

## **B.Sc. PART II ZOOLOGY**

**Scheme:**

Paper	Duration	Max. Marks	Min. Pass Marks
Paper I	3 hrs.	50	18
Paper II	3 hrs.	50	18
Paper III	3 hrs.	50	18
Practical	5 hrs.	75	27
Total Marks		225	81

**Note:** Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part -C. Part A (10 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of one mark. Part -B (10 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of two marks (50 words). Part -C (30 marks) contains six questions, two from each unit. Candidate is required to attempt three questions, one from each Unit. Each question is of ten marks (400 words).

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#### **PAPER I**

### **STRUCTURE AND FUNCTIONS OF INVERTEBRATE TYPES**

#### **UNIT I**

Structural and functional organisation of vital systems of nonchordates as exemplified by *Amoeba*, *Paramecium*, *Euglena*, *Obelia*, *Sycon*, *Fas-*

*ciola, Taenia, Nereis, Hirudinaria, Palaemon, Lamellidens, Pila and Asterias :*

- 1 Locomotion :Pseudopodial(*Amoeba*), ciliary(*Paramecium*) and flagel-lar (*Euglena*), parapodial (*Nereis*), pedal muscular foot(*Pila*) and tube feet (*Asterias*).
- 2 Skeleton : Endoskeleton (spicules of *Sycon*), exoskeleton, chitinous (*Palaemon*), calcareous (Corals, *Pila, Lamellidens, Asterias*), siliceous (*Radiolaria*).
- 3 Nervous System : Sensory and nerve cells (*Obelia*); brain ring and longitudinal nerves (*Fasciola* and *Taenia*), brain and ventral nerve cord (*Nereis, Palaemon*), nervous system of *Pila* and *Lamellidens*.
4. Sense-organs : Statocyst and osphradium(*Lamellidens* and *Pila*), compound eye (*Palaemon*) and simple eye (*Nereis, Pila*), tactile and olfactory organs (*Palaemon*), nuchal organs(*Nereis*).

#### UNIT II

- 1 Food, Feeding, Digestive structures and Digestion: Autotrophic(*Euglena*), heterotrophic: through food vacuole(*Paramecium*) and in hydroid and medusoid zooids (*Obelia*), parasitic (*Fasciola, Taenia, Hirudinaria*), predatory (*Nereis, Palaemon, Asterias*), filter feeding (*Lamellidens*)
- 2 Respiration : Aquatic general body surface (*Euglena, Nereis, Hirudinaria*), dermal branchiae(*Asterias*), parapodia (*Nereis*), gills (*Palaemon, Lemellidens, Pila*), aerial, pulmonary sac (*Pila*), trachea (Insect), anaerobic (*Fasciola, Taenia*).
- 3 Excretion : General body surface (Protozoa, *Sycon, Obelia*), protonephridial system and flame cells(*Fasciola, Taenia*), nephridia(*Nereis, Hirudinaria*), malpighian tubules (insect); organ of Bojanus(*Lamellidens, Pila*).
- 4 Circulation : Cyclosis (*Euglena, Paramecium*), diffusion (*Sycon, Obelia, Fasciola, Taenia*), open circulatory system (*Hirudinaria, Palaemon, Lamellidens, Pila, Asterias*), closed circulatory system (*Nereis*).
- 5 Reproduction : Asexual (*Paramecium, Euglena, Sycon*), alternation of generation (*Obelia*), sexual (*Fasciola, Taenia, Nereis, Lamellidens, Pila, Hirudinaria, Asterias*).

#### UNIT III

- 1 Evolution of canal system of sponges.
- 2 Parasitic adaptations in helminthes and arthropods.
- 3 Characteristics of social insects; Social organisation in termites.
- 4 Direct and Indirect Development in Insects.
- 5 Water vascular system in Starfish.
- 6 Torsion in Gastropoda.
- 7 Adaptive radiation in Annelida.
- 8 Autotomy and regeneration in Echinodermata.

## PAPER II ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

### UNIT- I

#### Animal Physiology with special reference to Mammals :

- 1 Osmoregulation, membrane permeability, active and passive transport across membrane.
- 2 Physiology of Digestion: nature of food stuff, various types of digestive enzymes and their digestive action in the alimentary canal.
- 3 Physiology of Circulation: Composition and function of blood, mechanism of blood clotting, heart beat, cardiac cycle, blood pressure, body temperature regulation.
- 4 Physiology of Respiration : Mechanism of breathing, exchange of gases, transportation of oxygen and carbon dioxide in blood, regulation of breathing.
5. Physiology of Excretion : Kinds of nitrogenous excretory end-products (aminotelic, ureotelic and uricotelic), role of liver in the formation excretory end products, functional architecture of mammalian kidney tubule and formation of urine, hormonal regulation of water and electrolyte balance.

