

CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK B.Sc Zoology Those who have joined from the Academic year 2023-24 onwards	
Programme:	B.Sc. Zoology
Programme Code:	23
Duration:	3 years [UG]
Programme Outcomes: (These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)	<p>PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p>PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p>PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p>PO4: Problem solving:Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real life situations.</p> <p>PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p> <p>PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation</p> <p>PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team</p> <p>PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p> <p>PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p>PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.</p> <p>PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p>

	<p>PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.</p> <p>PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one’s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one’s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p>PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.</p> <p>PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.</p>
<p>Programme Specific Outcomes: (These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)</p>	<p>PSO1 – Placement: To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p>PSO 2 - Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations</p> <p>PSO3 – Research and Development: Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p>PSO4 – Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p>PSO 5 – Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit</p>

CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK

(Those who have joined in the Academic year 2023-24 onwards)

B.Sc Zoology

Part	Courses	Subject	Code	Cr.	Hrs
SEMESTER I					
I	Lang. – I	nghJj;jkpo; - I	230103101	3	6
II	Lang. - II	General English	231003101	3	4
III	CC – 1 - T	Invertebrata – I	232303101	3	4
	CC – 1 – P	Invertebrata Lab	232303102	2	2
	CC – 2	Invertebrata - II	232303103	2	2
	EC – I T	Chemistry for Biological Science I	232203121	3	4
	EC – I P	Chemistry Practical for Physical and Biological Science	232203122	1	2
IV	SEC –I (NME)	Ornamental Fish Farming and Management	234603123	2	2
IV	FC	Economic Zoology	234403123	2	2
	AECC- I	Soft Skill - I	236003101	2	2
	Total			23	30
SEMESTER II					
I	Lang. -I	nghJj;jkpo; - II	230103201	3	6
II	Lang. -II	General English	231003201	3	4
III	CC – 3	Chordata	232303201	5	5
	CC - 4	Chordata Lab	232303202	2	3
	EC – II – T	Chemistry for Biological Science – II	232203221	3	4
	EC – II - P	Chemistry Practical for Physical and Biological Science	232203222	1	2
IV	SEC –II (NME)	Bio composting for Entrepreneurialship	234603223	2	2
	SEC - III	Animal Behaviour	234403223	2	2
	AECC –II	Soft Skill - II	236003201	2	2
				23	30
SEMESTER III					
I	Lang. -I	nghJj;jkpo; - III;	230103301	3	6
II	Lang. -II	General English	231003301	3	4
III	CC – 5 T	Cell Biology	232303301	3	3
	CC – 5 P	Cell Biology and Genetics Lab	232303302	1	2
	CC - 6	Genetics	232303303	3	3
	EC –3 T	Allied Botany – I	232403321	4	4
	EC – 3 P	Allied Botany Lab	-	-	2
IV	SEC –IV	Aquarium Keeping	234403323	2	2
	SEC – V	Wild Life	238203323	1	1
	AECC – III	Soft Skill - III	236003301	2	2
	EVS	Environmental Studies	234103301	1	1
				23	30

SEMESTER IV					
I	Lang. – I	nghJj;jkpo; - IV	230103401	3	6
II	Lang. - II	General English	231003401	3	4
III	CC – 7	Developmental Biology	232303401	3	4
	CC - 8	Developmental Biology Lab	232303402	3	3
	EC – IV T	Allied Botany – II	232403421	3	4
	EC – IV P	Botany Lab – II	232403422	2	2
IV	SEC –VI	Nanobiology	234403423	2	2
IV	SEC –VII	Human reproductive Biology	238203423	2	2
	AECC- 4	Soft Skill – IV	236003401	2	2
	EVS	Environmental Studies	234103401	1	1
	Total			24	30
SEMESTER V					
III	CC – 9	Evolutionary Biology	232303501	4	5
	CC - 10	Animal Physiology	232303502	4	5
	CC - 11	Environmental Biology	232303503	4	5
	Core 12	Project with Viva voce	232303504	4	4
	EC – V	Biophysics & Biostatistics	232303505	3	5
	EC – VI	Elective - VI	232303506	3	5
IV		Value Education	234303501	1	1
		Internship/Industrial Training(carried out in II year summer vacation)30 hrs	232303507	2	
				25	30
SEMESTER VI					
III	CC – 13	Animal Biotechnology	232303601	4	5
	CC – 14	Microbiology	232303602	4	5
	CC – 15	Core Lab	232303603	4	5
	EC –7	Agricultural Entomology	232303604	3	5
	EC - 8	Elective - VIII	232303605	3	5
IV	Professional competency skill enhancement course	Professional competency skill	232303606	2	4
		Value Education	234303601	1	1
V		Extension Activity (outside college hrs) *	232303607	1	
				22	30

