

**E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI – 625 014.**

*(An Autonomous Institution – Affiliated to Madurai Kamaraj University)*

Re-accredited **(3<sup>rd</sup> Cycle)** with Grade **A<sup>+</sup>** & **CGPA 3.51** by NAAC

## **DEPARTMENT OF ZOOLOGY**



**CBCS With OBE**

**BACHELOR OF SCIENCE**

**PROGRAMME CODE - Z**

**COURSE STRUCTURE**

(w.e.f. 2022 – 2023 Batch onwards)

**E.M.G. YADAVA WOMEN'S COLLMADURAI -14.**  
**(An Autonomous Institution – Affiliated to Madurai Kamaraj University)**  
**(Re –accredited (3<sup>rd</sup> cycle) with Grade A<sup>+</sup> and CGPA 3.51 by NAAC)**

**DEPARTMENT OF ZOOLOGY – UG**  
**(with Allied Chemistry and Allied Botany)**  
**CBCS with OBE**

**COURSE STRUCTURE**  
**(w.e.f. 2022 – 2023 Batch onwards)**

Semester	Part	Course Code	Title of the Course	Teaching hrs (per week)	Duration of Exam (hrs.)	Marks Allotted			Credits
						CIA	SE	Total	
III	I	22OU1TA3	Tamil	6	3	25	75	100	3
	II	22OU2EN3	English	6	3	25	75	100	3
	III	22OUZO31	<b>Core – Cell and Molecular Biology</b>	4	3	25	75	100	4
	III		<b>Core - Lab</b> in Cell and Molecular Biology and Developmental Biology	2	-	-	-	-	-
	III	22OUZOGCH3	<b>GEC– Chemistry -III Industrial Chemistry</b>	4	3	25	75	100	4
	III		<b>GEC- Practical- II Volumetric Analysis</b>	2	-	-	-	-	-
	III	22OUZOGBO3	<b>GEC: Botany –I Plant Diversity- I</b>	4	3	25	75	100	4
	III		<b>GEC : Botany Practical – I Plant Diversity- I &amp; Basics of Botany</b>	2	-	-	-	-	-
IV	I	22OU1TA4	Tamil	6	3	25	75	100	3
	II	22OU2EN4	English	6	3	25	75	100	3
	III	22OUZO41	<b>Core – Developmental Biology</b>	4	3	25	75	100	4
	III	22OUZO4P	<b>Core - Lab</b> in Cell and Molecular Biology and Developmental Biology	2	3	40	60	100	2
	III	22OUZOGCH4	<b>GEC– Chemistry –IV Medicinal, Green &amp; Nano Chemistry</b>	4	3	25	75	100	4
	III	22OUZOGCH4P	<b>GEC- Practical -II Volumetric Analysis</b>	2	3	40	60	100	1
	III	22OUZOGBO4	<b>GEC: Botany –II Basics of Botany</b>	4	3	25	75	100	4
	III	22OUZOGBO4P	<b>GEC: Botany Practical – I Plant Diversity- I &amp; Basics of Botany</b>	2	3	40	60	100	1

**GEC:** Generic Elective Course

**SEC :** Skill Enhancement Course

**DSEC:** Discipline Specific Elective Course

**AECC:** Ability Enhancement Compulsory Course

**IDC :** Inter Disciplinary Course

**NOTE:**

**The students are permitted to obtain additional credits (Optional)**

1. MOOCs / SWAYAM / NPTEL Courses(Online)
2. Project

Year	Semester	Title	Duration of Study	Credit
III	VI	Project title	6 months	1

Department of Zoology					Class: IB.Sc			
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
III	Core	22OUZO31	Cell & Molecular Biology	4	4	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

**Course Objectives:**

1. To illustrate ,elucidate and describe the basic structure and functions of cell as a basic fundamental unit of an organism
2. To explore the molecular architecture of biomolecules and their complex interactions.
3. To learn about the significance of macromolecules- DNA, RNA and proteins.
4. To understand the importance of cell division and replication.