### UNIT II

#### Regulatory aspects of animal physiology

1. Physiology of Nerve Impulse and Reflex Action : Functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission, spinal reflex arc, central control of reflex action.
2. Physiology of Muscle Contraction : Functional architecture of skeletal muscle, chemical and biophysical events during contraction and relaxation of muscle fibres.
3. Types of Endocrine Glands, their secretions and functions: Pituitary, Adrenal, Thyroid, Islets of Langerhans, Testis and Ovary. Elementary idea about mechanism of hormone action
4. Hormonal control of male and female reproduction and implantation, parturition and lactation in mammals.
- 5 Preliminary idea of neurosecretion, hypothalamic control of pituitary function : neuroendocrine and endocrine mechanism of Insecta.

### UNIT III

#### BIOCHEMISTRY

- 1 Carbohydrate : Structure, function and significance. Oxidation of glucose through glycolysis, Krebs cycle and oxidative phosphorylation, elementary knowledge of interconversion of glycogen and glucose in liver, role of insulin.

2. Proteins : Essential and non-essential amino acids, catabolism decarboxy-lation, fate of ammonia (ornithine cycle), fate of carbon skeleton. Structure, function and significance.
3. Lipids : Structure, function and significance. Biosynthetic and beta oxidative pathways of fatty acids, brief account of biosynthesis of triglycerides.

**PAPER III**  
**IMMUNOLOGY, MICROBIOLOGY AND**  
**BIOTECHNOLOGY**

**UNIT I**

**Immunology**

1. Immunology : Definition, types of immunity, innate and acquired, humoral and cell mediated.
2. Antigen : Antigenicity of molecules, haptens
3. Antibody : Definition (IgG, IgM, IgD, IgA and IgE) outline idea of properties and function of each class of immunoglobulin.
4. Antigen-antibody reactions : Precipitation reaction, agglutination reaction, neutralizing reaction, complement and lytic reactions and phagocytosis.
5. Cells of Immunity ; Macrophages, lymphocytes (B and T types), T - Helper cells, T-killer cells, plasma cells and memory cells.
6. Mechanism of humoral or antibody mediated immunity.

**UNIT II**

**Microbiology**

1. Brief introduction to the history of microbiology : work of Antony Van Leeuwenhoek, theory of spontaneous generation, Germ theory of fermentation and disease, Works of Louis Pasteur, John Tyndal, Robert-Koch and Jenner.
2. The Prokaryota (Bacteria)  
Structural organization :
  - i) Size, shapes and patterns
  - ii) Structural organization  
Slime layer (capsule), cell envelopes cytoplasmic membrane (inner membrane) cell wall (outer membrane) of Gram negative and Gram positive bacteria, mesosomes, cytoplasmic organization cell projections, flagella and pili.
3. Genetic material of bacteria.
  - i) Chromosome (ii) Plasmids (iii) replication of bacterial DNA.
4. Reproduction in Bacteria , asexual re-production: binary fission, budding, endospore formation, exospore and cyst formation, sexual reproduction, conjugation.

5. Microbial nutrition culture of Bacteria
  - a) Carbon and energy source
  - b) Nitrogen and minerals
  - c) Organic growth factors
  - d) Environmental factors : Temperature, hydrogen-ion concentration
6. Bacteria of medical importance
  - i) Gram positive
    - a) Cocci: Staphylococci, Streptococci
    - b) Bacilli : Diphtheria, Tetanus
  - ii) Gram-negative
    - a) Cocci : Gonorrhoea, Meningitis
    - b) Bacilli : Diarrhea
  - iii) Mycobacteria : Tuberculosis, Leprosy.
7. AIDS and Hepatitis (with emphasis on B)
  - i) The causative agents
  - ii) Transmission
  - iii) Pathogenicity
  - iv) Laboratory diagnosis, treatment and prevention.

**UNIT III**

**Biotechnology**

1. History, scope, significance of Biotechnology. Major areas of Biotechnology, Biotechnology industries in India.
2. Vectors for gene transfer (plasmids and phages). Basic concepts of cell and tissue culture. Hybridoma technology.

**PRACTICAL ZOOLOGY**

**Duration 5 hrs.**

**Max. Marks 75**

**Min. Marks 27**

Practical work based on Papers I, II and III

**I. External features and Anatomy**

- (a) External features, alimentary canal, nervous system, excretory and reproductive systems in *Hirudinaria*.
- (b) External features, appendages, alimentary canal and nervous system *Palaemon*.
- (c) External anatomy, pallial organs and nervous system *Unio* and *Pila*  
Note: External features and anatomy should be studied preferably by digital techniques and alternatives like charts etc.