* NSS / NCC / Physical Education / Rovers and Rangers / Library Science

ALLIED – ZOOLOGY FOR CHEMISTRY					
Sem	Title of the Paper	SUB CODE	Hrs.	Cr.	Generic/Discipline Specific
I	Allied - Animal Diversity	232303121	4	4	EC 1 - Theory
I	Animal Diversity, Genetics, Cell Biology and Bio chemistry Lab	-	2	-	EC 1 - Practical
II	Genetics, Cell Biology and Bio Chemistry	232303221	4	2	EC 2 - Theory
II	Animal Diversity, Genetics, Cell Biology and Bio chemistry Lab	232303222	2	2	EC 2 - Practical

Title of the Course		CELL BIOLOGY						
Part		III						
Category	Core 5 Theory	Year	II	Credits	3	Course Code	232303301	
		Semester	III					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		3	-	--	3	25	75	100
Learning Objectives								
LO1	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.							
LO2	To understand how these cellular components are used to generate and utilize energy in cells.							
LO3	To understand the cellular components underlying mitotic cell division.							
LO4	To apply the knowledge of cell biology to selected examples of changes or losses in cell function.							
UNIT	Details							No. of Periods for the Unit
I	History of Cell Biology , Tools and Techniques of Cell Biology Cell Fractionation, Homogenization, Centrifugation. Histological techniques - Staining - Vital Stains. – Cytoplasmic and Nuclear Stains. Micro Technique Methods, Microscopes - Types - Light, Phase contrast.							9
II	The Cell - Cell theory - Animal cell - Cytoplasm - Structure and Composition, Function - Extra Cytoplasmic Structure - Cilia Flagella - Cytoplasmic Inclusions.							9
III	Cell components - Plasma Membrane Ultra Structure - Different Models - Functions - Ultrastructure, Composition and Function of Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysosomes, Centrioles, Mitochondria.							9
IV	Nucleus - Ultrastructure, Composition and Functions - Nuclear Membrane - Nucleoplasm - Chromosomes - Heterochromatin and Euchromatin - Protein Synthesis & regulation.							9
V	Cell Divisions and Cell Cycle - Amitosis, Mitosis and Meiosis and their Significance - Cancer, Biology – Characteristics of cancer cells, types, theories on Carcinogenesis, Ageing of Cells – Apoptosis and Stem cell studies.							9

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	To understand and recall the basic structure, origin and development of cell organelles.
CO2	To integrate and assess the biochemical, cytological and histological tools to infer cellular basis of organization.
CO3	To analyze and differentiate organisms based on structure, composition and inter and intra cellular interactions.
CO4	To explain the role of cells and cell organelles in various biological processes
CO5	To construct and simulate the role of different cytological tools to explain the structure and complexity of cells and cell organelles.

Text Books (Latest Editions)	
1.	Ambrose, E.J. and Dorothy, M. Easty, 1970. Cell Biology, Thomas Nelson & Sons Ltd., 500 pp.
2.	Kumar P. and Mina U. (2018) Life Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication. p.608.
3.	VeerBala Rastogi, Introductory cytology. Kedar Nath Ram Nath. Meerut 250 001.
4	Verma, P.S. and V. K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S.Chand & co., New Delhi - 110 055, 567 pp.
5	Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5th Edn.,(paperback) W.W. Norton & Company p.864.
2.	Burke, Jack. D., 1970. Cell Biology, Scientific Book Agency, Calcutta.
3.	Challoner J. (2015) The Cell: A visual tour of the building block of life, The University of Chicago Press and Ivy Press Ltd., p.193.
4.	Cohn, N. S., 1979, Elements of Cytology, Freeman Book Co., New Delhi – 110007, 495 pp
5.	Cooper G.M. (2019) The Cell – A Molecular Approach, 8th Edn., Sinauer Associates Inc., Oxford University Press p.813.
6	DeRobertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and Molecular Biology, 8th Edition, International Edition, Info med, Hong Kong, 734pp.
7	Dowben, R., 1971. Cell Biology, Harper International Edition. Harper and Row Publisher, New York, 565 pp.
8	Giese, A.C., 1979. Cell Physiology, Saunders Co., Philadelphia, London, Toronto, 609 pp.
9	Hardin J. and Bertoni G. (2017) Becker’s World of the Cell. 9th Edn (Global Edition). Pearson Education Ltd., p. 923
10	Karp G., Iwasa J. and Masall W. (2015) Karp's Cell and Molecular Biology Concepts and Experiments. 8th Edn. John Wiley and Sons. p.832.
11	Loewy, A.G. and P.Sickevitz, 1969. Cell Structure and Function, Amerind Publishing Co., NewDeihi - 110 020, 516 pp.
12	Mason K.A., Losos J.B. and Singer S.R. (2011) Raven and Johnson’s Biology. 9th Edn. Mc Graw Hill publications. p.1406.
13	Powar, C.B., 1989. Essential of Cytology, Himalaya Publishing House, Bombay - 400 004, 368 pp.
14	Swansen, C.P. and P.L.Webster, 1989. The Cell, Prentice Hall of India Pvt. Ltd., New Delhi - 110 001, 373 pp.
15	Urry L.A. Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014) Campbell Biology in Focus. Pearson Education. p.1080.
Web Resources	
1.	http://www.microscopemaster.com/organelles.html
2.	https://bit.ly/3tXwDSB
3.	https://bit.ly/3tWNpRX
4.	https://bit.ly/3AuYR9M
5.	https://rsscience.com/cell-organelles-and-their-functions/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	P	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	M	S
CO4	S	S	M	S	S	M	S	S
CO5	M	S	S	S	S	S	S	S

