

महाराजा सूरजमल बृज विश्वविद्यालय  
भरतपुर (राज.)

Syllabus  
B.Sc.Part-i,ii,iii

ZOOLOGY

Scheme:

Max Mark: 100

Min. Pass Marks: 36

Paper - I	3 Hrs duration	33 Marks
Paper - II	3 Hrs duration	33 Marks
Paper - III	3 Hrs duration	34 Marks
Practicals	4 Hrs duration	50 Marks

NOTE:

1. There will be two parts of every theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9(Paper I & II) or

Only For Session  
2020-21

अकादमिक प्रभारी  
महाराजा सूरजमल बृज विश्वविद्यालय  
भरतपुर (राज.)



10 (Paper III) very short answer (Maximum 25 Marks) type questions, each of 1 mark. This part is compulsory to attempt. Question should be evenly distributed covering the entire syllabus.

Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q No. 2 to 10) in this part i.e. three from each unit / section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.

2. The candidate has to answer all questions in the main answer book only.

### **PAPER - I: Z-101**

### **DIVERSITY OF ANIMAL AND EVOLUTION**

#### **NOTE:**

1. There will be two parts of every theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 (Paper I & II) or 10 (Paper III) very short answer (Maximum 25 Marks) type questions, each of 1 mark. This part is compulsory to attempt. Question should be evenly distributed covering the entire syllabus. Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q No. 2 to 10) in this part i.e. three from each unit / section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

#### **Section - A**

#### **Diversity of Animals**

1. Adaptation of animal and their modes of life and the environment.
2. Reason of depletion of biodiversity and conservative measures of biodiversity wherever required.
3. Continental drift.

#### **Section - B**

#### **Biosystematic and Taxonomy**

1. Concept of Protozoa and Metazoa, and levels of organisation.
2. Taxonomy and basis of classification of non-chordata and chordate: symmetry, coelom, segmentation and embryogeny.
3. Detailed classification of non-chordata and Chordata (up to sub orders with examples).

#### **Section - C**

#### **Evolution**

1. History of evolutionary thoughts (Lamarckism and Darwinism).
2. Natural selection, speciation.
3. Variation, isolation and adaptations..
4. Study of extinct forms: Dinosaurs, Archaeopteryx.



**PAPER - II: Z-102**  
**CELL BIOLOGY AND GENETICS**

**NOTE:**

1. There will be two parts of this theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 very short Answer (Maximum 25 Marks) type questions, each of 1 mark. This part is compulsory to attempt. Question should be evenly distributed covering the entire syllabus.  
Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q No. 2 to 10) in this part i.e. three from each unit / section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

**Section - A**

**Cell Biology**

1. Introduction to cell; Morphology, size, shape, characteristics and structure of prokaryotic and eukaryotic animal cell; basis idea of virus and cell theory.
2. Cell membrane; Characteristics of cell membrane molecules, fluid-mosaic model of Singer and Nicholson, concept of unit membrane.
3. Cytoplasmic organelles:
  - (i) Structure and biogenesis of mitochondria; electron transport chain and generation of ATP molecules.
  - (ii) Structure and function of endoplasmic reticulum, ribosome (prokaryotic and eukaryotic) and Golgi complex.
  - (iii) Structure and function of lysosome, microbodies and centrioles.
  - (iv) Structure and function of cilia, flagella, microvilli and cytoskeletal elements.

**Section - B**

1. **Nuclear Organization:**
  - (i) Structure and function of Nuclear envelope, nuclear matrix and nucleolus.
  - (ii) Chromosomes; Morphology, chromonema, chromomeres, telomeres, primary and secondary constrictions, chromatids, prokaryotic chromosome.
  - (iii) Giant chromosome types; Poletene and Lamp brush.
  - (iv) Chromosomal organisation; Euchromatin, heterochromatin and folded fiber model and nucleosome concept.
2. **Nucleic Acids:**
  - (i) DNA structure, polymorphism (A, B and Z types) and replication (semi conservative mechanism) experiments of Messelson and Stahl; elementary idea about polymerases, topoisomerases, single strand binding proteins, replicating forks (both unidirectional bidirectional), leading and lagging strands, RNA primers and Okazaki fragments, elementary idea about DNA repair.
  - (ii) RNA structure and types (mRNA, rRNA and tRNA and transcription).