**II. Study of Microscopic Slides:**

**Porifera** : T.S and L.S. of *Sycon*.

**Coelenterata**: *Obelia* medusa and polyp, *Planula*, *Scyphistoma*, *Ephyra* larva of *Aurelia*.

**Platyhelminthes**: T.S. body of *Taenia* and *Fasciola*. Scolex of *Taenia*,

mature and gravid proglotid of Taenia, Hexacanth, Bladderworm and cysticercus stages of Taenia, Miracidium, Sporocyst, Redia and Cercaria Larva of Fasciola.

**Aschelminthes:** Ascaris T.S body wall; Ascaris T.S. Pharynx; Ascaris T.S. mature male and female

**Annelida:** T.S. of Leech and Neries through different regions,

**Arthropoda** - Nauplius, Zoea, Megalopa and Mysis larvae,

**Mollusca:** T.S. gill of *Pila*, Glochidium.

Echinodermata: Pedicellareae

### III. Permanent Preparation and Study of the following

**Protozoa:** Euglena, Paramecium, Polystomella, or any other foraminifera.

**Porifera:** Spicules, spongin fibres, gemmule.

**Coelenterata:** Obelia medusa

**Annelida:** Neries (parapodia)

**Arthropoda:** Cyclops, Daphnia.

**Mollusca:** Pila- Gill lamella, Osphradium, Radula, Unio- Gill lamella

### V. Microbiology.

1. Preparation and use of culture media for microbes.

2. Study of microbes in food materials

3 Educational tour to microbiological laboratories, dairy, food processing factory, distillery, museum of natural science for first hand study and collection of material. Methods of microbial waste disposal. Candidates are expected to submit a report of their visit.

### VI. Animal Physiology

1 Counting of red and white blood cells in a blood sample.

2 Estimation of haemoglobin in a blood sample.

3 Estimation of haematocrit value in a blood sample.

4 Demonstration of enzyme activity (catalyses) in liver.

5 Study of histological structure of major endocrine glands of mammals and their physiological importance using slide/charts/models/digital techniques.

### VII. Biochemistry

1 Detection of proteins, carbohydrates and lipids.

2 Demonstration of the principle of paper chromatography.

### VIII. Live Zoology:

To study local invertebrate fauna. Observation of their locomotion, feeding, respiration, circulation and reproduction in the natural habitats. Student is required to prepare a report of these observations and submit along with the practical record. A note on the conservation of invertebrate fauna is compulsory in this report.

**Note :**(i) Use of animals for dissection is subject to the conditions that these are not banned under the Wild life (Protection) Act.

(ii) Those Institutions which are already having Zoology Museums should not procure Museum Specimens now onwards and should use charts / slides / models / photographs and digital alternatives in case of need. Those new institutions which are not having Zoology Museum in their Department should provide learning related to zoological specimens with the help of charts / slides / models / photographs and digital alternatives/ and visit of students to already established museums.

### Scheme of Practical Examination

Time: 5 hrs.	Min.Pass Marks: 27	Max. Marks: 75
Regular/Ex-students/Non-Collegiate		
1	Anatomy (Through Chart / Model / Photograph / CD)	05
2	Permanent preparation	06
3	Exercise in Animal Physiology	08
4	Exercise in Biochemistry	08
5	Exercise in Microbiology	05
6	Identification and Comments Spots (1 to 8)	16
7	Live Zoology: Study report of animals in Nature	07
8	Viva-voce	10
9	Class record	10
Total		75

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; kst uk %

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i l u i = & I 3 ?k. Vs 50 18

i l u i = & II 3 ?k. Vs 50 18

i l u i = & III 3 ?k. Vs 50 18

i k; k f x d 5 ?k. Vs 75 27

dy v d 225 81

uk s / % i l u l k = rhu b d k b ; ka ea fo H k D r g a i l u i = rhu H k k x ka & H k k x v j H k k x

c o H k k x l ea fo H k D r g a H k k x v 1/10 v d 1/2 v fuok; l g s o b l ea 10

i l u g a 1/20 'k c n 1/2 r f k k i r; d b d k b z l s de l s de 3 i l u g a i r; d

i l u 1 v d d k g a H k k x c 1/10 v d 1/2 H k h v fuok; l g s o b l ea d y 5

i l u g a r f k k i r; d b d k b z l s de l s de 1 i l u g a v h; F k h z d k s l H k h

i kp izuka ds mrj nus gA i R; d izu 2 vdl 150 'kCn½ dk gA Hkx&I  
1/30 vdl½ ea dgy N izu gA i R; d bdkbz ea l s nks izu gA vH; Fkz  
dks i R; d bdkbz l s, d izu d jrs gq dgy rhu izu d jus gS i R; d  
izu 10 vdl dk gS 1400'kCn½ A