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		CELL BIOLOGY AND GENETIC LAB						
Part		III						
Category	Core 5 Practical	Year	II	Credits	1	Course Code	232303302	
		Semester	III					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
			-	2	2	25	75	100
Learning Objectives								
✍ To understand the basic structures of cells and the purpose of basic components of prokaryotic and eukaryotic cells								
✍ To gain knowledge in the stages of mitosis and meiosis highlighting similarities and differences								
✍ Students will learn the basic principles of Mendelian inheritance								
✍ Gaining practical skills in genetic analysis and the ability to apply genetic principles								
Details								
CELL BIOLOGY:								
Observation of Miotic stages in Onion root tip.								
Observation of Meiotic stages in grasshopper testis squash.								
Preparation of Squamous epithelium from oral smear								
Preparation of Striated muscle from goat meat								
Preparation of onion epidermis from Onion peel								
Observation of Giant chromosomes in Chironomus larva								
Spotters/charts on -								
Microtome								
Lamp brush chromosome								
Mitochondrion								
Golgi complex								
Nucleus								
Nucleolus								
Rough Endoplasmic reticulum								
Ribosomes								
Polytene chromosome								
Lambrush chromosome								
Genetics								
Observation and record of simple Mendelian traits in Human								
Demonstration of Mendelian inheritance-Monohybrid and Dihybrid Cross Experiment with beads								
Observation of finger print patterns among II Bsc Zoology students								
Study of abnormal Karyotype – Downs Syndrome, Turners Syndrome and Kline felters Syndrome (pictures)								
Charts on DNA ,tRNA								
Sickle cell anemia								
Haemophilia								
Comb pattern in fowl								

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Will be able to identify and describe the structure of various cell types observed under a microscope
CO2	Develop proficiency in basic laboratory techniques such as cell staining and microscopy
CO3	Understand the concept of mitotic and meiotic cell division.
CO4	Understand the basic principles of genetics including Mendelian inheritance
CO5	Equip students with a strong foundation in genetics, and practical skills in genetic analysis.

Text Books (Latest Editions)	
1.	Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc
2.	Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.
3.	Ambrose, E.J. and Dorothy, M. Easty, 1970. Cell Biology, Thomas Nelson & Sons Ltd., 500 pp.
4.	Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.
5.	Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012).
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Becker, W.M.; Kleinsmith, L.J.; Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco.
2.	De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8th edition) Lippincott Williams and Wilkins, Philadelphia.
3.	Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4.	Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
5.	Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
Web Resources	
1.	http://www.microscopemaster.com/organelles.html
2.	https://rsscience.com/cell-organelles-and-their-functions
3.	https://askabiologist.asu.edu
4.	https://www.jax.org
5.	https://vectorgeneticslab.ucdavis.edu

Title of the Course		GENETICS						
Part		III						
Category	Core 6	Year	II	Credits	3	Course Code		232303303
		Semester	III					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		3	-	--	3	25	75	100
Learning Objectives								
LO1	To understand the structure and functions of nucleic acids in the cell.							
LO2	To know the causes and effects of mutations.							
LO3	To comprehend the importance of genetic variation in evolution.							
LO4	To know about the harmful effects of genetic variations in humans, their cumulative effect in human population and the molecular basis of variations.							
UNIT	Details							No. of Periods for the Unit
I	Mendelian Genetics and Inheritance: Mendelian genetics: Mendelian experiments, laws of Mendel, Monohybrid, Dihybrid, back and test cross; Interaction of genes: Incomplete dominance, Co-dominance, complementary genes, supplementary genes, inhibiting genes, lethal genes.							9
II	Inheritance: Polygenic inheritance- skin colour; multiple alleles- ABO blood groups and coat colour in rabbit; extra chromosomal inheritance- shell coiling, kappa particles; sex linked inheritance – colour blindness and hemophilia in man.							9
III	Linkage and Crossing Over: Linkage: Linked genes, complete and incomplete linkage. Crossing over: molecular mechanisms of crossing over, kinds of crossing over, models of recombination. Chromosome mapping: inference and coincidence, haploid mapping, somatic cell hybridization.							9
IV	Cytogenetics: Variation in chromosome number and structure: position effect, chromosomal mutation and evolution. Gene mutation: types, molecular basis of mutation and induced mutations (Physical and Chemical mutagenic agents). Detection of mutation - CIB method: DNA repair Mechanisms.							9
V	Human Genetics: Human genetics: Karyotype and ideogram; sex determination - Barr body technique, drumstick method; chromosomal abnormalities in humans, Pedigree analysis; diagnosis of genetic abnormalities; Eugenics, Euphenics, and Euthenics. Microbial Genetics: Conjugation, transformation, transduction and chromosome mapping. Regulation of Gene expression – structural and functional gene, Operon-Lac Operon, repressor of operon. feedback mechanism.							9
Course Outcomes								
Course Outcomes	On completion of this course, students will;							
CO1	Understand the basis of inheritance and expression of genes.							
CO2	Correlate changes in genetic makeup and phenotypic changes in progeny.							
CO3	Analyse the causes of variations in genetic material and predict the effect in a population using different techniques.							
CO4	Explain the role of cellular processes and different genetic elements in the expression of genes.							
CO5	Compile the factors which contribute to changes in gene expression and specify the changes which contribute to evolution.							

