Term paper (10 Marks), and Assignemnets(s) (5 Marks)
B: Pre-Scheduled Mid Semester Test-1: Based on Objective Type & Subjective Type Test (By Enlarged Subjective Type) (25 Marks)
C: Pre-Scheduled Mid Semester Test-2: Based on Objective Type & Subjective Type Test (By Enlarged Subjective Type) (25Marks)
D: End-Term Exam (Final): Based on Objective Type Tests (25 Marks)

Core Courses:

LAS.514: Stem Cell Biology& Regenerative Medicine 3 Credits

Learning Objective: This course provides a thorough understanding of stem cell science, including its history, the similarities and differences between different types of stem and progenitor cells, species-specific differences in stem cells, the molecular nature of pleuripotency and differentiation and appreciation of the many ways in which stem cell science is utilized in therapeutic contexts.

Unit	Syllabus	Lectures
1.	**The Biology of Stem Cells:** Overview; different types of stem cells, nuclear transfer of stem cells, stem cell differentiation, plasticity. **Embryonic Stem Cells:** the blastocyst and inner cell mass cells primitive endoderm implantation; blastocyst development *in vitro*; isolation and propagation of embryonic stem cells; chimeras; generation of knockout mice.	12
2.	**Nuclear Transfer Technology:** Transfer of nuclei into eggs; development potential of transplanted nuclei; reprogramming a nucleus. **Animal Cloning:** Overview; challenges in human therapeutic cloning; somatic cell nuclear transfer in humans: pronuclear early embryonic development.	12
3.	**Hematopoietic Stem cells and Bone Marrow Transplantation:** Hematopoietic reconstitution; cord blood stem cells; cells important for adaptive cellular immunotherapy; bone marrow transplantation advantages and disadvantage-considerations in allogenic, autologous, syngenic and congenic transplantation; T cell tolerance, graft rejection, GVHD (graft versus host disease) and its mitigation by selective stem / progenitor cell population.	14
4.	**Regenerative Medicine:** Clinical applications of stem cell therapy; neurodegenerative diseases- Parkinson's disease, Alzheimer's, spinal cord injury, other brain syndromes; tissue systems failures- diabetes, cardiomyopathy, kidney failure, liver failure, hemophilia, lymphoma and leukemic malignancies requiring stem cell therapy, organ development.	14

Suggested Reading:

1. Essentials of Stem Cell Biology, Third Edition, Robert Lanza & Anthony Atala, Academic Press
2. Stem cells: An insider's guide, First Edition, Paul Knoepfler, World Scientific Press
3. Stem cells: Basics & Applications, Kaushik Deb& Satish Totey, McGraw Hill Education Pvt. Ltd.

LAS.515: Animal Models of Disease & Research **2 Credits**

Learning Objectives: This course is designed for the first time in any central University specifically for Animal Sciences students who wish to pursue their research careers in the field working on animal model systems. This course will provide updated information on various animal models used in disease and research.

Unit	Syllabus	Lectures
1.	**Invertebrate Model Systems:** Hydra as a model for regeneration andmorphogenesis; *Drosophila&C. elegans* as models of genetics, development, drug discovery and neurobiology, Mosquitoes as models of transmission, Marine invertebrates as models of aging research, Daphnia as a model to study host-parasite interactions, ManducaSexta as a model to study musculoskeletal mechanisms, Honeybees as learning, neurosensory and behavioral model, *Hirudomedicinalis* as a model for wound healing and angiogenesis.	18
2.	**Vertebrate Model Systems:** Zebrafish as apoptotic and drug assessment model, Rodent and Murine models in scientific research, Canines as cancer and muscular dystrophy models, Swine models of human disease, Non-human primate models of biomedical research.	18

Suggested Reading:

1. Verma, A. S. and Singh, A. (2014). Animal Biotechnology. Academic Press, Elsevier, USA.
2. Cartwright, E. J. (2009). Transgenesis Techniques. Humana Press. London, UK.
3. McArthur, R. A. and Borsini, F. (2008). Animal and Translational Models for CNS Drug Discovery. Elsevier. London, UK.
4. Research Journals and Review Articles as suitable and applicable.

LAS.599: Research Project (Part – II) **16 Credits**

Course Objective: The objective of dissertation part II would be to ensure that the student learns the nuances of the scientific research. Herein, the student will carry out the experiments to achieve the objectives as mentioned in the synopsis. The data collected as a result of experiments must be meticulously analysed in light of established scientific knowledge to arrive at cogent conclusions.

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