### 3. Cell in reproduction

- (i) Interphase nucleus and cell cycle: S, G-1, G-2 and M phase.
- (ii) Mitosis: Different stages, structure and function of spindle apparatus; anaphasic movement.
- (iii) Meiosis: Different stages, synapses and synaptonemal complex, formation of chiasmata and significance of crossing over.

### Section - C

#### Genetics

1. Mendelism: Brief history of genetics and Mendel's work; Mendelian laws, their significance and current status chromosomal theory of inheritance. Linkage and crossing over, elementary idea of chromosome mapping.
2. Multiple genes inheritance, ABO blood groups and Rh factor and their significance.
3. Cytoplasmic inheritance.
4. Sex determination in Drosophila and man, pedigree analysis.
5. Genetic disorders; Down's Turner's and Klinefelter's syndromes, color blindness, Hemophilia, Phenylketonuria.

### PAPER - III: Z-103

### GAMETE AND DEVELOPMENTAL BIOLOGY

#### NOTE:

1. There will be two parts of this theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 very short Answer (Maximum 25 Marks) type questions, each of 1 mark. This part is compulsory to attempt. Question should be evenly distributed covering the entire syllabus. Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q No. 2 to 10) in this part i.e. three from each unit / section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

### Section - A

#### Developmental Biology: Scope and Early Events

1. Gametogenesis:
  - (i) Formation of ova and sperm.
  - (ii) Vitellogenesis.
2. Fertilisation: Activation of ovum, essence of activation: Changes in the organization of the egg cytoplasm.
3. Parthenogenesis.

### Section - B

#### Developmental Biology Pattern and Processes

1. Cleavage: Definition, planes and patterns of cleavage among non chordates and chordates, significance of cleavage, blastulation and morulation.
2. Fate maps, morphogenetic cell movements, significance of gastrulation.
3. Embryonic induction, primary organizer, Differentiation and competence.

Only For Session  
2020-21

अकादमिक प्रभारी  
अभारजा सुरजमल बूज विश्वविद्यालय  
भरतपुर (राज.)



4. Embryonic adaptations:
  - (i) Placentation in Mammals: Definition, types, classification on the basis of morphology and histology, functions of placenta.
  - (ii) Paedogenesis and neoteny.

### Section - C

#### Dimensions in Developmental Biology

1. Regeneration.
2. Various type of stem cells and their applications.
3. Cloning of animals.
  - (i) Nuclear transfer technique.
  - (ii) Embryo transfer technique.
4. Biology of aging.

### Zoology Practical

**Min. Marks: 18**

**4 Hrs. / Week**

**Max. Marks:50**

#### I. Microscopic Techniques:

1. Organisation and working of Optical Microscope, Dissecting and Compound microscopes.
2. General methods of microscopic slide preparations; narcotization; fixing and preservation; washing; staining; destaining; dehydration; clearing and mounting; General idea of composition, preparation and use of:
  - (i) Fixatives: Formalin, Bouin's fluid.
  - (ii) Stains: Aceto-carmin, Aceto-orcin, Haematoxylin-Eosin, Giemsa.
  - (iii) Common reagents: Normal saline, Acid water, Acid alcohol and Mayer's albumin.
3. Collection and Culture Methods:
  - (i) Collection of Animals from their natural habitat during field trips such as Amoeba, Paramecium, Euglena, Planaria, Daphnia, Cyclops, etc.
  - (ii) Culture of Paramecium in the laboratory and study of its structure life - process and behavior in live state.
  - (iv) Vermicomposting (Theory and Practice).

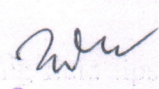
#### II. Study of Microscopic Slides and Museum Specimens:

**Protozoa:** *Amoeba*, *Euglena*, *Trypanosoma*, *Giardia*, *Entamoeba*, *Elphidium* (Polystomella). Foraminiferous shells, Monocystis, Plasmodium, Paramecium, Paramecium showing binary fission and conjugation, *Opalina*, *Nyctotherus*, *Balantidium*, *Vorticella*.

**Porifera:** *Leucosolenia*, *Euplectella*, *Spongilla*, T.S. Sycon, Spicules. Spongin fibers, Gemmules.

**Coelenterata:** *Millepora*, *Physalia*, *Velella*, *Aurelia*, *Alcyonium*, *Gorgonia*, *Pennatula*, Sea anemone, Stone corals, Obelia colony and medusa.

**Only For Session  
2020-21**

  
 अकादमिक प्रभारी  
 महाराजा सुरजमल बूज विश्वविद्यालय  
 भरतपुर (राज.)



