

Syllabus and Course Scheme
Academic year 2018-19



Bachelor of Science- Zoology
Exam.- 2019

UNIVERSITY OF KOTA
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Kota - 324 005, Rajasthan, India
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University of Kota, Kota

B.Sc.- Pt-I (Zoology) Exam.

Scheme:

Paper	Duration	Max. Marks	Min. pass Marks
Paper I	3 hrs.	50	54
Paper II	3 hrs.	50	
Paper III	3 hrs.	50	
Practical	5 hrs.	75	27

B.Sc.- Pt-II (Zoology) Exam.

Paper	Duration	Max. Marks	Min. Pass Marks
I Animal Diversity (Part-2)	3 Hours	50	18
II Endocrinology and Ethology	3 Hours	50	18
III Animal Ecology and Biostatistics	3 Hours	50	18
Practical	5 Hours	75	27

B.Sc.- Pt-III (Zoology) Exam.

Paper	Duration	Max.Marks	Min. Marks
I. Animal Diversity(Part-III , Vertebrates) and Evolution	3 Hours	50	18
II. Mammalian Physiology and Immunology	3 Hours	50	18
III. Developmental Biology	3 Hours	50	18
Practical	5 Hours	75	27

B.Sc.- Pt-I (Zoology) Exam.

Scheme:

Paper	Duration	Max. Marks	Min. pass Marks
Paper I	3 hrs.	50	54
Paper II	3 hrs.	50	
Paper III	3 hrs.	50	
Practical	5 hrs.	75	27

Paper I- Animal Diversity Part-I (Protozoa to Annelida)

Duration : 3 Hours

Max. Marks : 50

The question paper comprises of three sections , 'A', 'B' and 'C'

- Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).
- Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).
- Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

Unit –I

Taxonomy: - Classification of Protozoa. Porifera, Coelenterata, Platyhelminthes and Nematoda up to order with examples. Fundamentals of body organization emphasizing symmetry, metamerism, coelome and levels of structural organization.

Unit –II

Protozoa: - Study of structural organization and life history of Trypanosoma and paramecium. Study of locomotion, osmoregulation, nutrition and reproduction in protozoa. Parasitism, pathogenecity and control in protozoans with special reference to Entamoeba, Giardia, Leishmania, Trichomonas and Plasmodium.

Unit-III

Porifera: - Habit, habitat, structure and function of Sycon. Types of canal system.

Coelenterata: - Habit, habitat, structure, function and life history of Aurelia.

Polymorphism in coelenterata, coral reef.

Ctenophora - Structural organization and affinities.

Unit IV

Platyhelminthes: - Structural organization and life history of Dugesia & Fasciola. Parasitic adaptation in Helminthes.

Nematyhelminthes: - Study of structure and life history of Dracunculus medinensis Nematode parasites and human diseases.

Unit-V

Classification of Annelida (up to subclass); metamerism and coelome in Annelida General account and types of Annelida (earthworm) structural organization, Physiology & life history of Hirudinaria, Trochophore larva.

Paper-II- Genetics and Biotechnology

Duration : 3 Hours

Max. Marks : 50

The question paper comprises of three sections ,'A','B' and 'C'

- Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).
- Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).
- Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

Unit-I

Mendelian Genetics: - Mendel's laws of inheritance. Monohybrid and dihybrid cross. Dominance. Incomplete dominance. Current status of Mendelism. Genetic variation: Variation in chromosome number (Euploidy and Aneuploidy).

Unit-II

Genetic disorders in Human beings (Down's, Turner's, Klinefelter's and Edward's syndrome) Types of chromosomal mutations. Molecular basis of gene mutation, mutagens, crossing over and linkage.

Unit- III

Sex-determination XX-XY. XO-XY and WZ mechanisms. Sex-linked inheritance (X-and Y-linked) Color blindness. Haemophilia. Gene interactions. Supplementary, complementary, epistasis and inhibitory. Multiple allele-ABO, Rh and MN blood groups and their inheritance, polymorphic genes.

Unit-IV

Gene structure (Recon. muton, cistron) and regulation of gene (lac operon: inducible and repressible system). Bacterial genetic transformation, Transduction and conjugation. Lytic and lysogenic cycle. Elementary idea about eugenics. Elementary idea about genetic engineering. Gene cloning and recombinant DNA technology (Vectors for gene transfers. Plasmids and phages). Restriction enzymes.

Unit V

Introduction. Historical prospective animal cell hybridoma, major areas and future prospects of biotechnology. Medicines and Biotechnology: Microbes in medicine, antibiotics, vaccine, antibodies, antigens.

