SYLLABUS
B.Sc. (Zoology) Part-I
Session: 2014-15, 2015-16 & 2016-17

	Lectures to be delivered		MARKS		
	Theory	Practical	Theory	Internal	Practical
Semester-I:					
Cell Biology and Biodiversity	90	60	50	20	30
Semester-II:					
Biodiversity and Ecology	90	60	50	20	30

Note: There will be one Practical paper of 3 hours pertaining to entire syllabus in each semester.

Time: 9.00 a.m. - 12.00 noon

SEMESTER-I

CELL BIOLOGY AND BIODIVERSITY

Max. Marks: 50 ***Time Allowed: 3 hours***
Pass marks: 35% ***Lectures to be delivered: 90***
(Each of 45 minutes duration)

Note: The number of lectures per week will be nine for theory and six for practical.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 7½ marks each. Section C will consist of 10 short-answer type questions which will cover the entire syllabus uniformly and will carry 20 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

SECTION-A

CELL BIOLOGY

I. Methods in Cell Biology	:	Principles of light and electron microscopes, fixation and fixatives, staining techniques (single and double).
II. Organisation of Cell	:	Extra nuclear and nuclear ultra structure and functions of cell organelles.
(a) Plasma membrane	:	Structure, osmosis, active and passive transport, endocytosis and exocytosis.
(b) Endoplasmic reticulum	:	Structure, types and associated enzymes.
(c) Mitochondria	:	Structure, mitochondrial enzymes and the role of mitochondria in respiration.
(d) Golgi Complex	:	Structure and functions.
(e) Ribosomes	:	Types of ribosomes, their structure and functions.
(f) Lysosomes	:	Polymorphism and their function.
(g) Centrosome	:	Structure and functions.
(h) Nucleus	:	Structure and functions of nuclear membrane, nucleolus and chromosomes.

III. Type Study-I (Protozoa to Porifera)

1. Protozoa:

a. Classification upto orders with brief ecological note and economic importance of the following:
Entamoeba, Trypanosoma, Giardia, Noctiluca, Eimeria, Opalina, Vorticella, Balantidium and *Nyctotherus.*

b. Detailed study of the following animal types:
Amoeba, *Paramecium and Plasmodium.* Introduction to Parasitic Protozoa

2. Porifera :

a. Classification upto orders with brief ecological note and economic importance of the following:
Grantia, Euplectella, Hyalonema and *Spongilla.*

b. Detailed study of the following animal types:
Sycon

SECTION: B

IV. Type Study-II (Coelenterata to Annelida)

1. Coelenterata:

a. Classification upto orders with brief ecological note and economic importance of the following:
Hydra, Sertularia, Plumularia, Obelia, Tubularia, Bougainvillea, Porpita, Velella, Physalia, Rhizostoma, Millipora, Aurelia, Alcyonium, Tubipora, Zoanthus, Metridium, Madrepora, Favia, Fungia and *Astrangia*

b. Detailed study of the following animal types:
Obelia

2. Platyhelminthes:

a. Classification upto orders with brief ecological note and economic importance of the following:
Dugesia, Schistosoma and *Echinococcus.*

b. Detailed study of the following animal types:
Fasciola, Taenia

3. Aschelminthes:

a. Classification upto orders with brief ecological note and economic importance of the following:
Ascaris, Oxyuris and *Wuchereria*

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b. Detailed study of the following animal types:
Ascaris, Parasitic adaptations in Helminths

4. Annelida:

a. Classification upto orders with brief ecological note and economic importance of the following:
Nereis, Polynoe, Eunice, Arenicola, Aphrodite, Amphitrite, Chaetopterus, Tubifex and *Pontobdella.*

b. Detailed study of the following animal types:
Pheretima (Earthworm)

PRACTICAL PAPER

Max. Marks: 30 *Time Allowed : 3 hours*
Pass marks : 35%

1. Classification upto orders with ecological notes and economic importance of the following:

A. Protozoa: (a) Examination of cultures of *Euglena* and *Paramecium.*

(b) Slides: *Amoeba, Euglena, Trypansoma, Noctiluca, Eimeria, Monocystis, Paramecium (*Binary fission and conjugation), *Opalina, Vorticella, Balantidium, Nyctotherus* & *Polystomella.*

B. Porifera: Specimens: *Sycon, Grantia, Euplectella, Hyalonema, Spongilla* and *Euspongia.*

C. Coelenterata: (a) Specimens: *Porpita, Velella, Physalia, Aurelia, Rhizostoma, Metridium, Millipora, Alcyonium, Tubipora, Zoanthus, Madrepora, Favia, Fungia* and *Astrangia.*

(b) Slides: *Hydra (*W.M.), *Hydra* with buds, *Obelia (*colony and medusa), *Sertularia, Plumularia, Tubularia, Bougainvillea* and *Aurelia.*