**Course Content:**

**Unit I** Introductory Cytology: Cell theory - Prokaryotic and Eukaryotic cells. Cytological techniques: Fixation– Sectioning & Staining. Principle, Resolving power & uses of compound microscope, confocal microscope and electron microscope. Cell Junctions - Ultrastructure and functions of plasma membrane.

**Unit II** Cell Organelles -Ultrastructure and functions of Endoplasmic reticulum, Golgi body, Nucleus & Nucleolus. DNA structure and function - DNA Replication - Chromatin – Nucleosome. Chromosomes: – Structure, types, Giant chromosomes. Regulation of gene expression in Prokaryotes.

**Unit III** Ultrastructure and functions of Lysosomes, centrosomes, Mitochondria - Krebs cycle. Cell cycle – Mitosis & Meiosis .Biology of cancer - Biology of aging - Apoptosis- definition, mechanism and significance.

**Unit – IV Control of gene expression- Lac operon (Operon hypothesis:**

regulator gene, promoter gene, operator gene, structural gene, repressor gene, compressor gene and inducer gene) Stem cells-Embryonic and adult stem cells

**Unit V** Types (mRNA, rRNA and tRNA) and role of RNAs - structure of tRNA only- Ultra structure, function and types of ribosome. Genetic code - Protein synthesis –Post translational modifications.

**Books for Study:**

1. Arumugam.N., *Cell Biology*, Saras Publication, 2009 .
2. Arumugam.N., *Cell and Molecular biology*, Saras Publication, 2009.

**Books for Reference:**

- 1.Swanson C.P.*The Cell*, 8<sup>th</sup> Edn., Prentice Hall of India Pvt. Ltd. New Delhi.1990
- 2.Verma P.S. & Agarwal V.K. *Cytology*. S.Chand & Co, New Delhi.1991
- 3.De Robertis E.D.P. & De Robertis E.M.F. *Cell and Molecular Biology*, 8<sup>th</sup> Edition, BI Waverly Pvt. Ltd., New Delhi.1995
- 4.Cooper, G.M. and Hausman, R.E. *The Cell: A Molecular Approach*. 5th Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 2009
- 5.Gerald Karp . *Cell and Molecular Biology: Concepts and Experiments*, 7<sup>th</sup> Edition Binder Ready Version, Wiley.2013

**Web Resources / E.Books:**

1. <https://www.youtube.com/watch?v=VU8xIQXLoms>
2. [https://www.youtube.com/watch?v=VpINHa\\_9RII](https://www.youtube.com/watch?v=VpINHa_9RII)
- 3.[https://www.google.com/search?q=%22//efaidnbmnnnibpcajpcglclefindmkaj/%22+https://www.ou.ac.in/sites/default/files/slm/BSCZO-102.&sa=X&ved=2ahUKEwjif2N8ZT\\_AhWZ8jgGHfdLDA0Q5t4CegQIExAB](https://www.google.com/search?q=%22//efaidnbmnnnibpcajpcglclefindmkaj/%22+https://www.ou.ac.in/sites/default/files/slm/BSCZO-102.&sa=X&ved=2ahUKEwjif2N8ZT_AhWZ8jgGHfdLDA0Q5t4CegQIExAB)
- 4.[https://bio.libretexts.org/Bookshelves/Cell\\_and\\_Molecular\\_Biology/Book%3ABasic\\_Cell\\_and\\_Molecular\\_Biology\\_\(Bergtrom\)](https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology/Book%3ABasic_Cell_and_Molecular_Biology_(Bergtrom))

**Pedagogy:**

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

**Rationale for nature of Course:**

**Knowledge and Skill:** To make students aware of the basic idea of prokaryotic and eukaryotic cell, concept of cell cycle, cell death, senescence. Introduction to cancer biology, concept of Protein synthesis mechanism, regulation of gene, protein and Operon hypothesis.