Environmental Biotechnology: use of micro organisms in metal and petroleum recovery pest control. Waste treatment, Processing of industrial waste. Degradation of Xenophobic compounds including pesticides and surfactants. Surfactants, Surfactants and oil pollutants, Food and drink biotechnology, Ferment food dairy products. Food preservation microbial spoilage, alcoholic beverages, Vinegar. Monoclonal antibodies and their applications.

Paper III- Cell Biology, Biochemistry and Microscopy

Duration : 3 Hours

Max. Marks : 50

The question paper comprises of three sections, 'A', 'B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X 10 = 5 marks).

Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).

Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

Unit-I

- (a) Introduction, Discovery of cell, cell theory, golden period of cytology, prokaryotic and eukaryotic cell characteristics of animal cell.
- (b) Protoplasm:- History, physical characters, colloidal property, chemical composition and Biological characters of protoplasm.
- (c) Cell organelles: - Structure chemical composition and functions of plasma membrane, endoplasmic reticulum, Golgi apparatus, lysosome ribosome, mitochondria, nucleus and nucleolus.

Unit- II

- (a) Mitosis: - cell cycle, mitotic apparatus, centriole aster, and significance.
- (b) Meiosis: - Introduction, meiotic cycle, synapses of chromosomes, crossing over mechanism, Initiation and control of meiosis, significance.
- (c) Gametogenesis: - Introduction, spermatogenesis and oogenesis significance.

Unit III

- (a) Nucleic Acid: - Chemistry, Molecular model, Duplication, properties and functions of DNA, Types of RNA, Nucleic Acid as Genetic material.
- (b) Nucleic Acid synthesis: - Synthesised DNA, RNA biosynthesis of DNA and RNA. Genetic code, transcription and translation.
Protein synthesis: - Genetic code, transcription, translation, Role of RNA, Mechanism of protein-synthesis, Regulation of protein synthesis.

Unit –IV

- (a) Cell chemistry: - Nomenclature, classification, Action theory and specificity of Enzyme, enzyme activator, inhibitor, regulation and control of enzyme activity.
- (b) Cell metabolism: - Anabolic and catabolic process, metabolism of protein, carbohydrates and fats, ketone bodies.
- (c) Energy cycle: - Anaerobic and aerobic respiration, Energy transfer, redox, cytochrome-system.

Unit-V

- (a) Microscopy & cytological techniques: - Introduction, types of microscopes.
- (b) Autoradiography. (c) Isolation of cell components.

Zoology- Practical

General survey of Invertebrate (Spot & Slides)

(a) **Protozoa:** - Entamoeba, Polystomella, Monocystis, Euglena, Noctiluca Leishmania, Nyctotherus, Paramecium, Vorticella.

Porifera- Sycon, Hyalonema, Euplectella, Spongilla and Euspongia.

Coelenterate- Obelia colony (polyp & medusa) Physalia, Porpita, Aurelia, Rhizostom, Alcyonium, Corallium, Gorgonia, Pennatula, Madrepora.

Platyhelminthes-: Dugesia, Fasciola, Taenia, Schistosoma.

Nematode- Filaria, Dracunculus, Wuchereria, Enterobius

Annelida: - Neries (Heroneries with parapodia) Aphrodite, Arenicola, Pontobdella, Hirudinaria, Peripatus.

(b) Study of TS/LS of organs & developmental stages.

(i) **Porifera:** - T.S. of Sycon.

(ii) **Coelenterata-** Planula larva of jelly fish.

(iii) **Platihelminthes-** T.S of Fasciola, scolex of Taenia, mature & gravid segment of Taenia, Hexacanth, bladderworm & cysticercus stage of Taenia, miracidium, sporocyst, redia, cercaria larva of Fasciola.

(iv) **Annelida-** T.S through different region of leach & Nereis. Parapodia of Nereis and Heteronereis, trochophore larva.

(c) Dissection Through chart / model / Photograph / CD. – Hirudinaria –

Morphology, general anatomy, digestion, nervous & excretory and reproductive system.

Earthworm – Anatomy, morphology, digestive and nervous system.

(d) Mounting- (Permanent)

Protozoa – Euglena, Paramecium, Polystomella

Porifera- Spicules, fibres, gemmule

Coelenterata- Obelia medusa

Platyhelminthes – Taenia (proglotid)

Annelida – Nereis (parapodia)

Genetics:

Drosophila – life cycle and its culture. Identification of male and female and wild and mutants (yellow. Ebony body. Vestigial wings. White-eye and vestigial wings). Prepare slides of sex combs and salivary gland chromosomes of Drosophilae. Barr body of human chromosomes. Identification of blood group (ABO and Rh factors). Simple problems based on monohybrid / dihybrid cross.

