

Proceedings of the meeting of the Combined Board of Studies in Zoology held on 26.10.2013 at 11.30 am in the Department of Zoology, C.C.S. University, Meerut.

In reference to the University letter no. Committee Cell (BOS-Zoology)/850 dated 17.10.2013, a meeting of the Combined Board of Studies in subject of Zoology held on 26.10.2013 at 11.30 am in the Department of Zoology, C.C.S. University, Meerut. The following members have attended the meeting :-

1. Prof. H.S. Singh, Dean, Faculty of Science, C.C.S. University, Meerut (Chairman)
2. Dr. Sanjay Kumar Bhardwaj, Head, Department of Zoology, C.C.S. University, Meerut (Convener-I)
3. Dr. A. Jalil, Deptt. Of Zoology, M.S. College, Saharanpur (Convener-II)
4. Dr. Pankaj Kumar Manglik, Principal & Head, Deptt. Of Zoology, I.P. College, Bulandshahr.
5. Prof. Vinod Kumar, Deptt. Of Zoology, Delhi University, Delhi.
6. Prof. S.M. Singh, Deptt. Of Zoology, M.J.P. Rohilkhand University, Bareilly.
7. Dr. M.P. Tyagi, Principal, Ch. Shiv Nath Singh Sandilya (PG) College, Machhra (Meerut).
8. Dr. A.K. Pandey, Principal Scientist, N.B.F.G.R., Lucknow.

The committee members perused the syllabus of B.Sc./M.Sc./Pre-Ph.D. Course work in the subject of Zoology prepared by the committee members earlier and discussed the same syllabus thoroughly. After perusal and discussion, the committee has decided approved as under:

- i. The committee has approved the Theory and Practical syllabus of B.Sc. (Zoology) III year to be effective from academic session 2013-14. Further, the committee has authorized the conveners for changes, if needed.
- ii. Convener-I proposed the course of chronobiology and <sup>mechanisms</sup> regulation of behaviour to be opened in M.Sc. IV Semester Specialization from 2013-14 at the C.C.S. University Campus. After discussion it was modified and approved to be forwarded for further approval.
- iii. Further, the committee discussed the syllabus of M.Sc. (Zoology) I, II, III and IVth Semester Theory + Practical Courses including the special courses as well and approved the same with slight modification in applied entomology Special Courses Code No. H-4080 & H-4081.
- iv. The committee members discussed the syllabus of Pre-Ph.D. Course in Zoology and suggested the modification to be made and finalized by Convener-I & II in consultation with Chairman.

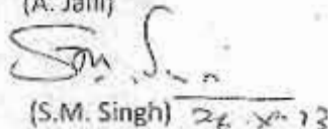
v. The conveners are authorized to submit the panel of examiners of B.Sc.

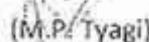
The committee ended with a vote of thanks to the chairman. and M.Sc.

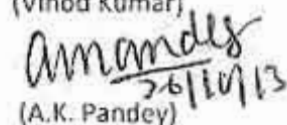
  
(A. Jalil)

  
(P. K. Manglik)

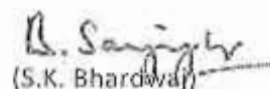
  
(Vinod Kumar)

  
(S.M. Singh) 26.10.13

  
(M.P. Tyagi)

  
(A.K. Pandey) 26/10/13

  
(H.S. Singh)

  
(S.K. Bhardwaj)

M.Sc. Zoology (Syllabus)

IV Semester (Special paper) – Chronobiology and mechanisms of behavior

- Paper 1: Chronobiology
- Paper 2: Photoperiodism and Seasonal Breeding
- Paper 3: Neuroendocrine control of behavior
- Paper 4: Applied Chronobiology

PAPER 1: Chronobiology

Unit 1: Introduction to biological clocks: Temporal organization. Evolution and adaptive significance; Types of Rhythms - Ultradian, Tidal/ Lunar, Circadian and Circannual rhythms. Chronobiology in the 21<sup>st</sup> century.

