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. Jali, 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.
7. Dr. M.P. Tyagi, Principal, Ch. Shiv Nath Singh Sandilya (PG) College, Machhra (Meerut).

The committee members persuaded 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 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 examination B.Sc.

The committee ended with a vote of thanks to the chairman.
1. Dissection Major - 12 Marks
   - Cockroach
     - Central Nervous System
     - Alimentary Canal with Salivary glands
   - Wallago or any other suitable fish
     - Cranial Nerves

2. Major Dissection & Permanent Mounting - 06 Marks
   - Halter, wing and Antenna of Housefly
   - Mouth parts of Mosquito, Housefly

3. Temporary Mounting 05 Marks
   - From Dissecting animals or material provided

4. Identify and comment upon spots (1 - 8) 16 Marks
   - Entamoeba, Englena, Paramecium, Opalina, Balantidium, Nyctotherus,
     Trypanosoma, Fasciola, Taenia, Polystomella, Schistosoma, Ascaris,
     Ancylostoma, Edible fishes, Cimex, Pediculus, Larval stages of helminths,
     arthropods, Pest – Sugarcane leaf hopper, Gundhi Bug, Termite, Rodents etc.

5. Economic Zoology Spot (One) 06 Marks
   - Life cycle of Silkworm, Honeybee, Lac insect

6. Biological Tool Techniques/Spot (One) 06 Marks
   - As per Theory Syllabus

7. Biostat Numerical/Microbiology/Immunology Behaviour (One) 06 Marks
   - As per Theory Syllabus

8. Ecology/Pollution/Toxicology (One) 06 Marks
   - As per Theory Syllabus

9. Viva Voce 06 Marks
10. Record/Project/Collection 06 Marks
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 2: Geophysical environment – Organisms in the cyclic environment; Proximate and Ultimate factors. Role of proximate factor in regulation of physiology and behavior.


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:


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-photic cues in regulation of seasonality; Cues- principal and supplementary cues. Seasonal migration in fishes and birds. Hibernation.
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.


**Suggested Readings:**


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

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

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

**Suggested Readings:**

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 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:


2. Biologic Rhythms in Clinical and Laboratory Medicine. Touitou, Yvan; Haus, Erhard (Eds.) Springer-Verlag, 1992
PRACTICALS:

1. To study the phototaxis and geotaxis behaviour of earthworm.
2. Demonstration of methods of recording activity rhythms in fishes/birds/mammals.
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.

Signed: (Signature)
Date: 26/6/2013

[Other handwritten notes]
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.
Course XVI E: Applied Entomology II - H4081

Unit I - Insects/Pests of Crops. Pest of Sugar cane, Pes 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.
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 Halters 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, halters, 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**

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**MARKS DISTRIBUTION**

Duration : 5 hours  
Max. Marks : 100

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Max. Marks</th>
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<tbody>
<tr>
<td>1. Major Dissection</td>
<td>20</td>
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<tr>
<td>2. Minor Dissection</td>
<td>08</td>
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<tr>
<td>3. Mounting</td>
<td>07</td>
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<td>4. Taxonomic Identification of two insects</td>
<td>15</td>
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<td>5. Spotting (10)</td>
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<td>6. Viva Voce</td>
<td>10</td>
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<td>7. Record and collection</td>
<td>20</td>
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*Signature: [Signatures* (Three signatures are present, the first two appear to be illegible, the third appears to be a date stamp: 26/11/13).]
## M.Sc. Zoology (Practical Syllabus)

### 1st Semester

<table>
<thead>
<tr>
<th>Duration – 5 hrs</th>
<th>IInd Semester</th>
<th>MM: 100</th>
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<tbody>
<tr>
<td>1. Major Dissection -</td>
<td>20 Marks</td>
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<tr>
<td>• Earthworm Reproductive System</td>
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<td>• Prawn/Squilla</td>
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<td>• Sepin/Loligo/Octopus</td>
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<td>2. Minor Dissection –</td>
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<tr>
<td>• Prawn</td>
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<td>o Statocyst, Hastate Plate</td>
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<td>• Earthworm</td>
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<tr>
<td>o Nerve ring, Ovary, Septal Nephridia, Pharyngeal Nephridia</td>
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<td>• Sea-urchin</td>
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<td>o Aristotl lantern</td>
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<td>• Mouth parts of Mosquito, Housefly</td>
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<tr>
<td>3. Permanent Mounting</td>
<td>10 Marks</td>
<td></td>
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<tr>
<td>• Material provided or material from dissected animal</td>
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<td></td>
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<tr>
<td>4. Cytological exercises</td>
<td>10 Marks</td>
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<tr>
<td>• Mitosis</td>
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<tr>
<td>o Onion root tip Squash Technique</td>
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<tr>
<td>• Giant Chromosome</td>
<td></td>
<td></td>
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<td>o Chironomous larva</td>
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<tr>
<td>5. Spotting</td>
<td>20 Marks</td>
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<tr>
<td>• Economic Zoology</td>
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<td>• Evolutionary biology</td>
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<tr>
<td>• Nonchordata</td>
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<tr>
<td>o Specimen &amp; Slides</td>
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*(Representation of the units in various courses of theory syllabus of M.Sc. I Semester)*