Text Books (Latest Editions)	
1.	David E Sadava, 1993. Cell Biology - Organelle Structure and Function, Jones Bartlett Publishers.
2.	Guptha G. K., 2013. Genetics Classical to Modern, Rastogi publishers, Meerut.
3.	Lewin B., 2008. Genes IX, Jones and Bartlett publishers.
4.	Veer Bala Rastogi., 2019. Text Book of Genetics, Medtech
5.	Verma P.S and Agarwal V.K., 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.
6.	Verma P. S. and V. K. Agarwal., 2018. Genetics, S. Chand & Company Pvt Ltd.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Cooper, Geoffrey M., 2018. The cell: A Molecular Approach, Eighth Edition, Oxford University Press.
2	De Robertis, E. D. P and E.M.F Robertis, 2017. Cell and Molecular Biology 8 th Edition, LWW.
3	Dobzhansky T., 1982. Genetics and The Origin of Species, Columbia University.
4	Fletcher H and Hickey I., 2015. Genetics, IV Edition. GS, Taylor and Francis Group, New York and London.
5	Gardner, Anne. 2009. Human Genetics, Scion Publishing Ltd.
6	Klug, W. S., Cummings, M. R., Spencer, C. A., 2012. Concepts of Genetics. X Edition. Benjamin Cummings.
7	Lodish, Harvey, Arnold Berk <i>et al</i> .,2007. Molecular cell biology. 6th edition, W. H. Freeman.
8	Russel, Peter J. 2013. iGenetics: A Molecular Approach, Pearson.
9	Strickberger M. W., 1995. Genetics, Prentice Hall India Learning Private Limited.
Web Resources	
1.	https://go.nature.com/2XE8V1q
2.	https://bit.ly/3zoTt6B
3	https://bit.ly/2XAm7oa
4	https://bit.ly/2XEbhxi
5	https://bit.ly/3AB4bso
6	https://bit.ly/39pZSE4
7	https://www.genome.gov/genetics-glossary/Sex-Linked
8	https://www.vedantu.com/biology/mutagens

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M
CO3	S	S	S	S	S	S	M	S
CO4	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	S

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		AQUARIUM KEEPING						
Part		IV						
Category	SEC – 4	Year	II	Credits	2	Course Code	234403323	
		Semester	III					
Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total	
	2	-	--	2	25	75	100	
Learning Objectives								
<ul style="list-style-type: none"> ➤ To create knowledge on self employment opportunity of ornamental fishes ➤ To provide the knowledge of ornamental fishes and their equipment ➤ To understand the different breeding techniques of ornamental fishes 								
UNIT	Details						No. of Periods for the Unit	
I	Introduction and scope - Aquarium fish keeping as hobby and cottage industry. Commercial aspects like national and international market. To create knowledge on self employment opportunity.						6	
II	External morphology of a typical fish. Exotic and endemic varieties of ornamental fishes.						6	
III	Aquarium preparation and maintenance - Kinds of tanks, tank setting, biological filter and aeration, water management, planting, lighting and feeds. Budget for setting up an Aquarium Fish Farm as a Cottage Industry						6	
IV	Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquarium ornamental fish varieties such as Guppies, Mollies, Sword tails, Platy, Siamese fighters and Gold fish, Butterfly fish, Blue morph and Anemone fish.						6	
V	Live fish transport- handling, feeding and forwarding techniques of fish. Fish Diseases and their control.						6	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Students to learn about different ornamental fishes and identify the diseases of them
CO2	To develop entrepreneur potential in the field of aquarium and get self employment.
CO3	Take prophylactic measures to prevent fish diseases
CO4	To make the students well versed in their practical skills starting from setting of aquaria to the aquarium fish production
CO5	To get aware about transportation of fishes
Text Books (Latest Editions)	
01. Mary Bailey –“The Complete Guide to Aquarium Fish Keeping”	
02. Aquariums: The Complete Guide to Freshwater and Saltwater Aquariums, Jan 2009 by Thierry Maitre-alain (Author), ChrisitanPiednoir (Author)	
03. A. Saxena: Aquarium Management. Daya pub. House, New Delhi	
04. Aquarium keeping:The Aquarium Keeping Guidebook by David Justin Smith (Author) Format: Kindle Edition	
05. A textbook of Ornamental fish and fisheries: Aquarium fish keeping, Publisher: Kalyani Publishers, New Delhi, January 2022.	
References Books	
(Latest editions, and the style as given below must be strictly adhered to)	
1	Santhanam, P., Sukumaran, N. & P. Natarajan, A manual of freshwater aquaculture (1987), Reprint 1999, Oxford & IBH Publishing Company Pvt., Ltd., New Delhi.
2	Cliff Harrison, A colour guide to Tropical Fish (1980), Chartwell Books, INC, Cerkshire, printed in Hon Kong.
3	O’Connell, R. F., The freshwater aquarium (1977), Arco Publishing Company, INC New York.
4	Jingran V.G., 1991: Fish and Fisheries in India – Hindustan Publ.co. New Delhi
5	Mill Dick, 1993: Aquarium Fish, Daya Pub.co., New Delhi