**izu I**

**vd'ks dh ik: ika dh I jpuK ,oa dk; Z**

**bdkbz & I**

vd'ks fd; kadsiaed[k rækadk I jpuKRed , oadkf; Zh I æBu ( mnkgj .k  
& vehck] i j'kehf'k; e] ; Wyhuk] vkcsfy; k] I k; dKw] Qd hvksyk] Vhf; k]  
ujhl ] fg: Mhusj; k] i fyeku] yæsyMNI ] ik; yk] , LVsj; I A

- 1- **pyu** 1/2% dV i knh; 1/2vehck] i {ekfHkdh; 1/4j'kehf'k; e½vks d'kafkdh;  
1/4Wyhuk] i k'oz knh; 1/4ujhl 1/4 i s kh; i kn 1/4 kbyk½ vks uky i kn 1/4 LVsj; I 1/2
- 2- **dadky** % vlr-%dadky 1/4 k; dKw dh dāvdk, 1/4 ckā dadky & dkbvuh  
1/4 fyeku] dSY'k; eh 1/4 dky] i kbyk] yæsyMNI ] , LVsj; I 1/4 fl yhdke;  
1/4 BM; kysj; k½
- 3- **ræ=dk ræ** % l onh vks ræ=dk dks'kdk; j 1/4Mksfy; k½ eflr"d oy;  
vks vup; Z ræ=dk; j 1/4Qd hvksyk vks Vhf; k½ eflr"d vks v/kj ræ=dk  
jTtq 1/4ujhl ] i fyeku] i kbyk vks yæsyMNI dk ræ=dk ræA
- 4- **l onh vak** % l urgy i qvdk vks tyf{dkk 1/4yæsyMNI vks i kbyk½  
l a Dr us= 1/4 fyeku½ vks l jy us= 1/4ujhl vks i kbyk½ Li 'kKki d vks  
?k.k vak 1/4 fyeku] U; dgy vak 1/4ujhl 1/4A

**bdkbz & II**

- 1- **[kk ] v'ku** i kpd I jpuK , j vks i kpu % Loā kskh 1/4 Wyhuk] fo'ke  
i kskh; ( [kk ] fjfDr dk }kj k 1/4j'kehf'k; e½vks gkbMkBM thod vks eMNI kbM  
thod ea 1/4vkcsfy; k½ ij thoh; 1/4Qd hvksyk] Vhf; k] fg: Mhusj; k½ Hk{kdh  
1/4ujhl ] i fyeku] , LVsj; I 1/4 fulinu v'ku 1/4yæsyMNI 1/2
- 2- **'ol u** % tyh; & l keld; ng l rg 1/4 Wyhuk] ujhl ] fg: Mhusj; k½ peh;  
Dyke 1/4 LVsj; I 1/4 i k'oz kn 1/4ujhl 1/4 fxYI 1/4 fyeku] yæsyMNI ] i kbyk½  
ok; oh; ] Qd dksk 1/4 kbyk½ 'okl ufydk 1/4dhV½ vok; oh; 1/4Qd hvksyk]  
Vhf; k½
- 3- **mRI tū** % l keld; ng l rg 1/4 kstksk] I k; dKw] vkcsfy; k½ vkfn oDdh;  
ræ= vks Tokyk dks'kdk; j 1/4Qd hvksyk] Vhf; k½ oDd 1/4ujhl ] fg: Mhusj; k½  
eS i h?kh ufydk; j 1/4dhV½ ckstul ds vak 1/4yæsyMNI ] i kbyk½
- 4- **ifjI pj.k ræ** % pØ .k 1/4 Wyhuk] i j'kehf'k; e½ fol j .k 1/4 k; dKw] vkcsfy; k]

Qd hvksyk] Vhf; k½ [kyk ifjI pj .k ræ= 1/4fg: Mhusj; k] i fyeku] yæsyMNI ]  
i kbyk] , LVsj; I 1/4 dln ifjI pj .k ræ= 1/4ujhl 1/2

- 5- **izuu** % vyxd 1/4j'kehf'k; e] ; Wyhuk] I k; dKw] i h-k , dKw] .k 1/4vkcsfy; k½  
yxd 1/4Qd hvksyk] Vhf; k] ujhl ] yæsyMNI ] i kbyk] fg: Mhusj; k] , LVsj; I 1/2  
**bdkbz & III**