Unit 2: Geophysical environment—Organisms in the cyclic environment; Proximate and Ultimate factors. Role of proximate factor in regulation of physiology and behavior.

Unit 3: Formal properties of biological clocks: Characteristics, Phase shift, phase angle difference, Phase response curve (PRC). Masking and concept of zeitgeber. Entrainment-parametric and non-parametric entrainment.

Unit 4: Clock system in prokaryotes/invertebrates: Clock in bacteria with example *Cyanobacteria*. Circadian pacemaker system in invertebrates with *Drosophila* as example.

Unit 5: Vertebrate Clock System: Suprachiasmatic nucleus (SCN), Molecular biology of the circadian pacemaker system with examples from birds and mammals.

Suggested Readings:

1. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros. Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers. Sunderland, MA, USA
2. Insect Clocks. D.S. Saunders, C.G.H. Steel, X., afopoulou (ed.)R.D. Lewis. (3rd Ed). 2002, Baren and Noble Inc. New York, USA

PAPER 2: Photoperiodism and Seasonal Breeding

Unit 1: Photoreception: The eye as organ of photoreception. Extra-retinal photoreception. Pineal as photoreceptive structure in non-mammalian vertebrates.

Unit 2: Seasonality: Concept of seasonality, Role of photic and non-photoc cues in regulation of seasonality; Cues- principal and supplementary cues, Seasonal migration in fishes and birds. Hibernation.

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**Unit 3: Circannual rhythms:** Circannual rhythm in regulation of seasonally breeding animals with examples from subtropical birds. Circannual rhythms in sheep. Frequency demultiplication hypothesis.

**Unit 4: Photoperiodic time measurement in vertebrates:** Hourglass mechanism, internal and external coincidence models. Lighting protocols to test the photoperiodic time measurement- night break, T-cycle, and resonance cycles.

**Unit 5: Hormonal control of seasonal reproduction:** Regulation of testicular functions. Regulation of reproductive cycle in male & females. Mechanism of action of reproductive hormones. Melatonin and seasonal reproduction.

**Suggested Readings:**

1. The Physiology of Reproduction, Vol 1 and 2, Ernst Knobil and Jimmy D. Neil, (ed), Raven Press.
2. Biological Rhythms: Vinod Kumar (ed 2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

**PAPER 3: Neuroendocrine control of behavior**

**Unit 1: Basic neurobiology:** Structure and properties of neurons; Propagation of nerve impulses; Different types of synapse and synaptic transmission. Neurotransmitter and its release.

**Unit 2: Hypothalamus and Pituitary gland:** The hypothalamus and hypothalamic hormones: an overview of releasing and release inhibiting hormones. Structure and development of pituitary gland.

**Unit 3: The hypothalamo-hypophyseal control of hormone secretion:** Hypothalamo-hypophyseal axis. Regulation of thyroid, adrenal and gonadal secretion. Regulation of oxytocin and vasopressin. Concepts of feed-back in regulation of hormone secretion.

**Unit 4: Neuroendocrine regulation of behaviors:** Regulation of motivational system. Control of feeding and drinking. Hormonal influence of activity behaviour.

**Unit 5: Principles and application of techniques in Neuro endocrinology:** Electrophysiology, immunocytochemistry, *in situ* hybridization, autoradiography.

**Suggested Readings:**

1. An Introduction to Neuroendocrinology, Brown R.. (1994). Cambridge University Press, Cambridge, UK
2. Psychoneuroimmunology, Ader R, Felten D.L. and edited by Nicholas C. (4th Ed., 2007), Academic Press, UK

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PAPER 4: Applied Chronobiology

Unit 1: Methods for the study of rhythms in humans: Measurement of rhythms in physiology and metabolism (e.g. heartbeat), blood pressure, body temperature, liver metabolism.