**Ctenophora:** Any Ctenophore.

**Platyhelminthes:** *Taenia*, *Planaria*, *Fasciola*, (W.M.) T.S. body of *Fasciola* through various regions. Miracidium, Sporocyst, Redia, Cercaria and Metacercaria Larvae of *Fasciola*, Scolex, T.S. mature proglottid of *Taenia*. Cysticercus larva.

**Aschelminthes:** *Ascaris*, *Wuchereria*, *Dracunculus*.

**III. Biodiversity:** Appliances used in Biodiversity study.

Nature trails, water sieving.

Discovery hunt in college campus/university campus/Forest reserves/sanctuaries/National Park.

Biodiversity survey:

Insect count on vegetation; Bird counts with general information on survey methods.

Preparation of fact sheet of common wild life found in your campus /area.

**IV. Fields visits/Excursion to wild life areas.**

( i A candidate is expected to submit a written report of the visit. ii No protected animal be harmed in any way).

**V. Study of the following Through Permanent Slide Preparation:** Paramecium Euglena, Foraminiferous shells, Sponge spicules. Spongin fibres, Gemmule, Hydra, Obelia colony, and Medusa; Parapodium of Neries and Heteronereis, Cyclops, Daphnia.

**VI. Exercise in Cell Biology:**

1. Squash preparation for the study of mitosis in onion root tip.
2. Squash preparation for the study of meiosis in grasshopper or cockroach testis.
3. Study of giant chromosomes in salivary glands of chironomous or Drosophila larva.
4. Study of cell permeability using mammalian R.B.C.
5. Permanent slides of mitosis and meiosis (all stages).

**VII Exercise in Genetics:**

**A Study of Drosophila:**

1. Life cycle and an idea about its culture.
2. Identification of male and female.
3. Identification of wild and mutants (yellow body, ebony, vestigial wing and white eye).
4. Study of permanent prepared slides: Sex comb and salivary gland chromosomes.

**VIII. Developmental Biology:**

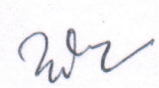
**1. Study of development of frog/toad with the help of Chart/Slides/Models:**

- (i) Eggs, cleavage, blastula, gastrula, neurula, tail-bud, hatching, mature tadpole larvae, metamorphic stages, toadlet/ froglet.
- (ii) Histological slides: Cleavage, blastula, gastrula, neurula and tail-bud stage.

**2. Study of development of chick with the help of whole mounts/Charts/Slides/Models.**

- (i) 18 hrs. 21 hrs, 24 hrs, 33 hrs, 48 hrs, 72 hrs and 96 hrs of incubation.

**Only For Session  
2020-21**

  
**अकादमिक प्रभारी**  
महाराजा सुरजमल बृज विश्वविद्यालय  
भरतपुर (राज.)



- (ii) Primitive streak stage in living embryo, if possible, after removal of the blastoderm from the egg.
- (iii) Study of the embryo at various stages of incubation in vivo by making a window in the egg-shell.
- (iv) Study of various foetal membranes in a 10-12 day old chick embryo.

### Scheme of Practical Examination and Distribution of Marks

**Time: 4 Hrs.**

**Min Pass Marks: 18**

**Max. Marks : 50**

		Regular	Ex. /N.C. Student
1.	Study of Biodiversity	06	4
2.	Permanent Preparation	04	7
3.	Cell Biology and Genetics	4+4	6+6
4.	Developmental Biology	6	6
5.	Identification and Comments on Spots (1 to 8)	16	16
6.	Viva Voce	5	5
7.	Class Record	5	-
		50	50

#### Notes:

1. With reference to study of museum specimens and developmental Biology, candidate must be well versed in the study of various systems with the help of chart/models/CD-ROMs, multimedia computer based simulations including computer assisted learning (CAL) and other softwares.
2. With reference to permanent preparations and microscopic slides, in case of non-availability, the exercise should be substituted with diagrams, photographs, models, charts etc.
3. Candidates must keep a records of all work done in the practical class and submit the same for the inspection of the time of the practical examination.
4. The candidates may be asked to write detailed methodology wherever necessary and separate marks may be allocated for the same.

**Only For Session  
2020-21**

**अकादमिक प्रभारी**  
महाराजा जूरजमल बूज विश्वविद्यालय  
भरतपुर (राज.)



5. Mounting material for permanent preparation would be as per the syllabus or as available through collection and culture methods.
6. It should be ensure that animal used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.