(Note- use of animals for dissection is subject to the conditions that these are not banned under the wild life protection act.)

(e) Tests: -

Biochemistry

(1) Protein

(2) Fat

(3) Carbohydrate

(4) Catalases enzyme in animal tissue

Cell Biology

- (1) Cell permeability
- (2) Acetocarmin preparation of mitotic activity
- (3) Demonstration of mitochondria by using vital stain.
- (4) Demonstration of Bacteria by using Gram's stain.

(**Note**- Animals used in dissection are subject to the condition that these are not banned under the wild life protection act.)

PRACTICAL

Distribution of marks	Regular/Private / Ex.	
1. Dissection - Through chart / model / Photograph / CD		10
2. Slide preparation		7
3. Cell Biology		6
4. Bio chemistry		6
5. Genetics		6
6. Spots (10)		20
7. Record		10
8. Viva-voce		10
Total		75

izk.kh foKku& izFke o"KZ

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	le;	vf/kdre vad	U;wure vad
1- iz'u i= 1	3 ?kaVs	50	
2- iz'u i= 2	3 ?kaVs	} 50	150
3- iz'u i= 3	3 ?kaVs		50
izk;ksfxd	5 ?kaVs	75	27

**iz'u i= 1 % tUrq fofokrk&Hkx&1 ¼izksVkstksvk ls ,uhfyMk rd½
le; vof/k & 3 ?kaVs iw.kkZad
& 50**

iz'u i= rhu [k.Mksa ¼,] ch] lh½ +dk gksxkA

[k.M&, % Nk=ks dks iz'u la;k 1 ds lHkh nl Hkx ¼izR;sd bdkbZ esa ls nks
iz'u ½

yxHkx 20 'kCnksa esa gy djus gkasxs A
¼1/2 X 10 = 5 vad½

[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250
'kCnksa dh lhek esa dqya

ikjp iz'u gy djus gkasaxsA ¼5 X 5 = 25

vad½

[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dksbZ nks iz'u 500 'kCnksa es gy
djus gksaxsA

¼10 X 2 = 20
vad½

bdkbZ & 1

ofxZdh & izksVkstksvk] iksjhQsjk] flysUV^asVk] lysVh&gSyfeUFkhl vkSj
fuesVksMk dk oxhZdj.k mnkgj.k lfr vkWMZj ¼x.k½ rd A lefey nsgxqgk] /kzqork
,oa lajpukRed laxBu ds Lrj ij tksj nsrs gq, 'kkjhfd laxBu ds vk/kkjHkwr A

bdkbZ & 2

iSjkeh'k;e vkSj fV^aisukslksek dk thou pØ vkSj lajpukRed laxBu dk v;;u
AizksVkstksvk esa pyu] ty larqyu ¼vksLeksa&jxqysa'ku½]iks"k.k vkSj tuu dk
v;;uA,UBvehck] thvkfMZ;k] yks'kesfu;k] V^akbdkseksukl o lykLeksfM;e ij fo'ks"k
lanHkZ j[krs gq;s izksVkstksvk esa ijthou;kiu] jksx&tudrk o fu;a=.k A

bdkbZ & 3

iksjhQsjk & lk;dksu dk vkokl & O;ogkj] lajpuk o dk;Z] uky ra= ds izdkj A
lhysUV^aksVk & vksjsfy;k dk vkokl&O;ogkj] lajpuk] dk;Z ,oa thou pØ] flysUV^asVk
esa cgq;irk A izoky fHkUkh¼ew;xs dh pV~Vku½A VhuksQksjk & lajpukRed
laxBu vkSj lehir A

bdkbZ & 4

lysVhgsfYeUFkl & M;wxsf;l;k] Qsflvksyk ,oa Vhfu;k dk lajpukRed laxBu vkSj thou
pØ A gfYeFl ¼d`fe½ esa ijthoh vuqdwyu A
fuesFkhfYeFkhl % fuesVksMk dk lkekU; laxBu A M^asdqudqyl esfMusfUll vkSj
owpsjsfj;k dh lajpuk vkSj thou pØ dk v;;u A
fuesVksMk % ijthoh vkSj ekuo jksx A