Unit 2: Circadian clock in humans: Organization of clock system in humans. Central and peripheral clock.

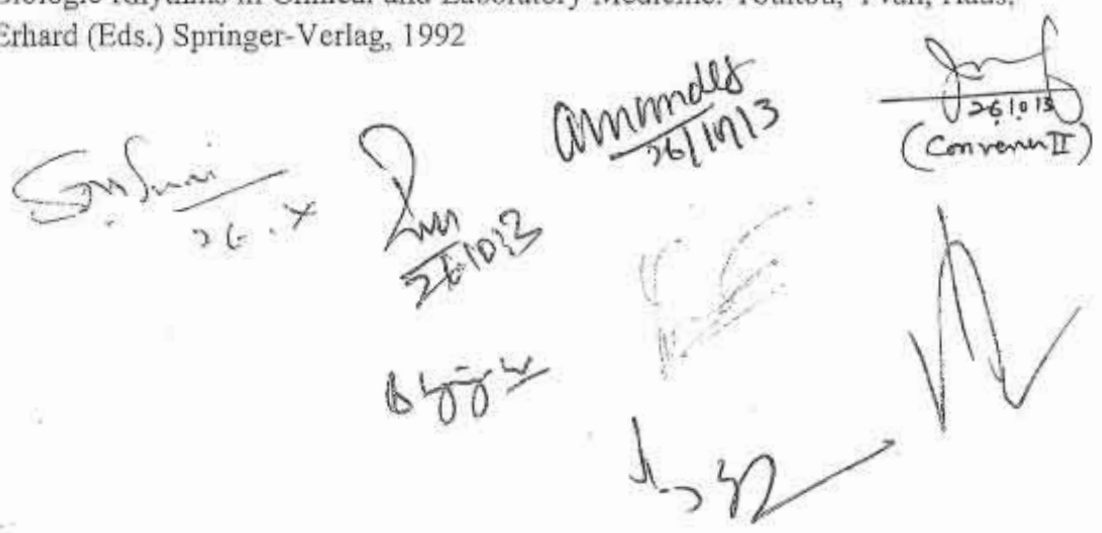
Unit 3: Clocks and metabolism: Clock regulation of metabolism. Disruption of clocks and diseases viz. Diabetes, Cardiovascular diseases. Ageing and sleep disorders.

Unit 4: Melatonin and human physiology : Bio-synthesis and regulation of melatonin, role of melatonin in regulation of diseases. Sleep and diseases in human.

Unit 5: Biological clocks in human welfare - Clock and Human health, Chronopharmacology, Chronomedicine and Chronotherapy.

Suggested Readings:

1. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed), 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
2. Biologic Rhythms in Clinical and Laboratory Medicine. Touitou, Yvan; Haus, Erhard (Eds.) Springer-Verlag, 1992


 A collection of handwritten signatures and dates in black ink. The signatures are: 'S. Suman' with date '26.12', 'L. M.' with date '26/10/13', 'Ammal' with date '26/11/13', and 'J. J.' with date '26/10/13' and '(Conven II)'. There are also several other scribbled signatures and lines.

PRACTICALS:

1. To study the phototaxis and geotaxis behaviour of earthworm.
2. Demonstration of methods of recording activity rhythms in fishes/birds/ mammals.
3. Assay of daily activity in human.
4. Ambulatory blood pressure monitoring and circadian rhythm analysis.
5. Quantifying oscillations from sample recorded data: phase, period and amplitude.
6. Recording of body temperature (Tb) of human.
7. Human chronotypes- MCTQ questionnaire and analysis.

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**Course XIII E: Morphology & Taxonomy of Insects - H4078**

- Unit I - General Principles of Insects Taxonomy.
- Unit II - General Characters, Classification (up to families) & affinities of different order of Apterygota and Pterygota (Exopterygota & Enopterygota)
- Unit III - Collection and Preservation of Insects - methods of insect collection, different methods of insect rearing, methods of insect preservation & maintenance of insect museum.
- Unit IV - Insect Integument - Structure & function.
- Unit V - Segmentation & body regions - Head, Thorax & abdomen-structure & appendages.