- 1- Liatka ea uky ræ= dk mnfodkI A
- 2- Nfe; ka , oa vkfka kbM ea ij thoh vup; uA
- 3- l kelftd i kf.k; ka ds y{k.k % nhi d ea l kelftd l æBu
- 4- dhvka ea i R; {k , oa vi R; {k ifjo/kūA
- 5- rkjkehu ea ty l ogu rl=A
- 6- xlVki km ea , Bu
- 7- , sushk l s vup; yh fofdj .k
- 8- bdkuMævk ea LokakBNnu o i q: nHku

**izu i = II**

**tUrq dkf; Zh ,oa tS jI k; u**

**bdkbz I**

tUrq dkf; Zh&Lrfu; ka ds fo'kSk I UnHkZ ea %  
1- ijkl j.k fu; eu] f>Yyh ikjx; r] f>Yyh ds vkj ikj I fØ; , oa fuf'Ø;  
ifjoguA

- 2- **ikpu dkf; Zh** % HkK; i nkFkZ dh i Nfr] fofHku i dKj ds i kpd , Ut kbEI  
vks vkgkj uky ea mudh i kpd fØ; kA
- 3- **ifjI pj.k dh dkf; Zh** % jDr dk l æBu , oa dk; l jDr l daku dh  
fØ; kfof/k( ân; Linu( ân; pØ( jDr nkc( nsgd rki fu; euA
- 4- **'ol u dh dkf; Zh** % l okaru dh fØ; kfof/k( xS ka dk fofue; ( jDr  
eadkū&Mkb&vkD l kbM , oavkD l htu dk ifjogu( l okaru dk fu; euA
- 5- **mRI tū dh dkf; Zh** % ukb½kstu ; Dr mRI tū i nkFka ds var mRI knka  
ds i dKj 1/4veku½fyd] ; f]j vks/fyd , oa ; f]j dks/fyd½ ( bu var mRI knka  
ds fuekZ k ea; N r dh HkKedk( Lru/kj h oDd ufydk dk fØ; kRed Lo: i  
, oa e# fuekZ k( ty vks fo| r ?kVdka dk gkekūh; fu; euA

**bdkbz & II**

- tUrq dkf; Zh ds fu; ked i gym
- 1- **rfl=dk vkox , oai frorh fØ; k dh dkf; Zh** % , d rfl=dk dks'kdk  
dk fØ; kRed Lo: i] rfl=dk vkox dh mRI fuk , oa l ogu] ; 1/4ekuqI/  
ku i k.k( es i frorh pki( i frorh fØ; k dk dlnh; fu; U=.kA
- 2- **i s kh l dpu dh dkf; Zh** % dadky i s kh dk fØ; kRed Lo: i] i s kh

- rUrq/ka ds l adpu , oa f' kffkyu ds nls ku gkus okyh jl k; fud , oa tð Hkkrdh; ?kVuk, A
- vUr%L=koh xRUFk; kads i dKj] mudsLoHko o dk; ( i h; Wk] vf/koDd] FkkbjkBM] y&j gð dh }hfi dk; } o'k.k] v.Mk'k; A gkekü fØ; k dh fØ; kfof/k dh i kjfEHkd tluckjha
  - uj , oa eknk iztuu dk gkkkuka }kjk fu; U=.k vksj vkjki .k] iil o vksj Lrfu; ka ea n/k L=koA
  - rfl=dk L=o.k dk i kjfEHkd Kku] i h; Wk ds dk; kã dk gkbã kfsyæl }kjk fu; U=.k( dhVka dh rfl=dk vr% L=koh , oa vUr% L=koh fØ; kfof/kA

**bdkbz & III**

**tð jlk; u %**

- dkckjkbM** % I j puk] dk; L , oa egRoA Xykbdkykbfl I }kjk Xyndkst dk vldl hdj .k] Øc pØ , oavkDI hdkj d QM/QkSj yhdj .k] ; Nr eakybdkstu , oa Xyndkst ds vUr% : i kUrj .k dk i kjfEHkd Kku] bul fyu dh HkfedkA
- i ks/hul** %vko' ; d , oavuko' ; d vehuksvEy] vi p; ] MhdckkDI yhdj .k] velsu; k dh fu; fr ¼/kWuZfku pØ½] dkcü dcky dh fu; frA I j puk] dk; L , oa egRoA
- ol k %** I j puk] dk; L , oa egRoA ol k vEyka dk tð l áysk.k , oa chVk&vkdI hdj .k