**Activities to be given:** Students shall be asked to do the models of cell organelles and DNA and make documentation as a group activity.

**Course learning Outcomes (CLOs):**

CLO	Course Outcomes Statement	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Understand the basic level of cell organization and Microscopy techniques.	K1 to K3
CLO2	Able to describe the organization, structure and functions of Endoplasmic reticulum, Golgi body, Nucleus, Nucleolus, DNA & Regulation of gene expression.	K1 to K3
CLO3	Able to describe the organization, structure and functions of Lysosomes, centrosomes, Mitochondria, cell cycle and Cancer Biology.	K1 to K4
CLO4	Perceive over all mechanism of stem cells and Operon hypothesis.	K1 to K3
CLO5	Learn about RNAs, Genetic code, Ribosome and protein and its synthesis.	K1 to K4

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

**1-Basic Level****2- Intermediate Level****3- Advanced Level**

**LESSON PLAN: TOTAL HOURS (60Hrs)**

UNIT	DESCRIPTION	Hrs	MODE
I	Introductory Cytology: Cell theory - Prokaryotic and Eukaryotic cells. Cytological techniques: Fixation–Sectioning & Staining. Principle, Resolving power & uses of compound microscope, confocal microscope and electron microscope. Cell Junctions - Ultrastructure and functions of plasma membrane.	9	Chalk and Talk, PPT, quiz, on the spot test
II	Cell Organelles-Ultrastructure and functions of Endoplasmic reticulum , Golgi body, Nucleus & Nucleolus. DNA structure and function - DNA Replication - Chromatin – Nucleosome. Chromosomes: – Structure, types, Giant chromosomes. Regulation of gene expression.	12	Chalk and Talk, OHP quiz, on the spot test
III	Ultrastructure and functions of Lysosomes,centrosomes, Mitochondria - Krebs cycle. Cell cycle – Mitosis & Meiosis .Biology of cancer - Biology of aging - Apoptosis- definition, mechanism and significance.	9	Chalk and Talk, PPT, group discussion , OHP and You tube Links
IV	Control of gene expression- Lac operon(Operon hypothesis: regulator gene, promoter gene, operator gene, structural gene, repressor gene, corepressor gene and inducer gene)Stem cells-Embryonic and adult stem cells	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Types (mRNA , rRNA and tRNA)and role of RNAs - structure of tRNA only- Ultra structure, function and types of ribosome. Genetic code - Protein synthesis –Post translational modifications.	15	Chalk and Talk, PPT, group discussion , OHP presentations, quiz, open book test

**Course Designers: Dr.(Mrs).M.A.Soniya & Mrs.S.Sharmila**

Department of Zoology					Class: I B.Sc			
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
IV	Core	22OUZO41	Developmental Biology	4	4	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓		

## Course Objectives

1. To make an awareness to the students about the theories, concepts and basics of Developmental Biology.
2. To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
3. To make an awareness of the induction, organizers and development of extra embryonic structures.
4. To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing.
5. To give an idea about teratogenesis, invitro fertilization, stem cells and amniocentesis to the students.

## Course content:

**Unit I Gametes & Fertilization:** Basic concepts of developmental biology. Structure & types of Spermatozoa, Mammalian egg - Egg membranes. Patterns of egg - Spermatogenesis & Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.

**Unit II Blastulation & Gastrulation:** Cleavage - Planes & Patterns, Factors controlling cleavage - Fate map & its construction. Blastulation – Morphogenetic movements - Gastrulation of frog & chick.

**Unit III Organogenesis :** Development of Brain, Eye and Heart in frog. Development of Nervous system in chick & Foetal membranes in chick. Placentation in mammals. Development of Pronephric, Mesonephric & Metanephric kidneys.

**Unit 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 – IVF & ICSI

**Unit V Embryological Techniques:** Oestrous, Menstrual cycle and menopause - Pregnancy – trimesters – development. Erythroblastosis foetalis -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.