D. Platyhelminthes: (a) Specimens: Dugesia, Fasciola*, Taenia* and *Echinococcus.*

(b) Slides: Miracidium, Sporocyst, Redia, Cercaria of *Fasciola,* Scolex and Proglottids of *Taenia (*mature and gravid)

E. Aschelminthes : *Ascaris (*male and female*), Trichinella* and *Ancylostoma.*

F. Annelida : Specimens: *Pheretima, Nereis, Heteronereis, Polynoe, Eunice, Aphrodite, Chaetopterus, Arenicola, Tubifex* and *Pontobdella.*

2. Study of the following permanent stained preparations:

A. L.S. and T.S. *Sycon,* Gemmules, Spicules and Spongin fibres of a sponge.
B. T.S. *Hydra* (Testis and ovary region)
C. T.S. *Fasciola* (Different regions)
D. T.S. *Ascaris* (Male and Female)
E. T.S. *Pheretima* (Pharyngeal and typhlosolar regions), setae, septal nephridia, spermathecae and ovary

3. Preparation of the following slides:

Preparation of permanent whole mount stained in borax carmine : *Hydra, Obelia, Sertularia, Plumularia* and *Bougainvillea.*

4. Major dissection: *Pheretima* (Earthworm) : Digestive, reproductive and nervous systems.

5. Cell Biology:

Study of permanent slides of Mitosis and Meiosis

INSTRUCTIONS FOR PRACTICAL PAPER

1. Candidates will be required to submit their original note-books containing record of their laboratory work initiated with date by their teachers at the time of practical examination.
2. Students must be taken out for short excursion to the Zoological gardens, sea shores and hill stations to study habitat and ecology of the animals.
3. Practical examination shall be held in one session from 9.00 a.m. to 12.00 noon.
4. Practical examination is to be conducted by two external examiners.

Max. Marks: 30 *Time Allowed: 3 hours*
Pass Marks: 35%

1.	Museum specimens: Protozoa to Annelida. 3 specimens for identification, classification and short morphological note.	9
2.	Study of the permanent slides from Protozoa to Annelida. 3 slides for identification with emphasis on identification characters.	6
3.	Preparation of the stained permanent slide.	4
4.	Study the permanent mount of any stage of cell division	2
5.	Major dissection	5
5.	Viva-voce	2
6.	Practical note-book	2

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SEMESTER-II
BIODIVERSITY AND ECOLOGY

Max. Marks: 50 ***Time allowed : 3 hours***
Pass Marks: 35% ***Lectures to be delivered : 90***
(Each of 45 minutes duration)

Note: The number of lectures per week will be nine for theory and six for practicals.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 7½ marks each. Section C will consist of 10 short-answer type questions which will cover the entire syllabus uniformly and will carry 20 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

SECTION-A

I. Type Study (Arthropoda to Hemichordata):

1. Arthropoda:

a. Classification upto orders with ecological notes and economic importance (if any) of the following:

*Peripatus, Prawn, Lobster, Cancer (*Crab*) Sacculina, Eupagurus (*Hermit crab), *Lepas, Balanus, Apis, Lepisma (*Silver fish), *Schistocerca (*Locust), *Poecilocerus* (AK Grasshopper), *Gryllus* (Cricket), *Mantis (*Praying Mantis), *Cicada, Forficula (*Earwig), Dragon fly, termite queen, bug, moth, beetle, *Polistes, (*Wasp), *Bombyx (*Silk moth), Millipede, *Scolopendra (*Centipede), *Palamnaeus (*Scorpion), *Aranea (*Spider) and *Limulus (King crab).*

b. Detailed study of the following animal types:
Periplaneta (cockroach), Prawn and Social organizations in insects (honey bee and termite)

2. Mollusca:

a. Classification upto orders with ecological notes and economic importance (if any) of the following:
Chiton, Anodonta, Mytilus, Ostrea, Cardium, Pholas, Solen (Razor fish), Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus shell and *Dentalium.*

b. Detailed study of the following animal types:
Pila

3. Echinodermata:

a. Classification upto orders with ecological notes and economic importance (if any) of the following:
Echinus, Cucumaria, Ophiothrix and *Antedon.*

b. Detailed study of the following animal types:
*Asterias (*Starfish) and Echinoderm larvae

4. Hemichordata

a. Classification upto orders with ecological notes and economic importance (if any) of the following:
Balanoglossus

b. Detailed study of the following animal types:
Balanoglossus : External characters and affinities.