6. Viva Voce

7. Records & Collection

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## M.Sc. Zoology (Practical Syllabus)

### IIInd Semester

<table>
<thead>
<tr>
<th>Duration – 5 hrs</th>
<th>MM: 100</th>
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<tbody>
<tr>
<td>1. Enumeration of the number of RBC/WBC by Haemocytometer</td>
<td>20 Marks</td>
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<tr>
<td>Estimation of % of haemoglobin by Haemometer</td>
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<tr>
<td>2. Numerical Problems (02) from Biostatistics</td>
<td>10 Marks</td>
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<tr>
<td>3. Numerical Problems (02) from Genetics</td>
<td>10 Marks</td>
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<tr>
<td>4. Biochemical tests from Proteins, Carbohydrates Lipids &amp; Enzymes</td>
<td>10 Marks</td>
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<tr>
<td>5. Spotting (1-10) (representing each unit from theory course of II Sem.)</td>
<td>20 Marks</td>
</tr>
<tr>
<td>6. Viva Voce</td>
<td>10 Marks</td>
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<tr>
<td>7. Records, &amp; Collection</td>
<td>20 Marks</td>
</tr>
</tbody>
</table>

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*(Signatures and Annotations)*
M.Sc. Zoology (Practical Syllabus)
IIIrd Semester

Duration – 5 hrs

1. Major Dissection -
   - Wallago/Mystus/any other Edible fish – Cranial Nerves

2. Minor Dissection–
   - Velum, pharyngeal wall, wheel organ of Amphioxus etc.

3. Permanent Mounting
   - From Dissected animal/provided material

4. Spot from Ecology (One)

5. Spots from Animal behaviour (One)

6. Spots from Embryology (One)

7. Spots (1-10)
   - Specimen, Slides & Osteology of Chordata (as per representative of theory Syllabus)

8. Viva Voce

9. Records

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(Handwritten notes and signatures)

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MM: 100
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<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Plasmolysis</td>
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<tr>
<td>2.</td>
<td>Electrophoresis of protein</td>
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<td>3.</td>
<td>Centrifugation</td>
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<td>4.</td>
<td>DNA staining</td>
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<td>5.</td>
<td>Cytology Different stages of mitosis</td>
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<tr>
<td>6.</td>
<td>Instrumentation</td>
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<td>7.</td>
<td>Spotting</td>
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<td>8.</td>
<td>Viva</td>
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<td>9.</td>
<td>Records</td>
</tr>
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M.Sc. Zoology (Practical Syllabus)
IVth Semester (Fish & Fisheries) MM: 100

1. Major Dissection -
   - Cranial nerves of Wallago
   - Cranial nerves of Mystus
   - Cranial nerves of Labeo
   - Cranial nerves of Sting ray
   10 Marks

2. Minor dissections –
   - Accessory respiratory organs of
     - Clarias
     - Heteropneustis
     - Anabas
   - Electric organs of Torpedo
   - Weberian Ossicle of Wallago
   - Internal ear of Scoliodon
   - Pituitary
   - Biometry of a local fish
   10 Marks

3. Mounting –
   - Placoid scales
   - Cteniod scales
   - Cycloid scales
   - Rhomboid scales
   - Scale showing lateral line
   - Preparation of blood film
   - Chromatophore
   10 Marks

4. Water analysis –
   - pH, turbidity, salinity, DO, TDS
   10 Marks

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
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 Halter of House Fly, Alimentary canal of some common insects, Tentorium and Spiracle of Grasshopper etc.

3. **Permanent mounting**
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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.
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6. **Insect Collection & practical record**

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