**Books for Study:**

- 1.Arumugam.N, *Developmental Biology* , Saras Publication 2010.
- 2.Verma P.S. & Agarwal,V.K., *Chordate Embryology* , S.Chand & Co. Ramnagar New Delhi.2000.

**Books for Reference:**

1. Patten, B.M., *Foundations of Embryology*, McGraw Hill, New York. 1958.
2. Balinsky, B.I., *An Introduction to Embryology*, Holt Saunders, New York. 1981.
3. Saunders, J.W. *Developmental Biology – Patterns and Principles*, Macmillan, New York. 1982.
4. Berrill, N.J., *Developmental Biology*, McGraw Hill, New Delhi. 1986.
5. Gilbert SF., *Developmental Biology*, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA. 2010

**Web Resources/ E.Books:**

1. <https://www.youtube.com/watch?v=TDBk2zoSAq8>
2. <https://www.youtube.com/watch?v=OaebupPaUbc>
3. <http://efaidnbmnnnibpcajpcgicfindmkaj/http://bgc.ac.in/pdf/study-material/developmental-biology-7th-ed-sf-gilbert.pdf>

**Pedagogy:**

Chalk and Talk, PPT, group discussion , OHP presentations, quiz, on the spot test and Virtual Labs. Charts, e-journals, Different channels of TV – Animal planet, Discovery, National Geographic.

**Rationale for nature of Course:**

**Knowledge and Skill :**Students will be able to obtain knowledge of the process by which organs grow and develop, cell growth, differentiation and morphogenesis, regeneration and ageing.

**Activities to be given:** Observation of Chick Embryos - 24hrs , 48hrs, 72hrs and 96hrs(Virtual labs)

**Course learning Outcomes (CLOs):**

<b>CLO</b>	<b>Course Outcome Statements</b>	<b>Knowledge According to Bloom's Taxonomy (Upto K level)</b>
CLO1	Elaborate the basic concepts of developmental biology	K1 to K3
CLO2	Acquire the knowledge on Blastulation, Gastrulation & Cleavage	K1 to K3
CLO3	Explain Organogenesis in Frog and chick	K1 to K3
CLO4	Understand about Applied Embryology	K1 to K3
CLO5	Explain the Embryological Techniques	K1 to K4

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CLO1</b>	3	1	1	2	3	2
<b>CLO2</b>	3	1	1	1	3	2
<b>CLO3</b>	3	1	1	1	3	2
<b>CLO4</b>	3	1	2	3	3	2
<b>CLO5</b>	3	2	1	2	2	3

**1-Basic Level**

**2- Intermediate Level**

**3- Advanced Level**

**LESSON PLAN : TOTAL HOURS(60Hrs)**

UNIT	DESCRIPTION	Hrs	MODE
I	<b>Gametes &amp; Fertilization</b> :Basic concepts of developmental biology. Structure& types of Spermatozoa, Mammalian egg - Egg membranes. Patterns of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.	12	Chalk and Talk, PPT, group discussion , OHP presentations, quiz, on the spot test and Virtual Labs.
II	<b>Blastulation&amp; Gastrulation</b> : Cleavage - Planes & Patterns, Factors controlling cleavage - Fate map& its construction. Blastulation – Morphogenetic movements - Gastrulation of frog & chick.	10	Chalk and Talk, PPT, group discussion , OHP presentations, quiz, on the spot test and Virtual Labs.
III	<b>Organogenesis</b> :Development of Brain, Eye and Heart in frog. Development of Nervous system in chick & Foetal membranes in chick. Placentation in mammals. Development of Pronephric, Mesonephric & Metanephric kidneys.	13	Chalk and Talk, PPT, group discussion , OHP presentations, quiz, on the spot test and Virtual Labs
IV	<b>Applied Embryology</b> :Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Embryonic stem cells & significance. Methods to culture embryo.	13	Chalk and Talk, PPT, group discussion , OHP presentations, quiz, on the spot test and Virtual Labs
V	<b>Embryological Techniques</b> : Oestrous, Menstrual cycle and menopause - Pregnancy – trimesters – development. Erythroblastosis foetalis -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentosis.	12	Chalk and Talk, PPT, group discussion , OHP presentations, quiz, on the spot test and Virtual Labs