**Course XIV E: Anatomy & Physiology - H4079**

- Unit I - Physiology of various systems (Digestive System, Respiratory System, Circulatory System, Nervous System & Sense organs) .
- Unit II - Effector organs (Sound producing organs & light producing organs)
- Unit III - The endocrine system - Organization, structure of gland sand their hormones, endocrine function (In metamorphosis, reproduction , metabolism & osmoregulation )
- Unit IV - Reproductive system - Male and Female reproductive organs and genitalia hermaphroditism, mating and transfer of sperms .
- Unit V - Embryology - Gametogenesis, embryonic & post embryonic development , embryonic dynamics

**Course XV E: Applied Entomology I - H4080**

- Unit I - Origin, evolution and distribution of Insects in time and space (oriental region) .
- Unit II - Insect and their abiotic environmental effect of temperature, humidity and light.
- Unit III - Symbiosis, Parasitism, Social life adaptation in Insects, Migration and Phase theory of Locust.
- Unit IV - Beneficial insects - Apiculture, sericulture and Lac culture.
- Unit V - Insect Plats Interaction: theory of Co evolution, Tri trophic interaction Host plant selection by phytophagous Insects.



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Course XVI E: Applied Entomology II - H4081

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- Unit I - Insects/Pest of Crops. Pest of Sugar cane, Pest of Cotton, Pest of Paddy, Pest of fruits & Vegetables, Pest of stored grains, Pest of Forest.
- Unit II - insects injurious to man and livestock - Importance, appearance, life cycle, control measures.
- Unit III - Insects control measures: Natural control, applied control, Integrated pest management, Different phase of pest control.
- Unit IV - Different types of insecticides. Their chemistry action and application, insecticide resistance.
- Unit V - Insect hormone and its role, insects Pheromones and its role.

Sm. Saini  
26.10.13

D. Saini  
26.10.13

Amandes  
26/10/13

Prof  
26.10.13  
(Convener II)

V.K. Singh

V.K. Singh

Brijesh

M.Sc. (IV Semester) – Zoology  
PRACTICAL SYLLABUS

Duration 5 Hrs.

**Specialize Course Entomology (Code H-862 P)**

- 1. **Major Dissection** Study of Anatomy including Central Nervous System by Dissection of Cockroach, Grass Hopper, Wasp, Honey Bee, House Fly, Mosquito, Bug, Beetle and Lepidopterous larvae etc.
- 2. **Minor Dissection** Sting apparatus of Honey bee, wasp, Arista and Halteres of House Fly, Alimentary canal of some common insects, Tentorium and Spiracle of Grasshopper etc.
- 3. **Permanent mounting** of suitable materials from insects specified for dissection such as wings, halteres, antennae, legs and mouth parts or material provided.
- 4. **Taxonomic identifications** upto families specified in theory syllabus.
- 5. **Spotting** Study of insects of Economic Importance, life stages, mode of damage, control of important pests and useful insects, study of Permanent slides of W.M. and sections of various organs etc. of insects.  
Study of Insecticides, their use, insecticide poisoning & antidotes.
- 6. **Insect Collection & practical record**

**MARKS DISTRIBUTION**

Duration : 5 hours

Max.Marks : 100

| Exercises                                  | Max. Marks |
|--|------------|
| 1. Major Dissection                        | 20         |
| 2. Minor Dissection                        | 08         |
| 3. Mounting                                | 07         |
| 4. Taxonomic Identification of two insects | 15         |
| 5. Spotting (10)                           | 20         |
| 6. Viva Voce                               | 10         |
| 7. Record and collection                   | 20         |

*Sonali*  
26/10/13

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26/10/13

*Anamika*  
26/11/13

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M.Sc. Zoology (Practical Syllabus)