**izu i= III**

**ifrj{kk&foKku} I wetsodh vksj tð rduhdh**

**bdkbz & I**

**ifrj{kk&foKku**

- ifrj{kk foKku % ifjHkk"kk] ifrj{kk ds idkj( vUrj tkr ¼LoHkkfod½ , oa mikftZr ifrj{kk( rjy , oa dks' kdk e/; orhZ ifrj{kkA
- ifrtu % v.kq/ka dh ifrtfurk] gSVl A
- ifrj{kh % ifjHkk"kk ¼ IgG, IgM, IgD, IgA , oa IgE ½ bE; ukkxys; fyu ds i R; d oxl ds xqkka , oa dk; kã dh : i j fkkA
- ifrtu&ifrj{kh vfhfØ; k, i %vo{ks .k vfhfØ; k] l eggu vfhfØ; k] mnkl huhdj .k vfhfØ; k] ij d , oa y; u vfhfØ; k, i vksj dks' kdk Hk(k.kA
- ifrj{kkdrk dh dks' kdk, i % o' gn Hkktsh] fyEQk kbV ¼ch o Vh idkj½ Vh&l gk; d dks' kdk, i Vh&ekj d dks' kdk, i lykTek dks' kdk, i , oa Lej .k dks' kdk, A
- rjy ; k ifrj{kh e/; orhZ ifrj{kkdrk dh fØ; kfof/kA

**bdkbz & II**

**I wetsodh %**

**vk/kkjHkur I wetsodh**

- I wetsodh ds bfrgkI dk l f(klr ifjp; % , UVku oku Y; oku gkkdI dk dk; ( Lor% tuu dk fl ) kUr( fd.ou vksj jkska dk teZfl ) kUr( ypl ik'pj] tkW fVUMy] jkcVZ dkkdI vksj tðuj ds dk; A
- i kcljsh; ks/k ¼thok.kkz**  
I j pukRed I xBu %  
(i) vkdkj] vkNfr , oa 0; oLFkk dk ifr: i  
(ii) I j pukRed I xBu %  
'ys'ed Lrj] l Ei W/( dks' kdk vkoy .k( dks' kdknØ; h f>fYy; k ¼kkrfd f>Yyh½ xE xqgh vksj xE vxqgh thok.kqdh dks' kdk fHkrh ¼cká f>Yyh½ ehtkI kE] dks' kdknØ; h l xBu( dks' kdk i d/kZ d' kkk , oa fifyA
- thok.kq dk vkupf'kd i nkFZ %  
¼½ xqkI = ¼½ lyfTeM+ ¼½ thok.kq/ka ds Mh , u , dk ifrfyidj .k
- thok.kq/kaeai ztuu] vyfXd iztuu( f)fo[k.Mu] ephyu] , UMk. i kj fuekZ k] , DI k. i kj , oa i q/h fuekZ k( yfXd iztuu) l a ðeuA
- thokf.od i ksk.k , oa thok.kq/ka dk l d/kZ  
¼½ dkcü , oa ÅtkZ L=kr  
¼c½ ukbV/stu vksj [kfut  
¼ ½ dkcud of) dkjd  
¼n½ i ; kbj .kh; dkjd % rkieku] gkbM/stu vk; u l kUrka
- fpdfRI k egro ds thok.kq  
¼½ xE l o.khZ  
¼½ dks'kdk % LVfQykdskdkk] LVfVkdskdkk  
¼c½ cfl yh % fMIFkhj; k( fVVul  
¼½ xE vo.khZ  
¼½ dks'kdk % xksksj; k] esultkbfVI  
¼c½ cfl yh % Mk; fj; k  
¼½ ekbdksDVhfj; k % ri find] dðBjks  
, M+ vksj fgiV/kbfVI ¼ fgiV/kbfVI 'ci' dks i e[krk nrs gq ½  
¼½ dkj .k vfhkdrkZ  
¼½ l pj .k  
¼½ jks tudrk  
¼½ iz ks'kkyk funku] mi plj , oa cpko