**Course Designers : Dr.(Mrs).M.A.Soniya & Mrs.S.Sharmila**

Department of Zoology			Class :IB.Sc					
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
III & IV	Core Lab	22OUZO4P	Core Lab in Cell & Molecular Biology and Developmental Biology	2	2	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

### Cell Biology

1. Microscopy-Cell Observation methods and uses of microscope
2. Observation of different stages of Mitosis in Onion Root tip.
3. Blood Cell count (Demo Only)
  - a) Total count RBC and WBC-Human
  - b) Differential count-Erythrocytes and Leucocytes.

### Molecular Biology

1. Mounting of bar bodies - buccal cavity
2. Isolation of genomic DNA from bacteria/liver tissue (Goat or Chick)-Demo Only

### Developmental Biology

1. Structure of Egg and Sperm
2. Observation of 48hrs and 72hrs Chick Embryo (Demo only)

### Spotters: Slides, Museum Specimens, Models and Charts.

- DNA and RNA
- Mitochondria
- Golgi complex
- Ribosomes
- Lysosomes
- Nucleus

- Blastula and Gastrula of Frog
- Teratology-Abnormal embryos.

Visit to Research Labs- A Report

**Books for References:**

- 1.Laura R.Keller,John Hyde Evans,ThomasC.S.Keller.,*Experimental Developmental Biology:A Laboratory Manual*,Academic Press,Biology.1999
- 2.Rocky S.Tuan,Cecilia W.Lo,*Developmental Biology Protocols:Volume II*,Springer Science &Business Media.2008

**Web Resources:**

1. <https://www.youtube.com/watch?v=5-ur7bWqlDQ>
2. <https://www.youtube.com/watch?v=hLt884HV8bE>
3. <https://www.youtube.com/watch?v=dM3ZNciixuU>

**Pedagogy**

PPT, Group Discussion , Interaction, Quiz, Tutorial And Virtual Labs.

**LESSON PLAN for practical ( Total hours : 60)**

<b>Cycle</b>	<b>Description</b>	<b>Staff Name Hrs</b>	<b>Mode</b>
<b>Cell Biology</b>			
<b>1</b>	Microscopy-Cell Observation methods and uses of microscope	4	Mounting for Microscopic observation
<b>2</b>	Observation of different stages of Mitosis in Onion Root tip.	4	Mounting for Microscopic observation
<b>3</b>	a)Total count of RBC and WBC-Human	4	Demo only
<b>4</b>	b)Differential count-Erythrocytes & Leucocytes	4	Demo only
<b>Molecular Biology</b>			
<b>5</b>	Mounting of bar bodies - buccal cavity	4	Mounting for Microscopic observation
<b>6</b>	Isolation of genomic DNA from bacteria/liver tissue(Goat or Chick)	4	Virtual lab
<b>Developmental Biology</b>			
<b>7</b>	Structure of Egg and Sperm	4	Observation of Slides
<b>8</b>	Observation of 48hrs and 72hrs Chick Embryo	4	Demo only
<b>Spotters</b>			
<b>9</b>	DNA and RNA	3+3	Observation of slides
<b>10</b>	Mitochondria & Golgi complex	3+3	Observation of Slides, Specimen
<b>11</b>	Ribosomes ,Lysosomes & Nucleus	3+3	Observation of Specimens, Images
<b>12</b>	Blastula and Gastrula of Frog	3+3	Observation of Specimens, Images
<b>13</b>	Teratology-Abnormal embryos	2	Observation of Specimens, Images
<b>14</b>	Internal Practical Test - I	2	

**Course Designer: Dr.(Mrs)M.A.Soniya**