Duration – 5 hrs

IIIrd Semester

MM: 100

- |   |          |
|---|----------|
| 1. Major Dissection -   | 15 Marks |
| • Wallago/Mystus/any other Edible fish – Cranial Nerves                               |          |
| 2. Minor Dissection-  | 10 Marks |
| • Velum, pharyngeal wall, wheel organ of Amphioxus etc.                               |          |
| 3. Permanent Mounting   | 10 Marks |
| • From Dissected animal/provided material   |          |
| 4. Spot from Ecology (One)  | 05 Marks |
| 5. Spots from Animal behaviour (One)  | 05 Marks |
| 6. Spots from Embryology (One)  | 05 Marks |
| 7. Spots (1-10)   | 20 Marks |
| • Specimen, Slides & Osteology of Chordata (as per representative of theory Syllabus) |          |
| 8. Viva Voce  | 10 Marks |
| 9. Records  | 20 Marks |

Sr. Sani 26.10.13

Amandas 26/10/13

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M.Sc. Zoology (Practical Syllabus)

Duration - 5 hrs


Special IVth Semester (Cytology & Cytogenetics)

MM: 100

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|---|----------|
| 1. Plasmolysis                          | 10 Marks |
| 2. Electrophoresis of protein           | 10 Marks |
| 3. Centrifugation                       | 10 Marks |
| 4. DNA staining                         | 10 Marks |
| 5. Cytology Different stages of mitosis | 05 Marks |
| 6. Instrumentation                      | 05 Marks |
| 7. Spotting                             | 20 Marks |
| 8. Viva                                 | 10 Marks |
| 9. Records                              | 20 Marks |

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Singh



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M.Sc. Zoology (Practical Syllabus)

Duration – 5 hrs

IVth Semester (Fish & Fisheries)

MM: 100

- |   |          |
|---|----------|
| 1. Major Dissection -   | 10 Marks |
| <ul style="list-style-type: none"> <li>• Cranial nerves of Wallago</li> <li>• Cranial nerves of Mystus</li> <li>• Cranial nerves of Labeo</li> <li>• Cranial nerves of Sting ray</li> </ul>   |          |
| 2. Minor dissections -  | 10 Marks |
| <ul style="list-style-type: none"> <li>• Accessory respiratory organs of             <ul style="list-style-type: none"> <li>o Clarias</li> <li>o Heteropneustis</li> <li>o Anabas</li> </ul> </li> <li>• Electric organs of Torpedo</li> <li>• Weberian Ossicle of Wallago</li> <li>• Internal ear of Scoliodon</li> <li>• Pituitary</li> <li>• Biometry of a local fish</li> </ul> |          |
| 3. Mounting -   | 10 Marks |
| <ul style="list-style-type: none"> <li>• Placoid scales</li> <li>• Cteniod scales</li> <li>• Cycloid scales</li> <li>• Rhomboid scales</li> <li>• Scale showing lateral line</li> <li>• Preparation of blood film</li> <li>• Chromatophore</li> </ul>   |          |
| 4. Water analysis -   | 10 Marks |
| <ul style="list-style-type: none"> <li>• pH, turbidity, salinity, DO, TDS</li> </ul>  |          |
| 5. Spotting (4 specimens + 4 slides + 2 bones)  | 20 Marks |
| 6. Identification (1 Cyprinid + 1 Silurid)  | 10 Marks |
| 7. Viva   | 10 Marks |
| 8. Records  | 20 Marks |

S. Srinivas  
26/11/13

D. Srinivas  
26/11/13

Amandeep  
26/11/13

Arjun

26/11/13  
(Kannur II)

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M.Sc. (IV Semester) – Zoology  
PRACTICAL SYLLABUS

Duration 5 Hrs.

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| 6. Viva Voce                               | 10         |
| 7. Record and collection                   | 20         |

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