bdkbz & III

tḥ rduhdh %

- 1 tḥ rduhdh dk bfrgkl ] {ks=} egRo] tḥ rduhdh ds iæf{k {ks= , oa Hkkjr ea tḥ rduhdh m | ksxA
- 2- thU LFkkuUrj.k dsokgd %ykrTeM vjg Hksth½ dks' kdk , oa Ård I ɔ/ kU dh ey/Hkr vo/kkj.kk, % gkbfcMkek rduhdh dh ey/Hkr vo/kkj.kk, %
- 3- ekukDykuh i frj {kk , oa muds vuiqz ksxA
- 4- i kdsj; ks/4 , oa ; wdsj; ks/4 thonb; d l ay; uA
- 5- i q; ksth Mh , u , rduhdh vjg bl ds vuiqz ksxA
- 6- thok.kq , oa vkuoḥ' kd vfhk; kfu=dh %doy cká j s[kh; Kku½ vkuoḥ' kd vfhk; kfu=dh dsykhk( i Hkkoḥ nqk/vuk, j , oavkuoḥ' kd vfhk; kfu=dh dk fu; euA
- 7- ijktuh %RU tḥud½ tUrq vjg tḥ rduhdh ea muds mi ; ksxA
- 8- Dyksux dk l f[kir y s[kk tk[kk( thukfed vuḥ dku & bl dh mi kns rk , oa vu&mi kns rkA
- 9- vkskf/k; ka ea tḥrduhdh] i-h- h-vkj-] ifr tḥod] Vhdj fd.od] foVkfell ] LVhj kWMt A
- 10- okrkoj.kh; tḥ rduhdh %/krqvjg i s/ky; e i kfr] uk'kd&tho fu; U= .k] vif'kV ty mipkjA
- 11- Hkktu] is vjg Ms jh l %e tḥodh %ckg; j s[kh; Kku½ fdf.or Hkktu mRi knu % Ms jh mRi kn] , Ydkgfyd is vjg fl jdk( l %etḥod foNfr , ɔ Hkktu ifjj {k.k.A

i k; kfxd & i k.kh foKku

l e; 5 ?k.Vs i wkkd 75 U; wre vad 27

1. बाह्य लक्षण एवं शारीरिकी

- (अ) हिरूडिनेरिया (जोंक) के बाह्य लक्षण, आहारनाल, तंत्रिका तन्त्र, उत्सर्जन एवं जनन तन्त्र।
  - (ब) पेलीमॉन के बाह्य लक्षण, उपांग, आहार नाल एवं तंत्रिका तन्त्र।
  - (स) यूनिओ और पाईला के बाह्य लक्षण, पेलियल अंग और तंत्रिका तन्त्र।
- ukv %ckg; y{k.k , oavkUrjfd 'kkjhfdh dks tglard l Hko gksfMftVy rduhdh ; k vl; fodYi ka }kjk v/; ; u fd; k tk; aA tc Hk fdl h thfor i k.kh dk vUrjfd 'kkjhfdh grq v/; ; u fd; k tk; s rks og ; k rks uk'kd gks ; k l ɔ) u dh gpl iztkfr gks ft l s i hMefgr v/; ; u fd; k tk; s A

2. सूक्ष्मदर्शीय स्लाइडों का अध्ययन :-

पेरिफेरा : साइकॉन का अनुदैर्घ्य एवं अनुप्रस्थ काट का अध्ययन

सीलेन्ट्रेटा : ओबीलिया- मेड्यूसा एवं पॉलिप, ओरीलिया के प्लेन्यूला, स्काइफीस्टोमा एवं एफाइरा लार्वा

प्लैटीहैलमिन्थीस : टीनिया एवं फेसिओला की देह का अनुप्रस्थ काट, टीनिया स्कोलेक्स, टीनिया के परिपक्व व ग्रेविड खण्ड, हैक्साकैथ, ब्लेडर वर्म और सिस्टिसरकस अवस्था।