Web Resources	
	https://www.learndirect.com/course/aquarium-and-fishkeeping
	https://www.animalbehaviorcollege.com/aquarium-maintenance/curriculum/
	https://www.hortcourses.com/courses/aquarium-management
	https://www.researchgate.net/publication/343999135_Ornamental_fish_and_aquarium

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	M	S	S	S	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		WILD LIFE						
Part		IV						
Category	SEC –V	Year	II	Credits	1	Course Code	238203323	
		Semester	III					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		1	-	-	1	25	75	100
Learning Objectives								
<p>✍ To understand and discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies.</p> <p>✍ To assess and instil strong foundations on wildlife policies and be familiar with a variety of laws and regulations.</p> <p>✍ To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions.</p> <p>✍ To evaluate and integrate all the related areas like Fundamentals in Ecology, Forestry, Natural Resource Conservation approaches and develops the role PVA models for protection of endangered species.</p> <p>✍ To explain the advanced scientific basis for wildlife management and discuss National and International Efforts for successful wildlife conservation.</p>								
UNIT	Details							No. of Periods for the Unit
I	Biodiversity Extinction and Conservation Approaches Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.							3
II	Theory and Analysis of Conservation of Populations Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity. Population viability analysis-conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species.							3
III	National and International Efforts for Conservation International agreements for conserving marine life, Convention on wetlands of International Importance (Ramsar convention), Conservation of Natural Resources. Overview of conservation of Forest & Grassland resources. CITES, IUCN, CBD National Forest Policy, 1988, National Wildlife Action Plan 2017-2031, Wildlife Protection Act 1972, National and State Biodiversity Action Plans and other Forests and Environmental Acts.							3
IV	Wildlife in India Wildlife wealth of India & threatened wildlife, Reasons for wildlife depletion in India, Wildlife conservation approaches and limitations. Wild life Habitat: Characteristic, Fauna and Adaptation with special reference to Tropical forest. Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors. Community Reserve and conservation Reserves.							3
V	Management of Wildlife Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.							3

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	To understand and recall the importance of wildlife, extinction and Conservation Approaches of wildlife.
CO2	To integrate and assess the National, international approaches for biodiversity conservation.
CO3	To analyse and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.
CO4	To explain the role PVA models, Wildlife conservation approaches, and limitations.
CO5	To construct and simulate National and International strategies for Conservation, Wild life laws and ethics.

Text Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478.
2	Aaron, N.M.1973 Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A.
3.	Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231.
4	Justice Kuldip Singh 1998. Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj Publishers, Dehradun.
5	Hosetti, B.B. 1997 Concepts in Wildlife Management, Daya Publishing House, Delhi.
6	Sutherland, W.J 2000. The conservation handbook: Research, Management and Policy. Blackwell Science.
7	Caughley.G and Sinclair, A.R.E 1994 Wildlife ecology and management. Blackwell Science.
8	Woodroffe R, Thirgood, S. and Rabinowitz A. 2005.People and Wildlife, Conflict or Co existence? Cambridge University.
9	Sinha, P.C. 1998. Wildlife and Forest Conservation, Anmol Publishing Pvt. Ltd., New Delhi.
10	Singh, S.K, 2005. Text Book of Wildlife Management. IBDC, Lucknow.
ReferencesBooks (Latest editions, and the style as given below must be strictly adhered to)	
1.	Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547.
2.	Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.
3.	Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun.
4.	Goutam Kumar Saha and SubhenduMazumdar, 2017. Wildlife Biology: An Indian Prospective, PHI Publisher, Delhi.
5.	Katwal/Banerjee, 2002. Biodiversity conservation in managed and protected areas, Agrobios, India.
6.	Gopal, Rajesh,1992. Fundamentals of Wildlife Management, Justice Home, Allahabad, India.
7.	Sharma, B.D, 1999. Indian Wildlife Resources Ecology and Development, Daya Publishing House, Delhi.
8.	Stephen, H.B. and V.B. Saharia,1995. Wildlife research and management. Asian and American Approaches, Oxford University Press, Delhi.
9.	Negi, S.S. 1993. Biodiversity and its conservation in India, Indus Publishing Co., New Delhi.
10.	Moulton, M. P. & J. Sanderson, 1997. Wildlife Issues in a Changing World. St. Lucie Press.

