

Course Code	Course Title	L	T	P	C
BABIT407	Developmental Biology and Regenerative Medicine	3	1	0	4
Pre-requisite	BABIT103 - Cell and Molecular Biology	Syllabus Version			
		1			
Course Objectives					
1. Relate the principles of developmental biology, relevance of model organisms, and assistive reproduction					
2. Inculcate knowledge of early developmental processes, from gametogenesis to germ layers formation, in model organisms					
3. Impart knowledge about the molecular controls of body patterning and regeneration, the role of stem cells, and recent advances in the field					
Course Outcomes					
1. Rewrite the overview of developmental biology, its approaches, the process of gametogenesis, fertilization and the modern techniques involved in assisted reproduction					
2. Summarize the early developmental process and concepts of polarity in Drosophila, fish and amphibians					
3. Identify the early and late developmental stages of birds and mammals amniotes					
4. Rephrase the homeotic factors associated with segmentation and molecular control of sex determination in animal embryos					
5. Identify various aspects of regenerative biology and medicine, vis-a-vis track the contemporary issues in developmental biology					
Module:1	Overview and details of Gametogenesis and Fertilization	9 hours			
Definition and introduction to developmental biology; Mathematical modelling of development, growth, and biological patterns; Approaches of developmental biology (anatomical, experimental, and molecular); Model organisms; Gametogenesis- formation and structure of the gametes, types of sperm; Fertilization- recognition of egg and sperm, gamete fusion, and the prevention of polyspermy in sea urchin and humans; Assistive reproductive technology.					
Module:2	Early Development in Drosophila and Amphibians	9 hours			
Early development of Drosophila embryo: the origins of anterior-posterior polarity. The generation of dorsal-ventral polarity; Early development of amphibian embryo: Development of germ layers, axis formation in amphibians; Cytoplasmic determinants; Conserved molecular pathways in axis specification, and gastrulation in zebrafish.					
Module:3	Early and Late Development in Birds and Mammals	9 hours			

Early development, axis specification in birds (chick) and mammal (mouse); role of cerberus in chick head formation; Tetrapod limb development (role of FGF); Neurulation (neural tube formation); Developmental anomalies in humans and scopes of artificial intelligence (AI) in fetal medicine.		
Module:4	Homeotic Genes and Sex Determination	7 hours
Homeotic genes; Chromosomal sex determination in mammals; Primary and secondary sex characteristics; Chromosomal sex determination in Drosophila; Environmental sex determination.		
Module:5	Regeneration and Regenerative Medicine	9 hours
Injury and healing; Types of regeneration; Popular regenerative models (salamander limbs/ mammalian liver/ bone regeneration); Stem cells in regenerative medicine, therapeutic tissue engineering–tissues and organs; Approaches for specific tissues and organs regeneration: (nervous system, eye, heart, lung, liver, pancreas and kidney).		
Module:6	Contemporary Topics	2 hours
Total Lecture Hours:		45 hours
Tutorial Hours:		15 hours
Text Book(s)		
Barresi MJF and Gilbert SF, " Developmental Biology ", Oxford University Press, 13 th Edition, 2023 El-Badri N, " Regenerative Medicine and Stem Cell Biology ", Springer Verlag, 1 st Edition, 2020		
Reference Books		
Slack JMW, " Essential Developmental Biology ", Blackwell Publishing, 3 rd Edition, 2012 Gardiner DM, " Regenerative Engineering and Developmental Biology ", CRC press, 1 st Edition, 2017		
Mode of Evaluation :Continuous Assessment Test, Digital Assignment, Quiz, Final Assessment Test, Seminar, Group Discussion, Presentaion		
Recommended by Board of Studies :		26-05-2025
Approved by Academic Council : No. 78		12-06-2025