फेसिओला के मिरासिडियम, स्पोरोसिस्ट, रेडिया एवं सरकेरिया लार्वा।

ऐस्केलिमन्थीज : ऐस्केरिस की देह, ग्रसनी परिपक्व नर व मादा का अनुप्रस्थ काट।

ऐनेलिडा : शरीर के विभिन्न भागों से नेरिस व जोंक का अनुप्रस्थ काट।

आर्थोपोडा : नॉप्लियस, जोइया, मेगालेपा एवं माइसिस लार्वा

मोलस्का : पाईला के गिल का अनुप्रस्थ काट, ग्लोकीडियम लार्वा

इकानोडर्मेटा : वृत्तपद।

III स्थाई आरोपण तैयार करना एवं उनका अध्ययन

प्रोटोजोओ : यूग्लीना, पेरामिशियम, पोलिस्टोमेला अथवा कोई फारेमिनिफेरा।

पेरिफेरा : कंटिकायें, स्पेन्जिन तन्तु, जेम्यूल

सीलेन्ट्रेटा : ओबीलिया मेड्यूसा

ऐनेलिडा : नेरीस के उपांग

आर्थोपोडा : साइक्लोप्स, डेफिनिया

मोलस्का : पाईला-गिल लैमिला, ऑस्फ्रेडियम, रेड्यूला, यूनिओ - गिल लैमिला

IV l %etḥodh %

- 1- l %e thoka ds fy; s l ɔ/kU ek/; e dk fuekzk , oa mi ; ksxA
- 2- [kk] inkFkka ea l %e thoka dk v/; ; uA
- 3- l %etḥodh; iz ks' kkykvk Ms jh] [kk] i d d j .k dkj [kkuk] fMLVhyjh] ikNfrd foKku l xgky; ka dk ikFkfed Kku , oa inkFkka ds l xg grq 'kkskf.kd Hke.kA l %e tḥodh vif'kV mipkj dh fof/k; kA fo | kFkz; ka l s mijkDr l LFkkuka ds voykdu dh fj i ks/z dk i Lnqhdj .k vi s {kr gA

v tUrq dkf; dh %

- 1- jDr ifrn'kz ea yky vjg 'or jDr dks' kdkvka dh x.kukA
- 2- jDr ifrn'kz ea ghekykscu dk eki uA
- 3- jDr ifrn'kz ea fge%ksØV oY; w dk eki uA
- 4- ; Nṛ ea , Utke fØ; k %dsvyst½ dk in'kzA
- 5- Lru/kkf; ka dh eq; vlr%ksh xlfk; ka dh Årdh; l jpuk dk LykbM @pkV@ekWYI @fMftVy rduhdh }kjk v/; ; u , oa mudh dk; dh; fo'kkrk, A

**VI tɔ j l k; u**

- 1- i k/hu] d k c k b M V , o a o l k d h i g p k u A
- 2- i j O k e v / s x t Q h d s f l ) k U r k a d k i n ' k i A

**VII I t h o i k . k h f o K k u & L F k u h ; i k N f r d v k o k l e a i k ; s t k u s o k y s v d ' l s d h ;**  
 t U r q / k a d k v / ; ; u A m u d s x e u j H k k s t u x g . k f o f / k l ' o l u j i f j l p j . k  
 o t u u d k i k N f r d v k o k l e a v / ; ; u A f o | k f F k z k a d k s b u v o y k d u k s  
 d h , d f j i k s / z c u k d j i k ; k s x d f j i k s / z d s l k F k i L r q d j u k g ' x k A L F k u h ;  
 v d ' l s d h ; t U r q / k a d s l j { k . k i j , d u k s / v k o ' ; d g s A

- uk s / % & (i) f o P N n u d s f y , i z O r t U r q d k ; z e a y a u s l s i m z ; g l f u f ' p r  
 d j y a f d t U r q o l ; t h o l j { k . k d s v l r x z i f r c l u / k r u g h a g A 1 / 2
- (ii) o s l h F k u t g k a i j t U r q l a x g k y ; i g y s l s g h m i y C / k g s o g k a u ; s l a x g k y ;  
 c f r n ' k z u g h a e a k ; s t k ; a r F k k v k o ' ; d r k i M e s i j p k V i l @ L y k b M I @  
 e k M Y I @ f p = o f m f t V y f o d Y i k a d k m i ; l s x f d ; k t k ; a A f t u l h F k u k a  
 e a i k . k h ' k k l = f o ' k ; u ; k [ k y k g s r F k k t U r q l a x g k y ; m u d s f o h k k x e a  
 m i y C / k u g h a g s o s p k V i l @ L y k b M I @ e k M Y I @ f p = r F k k f m f t V y f o d Y i k a  
 } k j k l a x g k y ; c f r n ' k z d k v / ; ; u d j o k ; a r F k k f o | k f F k z k a d h v U ; = f L F k r  
 t U r q l a x g k y ; k a d h H k e . k d j k o a A

**i k ; k s x d i j h { k k d h ; k s t u k**

I e ; 5 ? k . V s	U ; u r e m U k h z k k a d & 27	i w k k i d & 75
	fu; fer@i m z fo   k f k h z @ L o a i k B h	
1-	' k k j h f j d h ' p k V z @ e k M Y @ O k s / s x t Q @ l h M h d s } k j k 1 / 2	05
2-	L F k k b z v k j k i . k ' L y k b M I 1 / 2	06
3-	t U r q d k f ; z h d s i z l s x	08
4-	t ɔ j l k ; u d s i z l s x	08
5-	l i f e t f o d h d s i z l s x	05
6-	i k n ' k k a d h i g p k u , o a f v l i . k h 1 / 4 l s 8 1 / 2	16
7-	I t h o i k . k h f o K k u & i N f r e a i k f . k ; k a d s v / ; ; u d h f j i k s / z	07
8-	e k s [ k d	10
9-	f j d k M z	10
<b>d j y</b>		<hr/> 75