#### Recommended Books;

1. Balinsky B. I. and Fabain BC Intoduction to Embryology. CENGAGE Learning 2012.
2. Barrington EJW: The Biology of Hemichordata and Protpchordata. Oliver & Boyd. London 1965.
3. Berril N J: Development Biology. Tata McGraw Hill 1971.
4. Colbert EH: Evolution of the Vertebrates 2<sup>nd</sup> edition John Wiley & Sons, New York 1969.
5. Colbert EH. Morales M. Minkoff EC. Colberts Evolution of the Vertebrates: A History of the Backboned Animal Through Time 5<sup>th</sup> edition Wiley Liss 2001.
6. Costanzo LS: Physiology. 4<sup>th</sup> edition Saunders Inc 2009.
7. Davenport R: An outline of Animal Development Addison-Wesley Longman Inc 1979.
8. De Robertis EDP and De Robertic Jr EMF. Cell and Molecular Biology. 8<sup>th</sup> edition Lippincor Williams & Wilkins 2006.
9. Gasque: CD Manual of Laboratory, Experience Cell Biology Mc Graw-Hill Professional publishing 1989.
10. Gilbert SF and Singer SR: Development Biology, Sinauer Associates; 9<sup>th</sup> addition 2010.
11. Lodish H, berk A, Kaiser CA, Krieger M, Bertscher A, Ploegh H, Amon A, scott M P: Molecular Cell Biology 6<sup>th</sup> edition W.H. Freeman and Company, New Yark, 2008.
12. Lodish H, Berk A. Keiser CA, Kriser M, Bertscher
13. Lodish H, Berk A. Matsudaira, P, Kaiser CA, Krieger M, scott MP, Zipursky SL, Darnell J: Molecular Cell Biology . 5<sup>th</sup> addition W.H. freeman and Company. New York 2004.
14. Lodish H, Berk A, Zipursky SL, Matsudaira P, Baltimore D., Darnell J: Molecular Cell Biology 4<sup>th</sup> addition W.H. freeman and Company. New York 2000.
15. Morgan DD The Cell Cycle: Principal of Control, Sinauer/Panima Books 2007.
16. Petsko GA and Ringe D: Protein structure and function Sinauer/Panima Books 2004.
17. Rao KV Development Biology: A Modern synthesis. Oxford and IBH publishing 1994.
18. Rastogi VB Animal Distribution, Evolution and development Biology. Kedar Nath Ram Nath Educational Publisher.
19. Rastogi VB Evolutionary Biology Kedar Nath Ram Nath Educational Publisher.
20. Singh SP and Tomar BS: Cell Biology 10<sup>th</sup> edition Rastogi , Publication Meerut New Delhi. 1971
21. Snustad DP and Simmons MJ. Principle of genetics 4<sup>th</sup> edition John Wile & Sons Inc. 2005.
22. Verma PS. A manual of Practical Zoology: invertebrates. S. Chand & Co Ltd New Delhi 1971.
23. Verma PS & Agrawal VK: Chordate Embryology: Development Biology. S. Chand & Com Ltd 2012.
24. Verma PS & Agrawal VK: Cell Biology, Genetic Molecular Biology. Evolution and Ecology. 14<sup>th</sup> addition S. Chand 2004.
25. Winchester AM: An introduction to genetics Barners & Noble. Canada, 2002.

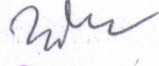
**Only For Session  
2020-21**

अकादमिक प्रभारी  
बहाराजा सुरजमल बृज विश्वविद्यालय  
भरतपुर (राज.)



26. Winchester AM: Genetics: A survey of principal of Heredity Oxford & IBH Publishing Co. 1967.
27. Winchester AM: Human Genetics: Ohio Charles E. Merrill Publishing Co. 1971.
28. Trigunayat, M.M & Kritika Trigunayat, A manual of practical Zoology, Part-I Scientific Publishers, Jodhpur.
29. एम.एम. त्रिगुणायत व कृतिका त्रिगुणायत, प्रायोगिक मैनुअल भाग-1 साइंटिफिक पब्लिशर्स जोधपुर (राज.)

**Only For Session  
2020-21**

  
**अकादमिक प्रभारी**  
महाराजा सूरजमल बृज विश्वविद्यालय  
भरतपुर (राज.)