Web Resources	
1	https://bit.ly/39oPj44
2	https://bit.ly/3IHdEYJ
3	https://bit.ly/3CwBCfY
4	https://bit.ly/3EDYr3a
5	https://bit.ly/3tVtG4U

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	S	M	S	S	S
CO2	S	S	S	M	M
CO3	M	S	S	S	S
CO4	S	S	M	M	S
CO5	M	S	S	S	S

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		DEVELOPMENTAL BIOLOGY						
Part		III						
Category	Core 7	Year	II	Credits	4	Course Code	232303401	
		Semester	IV					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		4	-	--	4	25	75	100
Learning Objectives								
✍ To create an awareness to the students about the theories, concepts and basics of Developmental Biology.								
✍ To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.								
✍ To make an awareness of the induction, organizers and development of extra embryonic structures.								
✍ To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing								
✍ To give an idea about teratogenesis, invitro fertilization, stem cells and amniocentesis to the students								
UNIT	Details							No. of Periods for the Unit
I	Gametogenesis & Fertilization Basic concepts of developmental biology. Structure & types of Spermatozoa, Mammalian egg - Egg membranes. types of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.							12
II	Blastulation & Gastrulation Cleavage - Planes and Patterns, Factors controlling cleavage - Fate map and its construction. Blastulation –types of blastula. Morphogenetic movements - Gastrulation of frog.							12
III	Organogenesis Development of Brain, Eye and Heart in frog. Development of Nervous system in chick. Foetal membranes in chick. Development of Pro, Meso Metanephrie kidneys. Placentation in Mammals.							12
IV	Applied Embryology Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Embryonic stem cells & significance. Methods to culture embryo							12
V	Human embryology Reproductive Organs, Menstrual cycle and menopause - Pregnancy – trimesters – development. Erythroblastosis foetalis – Twins – types Infertility – causes – Test tube baby– Amniocentesis.							12

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	To describe and illustrate the significance of cellular processes in embryonic development.
CO2	To relate the factors that contribute to the developmental process, construct fate maps and illustrate the steps in morphogenesis and organogenesis.
CO3	To correlate the involvement of specific cell types in the formation of specific organs and explain the importance of morphogens.
CO4	To distinguish between the different types of developmental mechanisms in various organisms and appraise the species-based differences in development.
CO5	To justify and validate the role of environment and genetics in influencing embryonic development

Text Books (Latest Editions)	
1	Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi, India
2	Subramoniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi, India.
3	Verma, P.S., Agarwal, V. K.2010.Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi., India.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Gilbert S.F. 2010. Developmental Biology, Sinauer Associates, Massachusetts, USA.
2.	Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London, UK.
3	Berril, N.J.1971. Developmental Biology, McGraw Hill, New York, USA.
4	Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.
5	Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA
Web Resources	
1.	https://www.ncbi.nlm.nih.gov/books/NBK10052/
2.	https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html
3.	https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468
4.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	S	S	S	S	S	S	S	S
CO2	M	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		DEVELOPMENTAL BIOLOGY LAB						
Part		III						
Category	Core 8	Year	I	Credits	3	Course Code		232303402
		Semester	IV					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		-	-	3	3	25	75	100
Learning Objectives								
✍ Understanding of the stages of embryonic development in various animal species								
✍ Acquire practical skills in whole mount preparation of chick embryo								
✍ Understand the regeneration concept in frog								
✍ Learn the recent techniques of culturing embryo								
Details								
<p>DEVELOPMENTAL BIOLOGY: Study the following prepared slides and museum specimens</p> <ol style="list-style-type: none"> Sections of testis and ovary showing the maturation stages of gametes (mammalian) Study of different types of eggs –Amphioxus, frog ,chick – based on charts Study of human egg and sperm - Charts Study of developmental stages of frog through permanent slides Cleavage, Blastula , Gastrula and neurula . <ul style="list-style-type: none"> 2 cell stage 4 cell stage Observatio of Early developmental stages of chick – Demo / permanent slides Primitive streak <ul style="list-style-type: none"> 24 hrs of incubation 48 hrs of incubation 72 hrs of incubation 96 hrs of incubation Study of Placenta of Sheep (model /specimen) Based on Charts – Test tube baby Twins Metamorphosis in Amphibia 								
References								
1. Kardong, K.V. (2005) Vertebrates’ Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education								
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies								
3. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.								
4. Lal, S.S. Atext book of practical Zoology vertebrate, 9 th Edition, Restogi publications, Meerut, 2004.								
5. Carlson, Bruce M (1996). Patten’s Foundations of Embryology, McGraw Hill, Inc.								