SECTION-B

II. Ecology

1. Ecology	:	Subdivisions and scope of ecology.
2. Ecosystem	:	Components, ecological energetics, food web, introduction to major ecosystems of the world.
3. Ecological factors	:	Temperature, light and soil as ecological factors.
4. Nutrients	:	Biogeochemical cycles and concept of limiting factors.
5. Ecological adaptations	:	Morphological, physiological and behavioural adaptations in animals in different habitats.

III. Environmental Studies:

I. Environmental education	:	Importance of Biodiversity.
II. Population	:	Characteristics and regulation of population.
III. Inter and Intra specific	:	Competition, predation, parasitism, relationships commensalisms & mutualism.
IV. Natural resources	:	Renewable and non-renewable natural resources and their conservations.
V. Environmental degradation:		Causes, impact and control of air, soil, water and noise pollution (in general).

PRACTICAL

Max. Marks: 30 *Time Allowed: 3 hours*
Pass Marks: 35%

1. Classification upto orders with morphological notes of the following animals :

A. Arthropoda : *Peripatus, Palaemon* (Prawn), *Lobster,* Cancer (Crab), *Sacculina, Eupagurus (*Hermit crab), *Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (*Cockroach), *Schistocerca* (Locust), *Poecilocerus* (Ak grasshopper), *Gryllus,* (Cricket), *Mantis* (Praying mantis), *Cicada, Forficula* (Earwig), Dragonfly, termite queen, bug, moth, beetle, *Polistes* (Wasp), *Apis* (Honey bee), *Bombyx, Pediculus* (Body louse), Millipede and Centipede, *Palamnaeus* (Scorpion*), Aranea* (Spider), and *Limulus* (King crab).

B. Mollusca : *Anodonta, Mytilus, Ostrea, Cardium, Pholas, Solen* (Razor fish), *Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus* shell (Complete and T.S.), *Chiton* and *Dentalium.*

C. Echinodermata: *Asterias, Echinus, Ophiothrix* and *Antedon.*

D. Hemichordata: *Balanoglossus.*

2. Dissections of the following animals:

I. Major dissections:

A. *Periplaneta* (Cockroach)	:	Digestive and nervous systems.
B. Pila	:	Pallial complex, digestive and nervous systems.

II. Minor dissections:

Mouth parts and trachea of cockroach, radula of *Pila,* appendages of Prawn

3. ECOLOGY:

A. Study of animal adaptations with the help of specimens, charts and models.
B. Study of biotic components of an ecosystem.
C. Study of different types of nests in birds.
D. Study and preparation of zoogeographical charts.

INSTRUCTIONS FOR PRACTICAL PAPER

1. Candidates will be required to submit their original note-books containing record of their laboratory work initiated with date by their teachers at the time of practical examination.
2. Students must be taken out for short excursion to the Zoological gardens, sea shores and hill stations to study habitat and ecology of the animals.
3. Practical examination shall be held in one session from 9.00 a.m. to 12.00 noon.
4. Practical examination is to be conducted by two external examiners.

Max. Marks: 30 *Time Allowed: 3 hours*
Pass Marks: 35%

1.	Museum Specimens from Phylum Arthropoda, Mollusca, Echinodermata to Hemichordata. 3 specimens to be set for identification, classification and morphological note.	9
2.	Major dissection.	6
3.	Minor dissection	4
4.	One experiment pertaining to Ecology (animal adaptation, next in birds)	2
5.	Excursion note	3
6.	Viva-voce	3
7.	Practical note-book and charts	3

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SUGGESTED READINGS

1. De Robertis, EDP, Dc Robertis, E.M.F., *Cell Biology and Molecular Biology,* Eighth Edition. W.B. Saunders Co., Philadelphia, 1995.
2. Powar, C.B., *Cell Biology,* Himalaya Publishing House, Bombay, 1999.
3. Alberts, B Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D., *Molecular Biology of the Cell,* Gerland Publ. Inc., New York, 1998.
4. Kormondy E. J., *Concepts of Ecology,* Englewood Cliffs, N.J. Prentice Hall Inc., 1975.
5. Kreb C. J., *Ecology,* Harper & Row, New York, 1982.
6. E.P. Odum, *Fundamentals of Ecology,* W.B. Saunders Co., Philadelphia, 1995.
7. Dhami P. S. & Dhami J. K., *Invertebrates,* R. Chand & Co., New Delhi, 2001.
8. Barnes, R.D., *Invertebrates Zoology,* W.B. Saunders Philadelphia, 1999.

SUPPLEMENTARY READINGS

1. E. L. Jordan and others: *Invertebrate Zoology,* 14th ed. Rep. 2002 ISBN: 81-219-0367X.
2. Ashok Sabharwal & S. K. Malhotra: *Modern Zoology,* Vol. I, Modern Publishers.
3. P. S. Verma & V. K. Aggarwal: *Environmental Biology,* 4th ed. Rep. 2003.