Title of the Course		NANO BIOLOGY						
Part		IV						
Category	SEC – 6	Year	II	Credits	2	Course Code	234403423	
		Semester	IV					
Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total	
	2	-	--	2	25	75	100	

Learning Objectives

✍ This course provides knowledge about the basic concepts of nanobiology. The learners will be able to acquire skills in the assembly, design and types of nanomaterials and nanoparticles, They will be able to appreciate the applications of nanobiology in diverse fields.

UNIT	Details	No. of Periods for the Unit
I	Nanobiology- Definition-concepts and scope. History of nanotechnology and nanoscience in Nature; Structure and Properties of nanomaterials: size, surface charge, conductivity, optical properties and biocompatibility.	6
II	Synthesis and characterization of nanomaterials, Fabrication of nanostructures, Metallic nanoparticles, semiconductor, biopolymeric nano-structures and nanoparticles	6
III	Composition and functional properties of nanostructures: Protein and peptide-based nanostructures, carbohydrate and nucleic acid based nanomaterials; Use of gold, silver and other metallic nanoparticles.	6
IV	Strategies to design biologically active nanostructure-based biomaterials. Interaction of nanoparticles with biomolecules to study their conformational and functional properties.	6
V	Biological Applications of Nanomaterials and nanoparticles – therapeutics – biomaterials - Immobilized enzymes - drug delivery systems – Biosensors - Cellular imaging tools and diagnostics.	6

Course Outcomes

Course Outcomes	On completion of this course, students will be able to:
CO1	Understand basics of Nano-science and Nano-biology.
CO2	Gain knowledge on nanomaterials and nanoparticles.
CO3	Familiarity with working principles, tools and techniques in the field of nanomaterials.
CO4	Understanding of the strengths, limitations and potential uses of nanomaterials.
CO5	Apply their knowledge in their career development in higher education, research and development.

Text Books (Latest Editions)

1	Nanobiotechnology: Concepts, Applications and Perspectives by Niemeyer C. M., Wiley – VCH, 2006.
2	Bionanotechnology by David S Goodsell, John Wiley & Sons, 2004
3	Bio-Nanotechnology: A Revolution in Food, Biomedical and Health Sciences by Debasis Bagchi, Manashi Bagchi, Hiroyoshi Moriyama, Fereidoon Shahidi, Wiley-Blackwell, 2013.
4	Biomaterials Science: An Introduction to Materials in Medicine by Budd
5	Nanobiotechnology: Concepts, Applications and Perspectives (2004), Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley VCH.
6	Nanobiotechnology - II more concepts and applications. (2007) - Chad A Mirkin and Christof M. Niemeyer (Eds), Wiley VCH.
7	Nanotechnology in Biology and Medicine: Methods, Devices, and Applications.

References	
1	Pradeep, T. (2017) The Essentials: Understanding Nanoscience and Nanotechnology: McGraw-Hill Education.
2	Phoenix, D.A. and Ahmad, W (2014) Nanobiotechnology. One Central Press Ltd.
3	G. Cao - Nanostructures and Nanomaterials - Synthesis, Properties and Applications, Imperial College Press, 2004.
4	Daniel L. Feldheim, Colby. A. Foss - Metal Nanoparticles: Synthesis, Characterization and Applications, Marcel Dekker, NY, 2002.
5	Janos. H. Fendler (Ed) - Nanoparticles and Nanostructured Films: Preparation, Characterization and Applications, Wiley – VCH, 1998.
6	Didier Astruc(Ed) - Nanoparticles and Catalysis, Wiley-VCH, 2008.
7	G.C. Hdjipanayis, R.W. seigel - Nanophase Materials- Synthesis, Properties and Applications, Kluwer Academic Publishers, 1994.
8	Yoon S Lee - Self-assembly and Nanotechnology-A force balance approach, Wiley, 2008.
9	Cullity. B. D and S. R. Stock - Elements of X-ray diffraction, Prentice-Hall, 2001.
10	Skoog. D. A, James Holler. F, Nieman. T. A - Principles of Instrumental Analysis, Harcourt College, 2007.
11	Willard H. H., Merrit. L. L., Dean. J. A and Settle. F. A - Instrumental Methods of Analysis, CBS Pub, 1986.
12	Williams. D. B and Carte. C. B - Transmission Electron Microscopy – A text Book of Materials Science, Plenum Press, N. Y, 1996.
13	Challa Kumar(Ed) - Nanomaterials for Medical Diagnosis and Therapy, Wiley-VCH, 2006.
14	Challa Kumar(Ed) - Semiconductor Nanomaterials, Wiley-VCH, 2010.
15	Charles Kittel - Introduction to Solid State Physics, John Wiley & Sons, 2003.
16	Harvey Lodish, Arnold Berk et al. - Molecular Cell Biology, W.H. Freeman& Co., New York, 2008.
17	Geoffrey M. Cooper, Robert E. Hausman – The Cell – A Molecular Approach – ASM Press, Washington, 2007.
18	Challa Kumar (Ed) – Biological and Pharmaceutical Nanomaterials, Wiley – VCH Verlag, Weinheim, 2006.
19	Ralph S. Greco, Fritz B. Prinz and R. Lane Smith (Eds) - Nanoscale Technology in Biological Systems, CRC Press, 2005.
20	K. J. Klabunde - Nanoscale Materials in Chemistry, Wiley, 2001.
21	R. C. O. Handely - Modern Magnetic Materials: Principles and Applications, Wiley, 1999.
22	P. N. Prasad - Nanophotonics, Wiley-Interscience, 2004.
Web resources	
1.	http://www.nanotech-now.com/
2.	http://www.understandingnano.com/
3.	http://nanotechweb.org/
4.	http://www.nano-biology.net/
5.	http://nanogloss.com/
6.	http://www.safenano.org/

MAPPING OF COs WITH POs

	PO1	PO 2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	M	S
CO 3	S	S	S	S	S
CO 4	M	S	M	M	S
CO 5	S	S	M	S	S

3- Strong 2- Medium 1- Low

Title of the Course		HUMAN REPRODUCTIVE BIOLOGY						
Part		IV						
Category	SEC – VII	Year	II	Credits	2	Course Code	238203423	
		Semester	IV					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		2	-	-	2	25	75	100
Learning Objectives								
<ul style="list-style-type: none"> ✍ To enable students to understand the endocrine structures and hormones associated with the physiology of reproductive system ✍ To enable students to learn about the male reproductive system and accessory glands and regulation ✍ To enable students to learn about the female reproductive system and regulation of its function ✍ To enable students to comprehend about fertilization, pregnancy, parturition and lactation ✍ To equip students with knowledge on causes of infertility, reproductive health, assisted reproductive technology and associated ethical issues 								
UNIT	Details							No. of Periods for the Unit
I	Outline and histoarchitecture of male reproductive system; Testis: Cellular functions; Spermatogenesis - Androgen synthesis Epididymal function and sperm maturation; Accessory glands functions; Andropause							6
II	Outline and histoarchitecture of female reproductive system; Ovary: oogenesis - Steroidogenesis and secretion of ovarian hormones; Reproductive cycles and their regulation, changes in the female tract; Menopause							6
III	Fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation							6
IV	Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation; Puberty							6
V	Infertility in male and female: causes, diagnosis and management; Sexually transmitted Infections; Modern contraceptive technologies; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, Stem Cell banks, <i>in vitro</i> fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; ethical issues related to ART; Surrogate motherhood; ethical issues; Consanguinity; Fetal Loss and Birth Defects; Adoption							6
Course Outcomes								
Course Outcomes	On completion of this course, students will be able;							
CO1	Recall the structure and functioning of the male and female reproductive system, associated endocrinology, causes for infertility and assisted reproductive technology							
CO2	Describe the structure and physiology functions of male and female reproductive systems.							
CO3	Explain the role of structures, accessory glands and hormones associated with the reproductive extracts and their control							
CO4	Explain the mechanism of sex determination.							
CO5	Analyze the different techniques and associated ethical issues related to reproductive technology							

Text Books (Latest Editions)	
1	Randall, David J., 1938-. (2002). Eckert animal physiology : mechanisms and adaptations. New York :W.H. Freeman and Co.,
2	Jain, A. K. (2017). <i>Textbook Of Physiology</i> (7th ed.). Avichal Publishing Company.
3	Arumugam, A., & Mariakuttan, A. (2019). <i>Animal Physiology</i> (13th ed., pp. 1-848). Saras Publication.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Cassan, A. (2005). <i>Human reproduction and Development (Inside the Human Body)</i> . New York: Chelsea Clubhouse
2	Field, M.A. (1990). <i>Surrogate Motherhood</i> . Massachusetts: Harvard University
3	Gardner, D. K. (2001). <i>Textbook of Assisted Reproductive Techniques: Laboratory and Clinical Perspectives</i> . London: Martin Dunitz.
4	Gardner, D. K. (2006). <i>In vitro Fertilization: A Practical Approach</i> . CRC press.
5	Johnson, M. H. (2018). <i>Essential Reproduction</i> . New Jersey: Wiley-Blackwell.
6	Jones, R.E. (2013). <i>Human Reproductive Biology</i> . Amsterdam: Elsevier.
7	Neill, Jimmy D. ed (2006). <i>Knobil and Neill's Physiology of Reproduction</i> . Volume I. Third edn. Elsevier Academic Press.
8	Pinon, R. (2003). <i>Biology of Human Reproduction</i> . California: University Science Books.

Web Resources	
1	http://www.uni-mainz.de/FB/Medizin/Anatomie/workshop/englWelcome.html
2	http://apchute.com/
3	http://teachmeanatomy.info/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	M	M	S	S
CO5	M	S	S	S	S

3 – Strong, 2 – Medium, 1 - Low