bZdkbZ & 5

,susfyMk dk oxhZdj.k $\frac{1}{4}$ mioxZ rd $\frac{1}{2}$ (,susfyMk esa le[k.MhHkou vkSj nsgxqgk(lkekU; fooj.k vkSj izk:i $\frac{1}{4}$ dsapqvk $\frac{1}{2}$] fg:fMusfj;k dk lajpukRed laxBu] dkf;Zdh vkSj thou pdz(V^aksdksQksj Hkkj.k A

iz'u i= 2 % vuqokaf'kdh ,oa tSo rduhdh

le; vof/k & 3 ?kaVs

iw.kkZad & 50

iz'u i= rhu [k.Mksa $\frac{1}{4}$,] ch] lh $\frac{1}{2}$ ++dk gksxkA

[k.M&, % Nk=ks dks iz'u la[;k 1 ds lHkh nl Hkkx $\frac{1}{4}$ izR;sd bdkbZ esa ls nks iz'u $\frac{1}{2}$

yxHkx 20 'kCnksa esa gy djus gkasxs A

$\frac{1}{4}1/2 \times 10 = 5$ vad $\frac{1}{2}$

[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250

'kCnksa dh lhek esa dqya

ikip iz'u gy djus gkasaxsA

$\frac{1}{4}5 \times 5 = 25$

vad $\frac{1}{2}$

[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dksbZ nks iz'u 500 'kCnksa es gy djus gksaxsA

$\frac{1}{4}10 \times 2 = 20$

vad $\frac{1}{2}$

bZdkbZ & 1

esUMsfy;u vkuqokaf'kdh % esUMy ds fu;e] ,d ladj laadj.k rFkk f}ladj ladj.k] izHkkfodrk] viw.kZ izHkkfodrk] esUMsfy;u dh orZeku fLFkfr] vkuqokaf'kd fofHkUurk,a] xq.klw=ksa dh la[;k esa fofHkUurk,a $\frac{1}{4}$;wlykWbMh vkSj ,U;wlykWbMh $\frac{1}{2}$

bZdkbZ & 2

ekuo esa vkuqokaf'kdh foiFkku $\frac{1}{4}$ MkmUl] VuZj] DykbuQsYVj o ,MoZM flaM^akse $\frac{1}{2}$] dzkekslkse mRifjorZu ds izdkj] thu mRifjorZu dk vkf.od vk/kkj rFkk mRifjorZd] dzkflax vksoj rFkk lgyXurk A

bZdkbZ & 3

fyax fu/kkZj.k xx - xy - xo - xy rFkk wz fdz;kfof/k] fyax lgyXu vkuqokaf'kdh $\frac{1}{4}$ x rFkk y esa lgyXu $\frac{1}{2}$ o.kkZU/krk] fgeksfQfy;k] thu lgfdz;k] iwjd] laiwjd] ,ihLVsfill ,oa bughchVjh rFkk ikWyhekWjfQd thUl cgqfodYih vyhy ABO, Rh rFkk MN jDr lewg RkFkk mudh vuqokaf'kdrk A

bZdkbZ & 4

vk.kfod vkuqoaf'kdh thu lajpuk $\frac{1}{4}$ jsdku] E;wVku] filLV^aku $\frac{1}{2}$ rFkk thu fu;a=.k $\frac{1}{4}$ ysd vkWijisu izsfjr rFkk fjlsfIVcy $\frac{1}{2}$ A thok.kq&vkuqokaf'kdh] V^akUIQkesZ'ku] V^akUIMD'ku] rFkk la;qXeu] ykbZfVd rFkk ykbZlkstsfud pdzAlqtufudh ds ckjs esa vkjafHkd Kku A

vkuqokaf'kd vfHk;kaf=dh ds ckjs esa vkjafHkd Kku A thu Dyksfuax rFkk fjdkfEcusUV $\frac{1}{4}$ iquZ;ksth $\frac{1}{2}$ rduhdh A $\frac{1}{4}$ thu LFkkukarj.k ds fy;s okgd(lykfTeM RkFkk Qst+st $\frac{1}{2}$ jsfLV^aD'ku fd.Mod A

bZdkbZ & 5

ifjp;% izk.kh dksf'kdk ladj.k dk bfrgkl] tSo rduhdh ds eq[; {ks= rFkk Hkfo"; ds vk;ke
 A tSo rduhdh rFkk vkS"kf/k;ksa esa lq{e tho] ,UVhck;ksfVd $\frac{1}{4}$ izfrtSo $\frac{1}{2}$] Vhdk]
 izfrj{kh izfrtu] i;kZoj.kh; tSo rduhdh] /kkrq rFkk isV^aksfy;e iquZizkflr] isLV fu;a=.k
 vif'k"Vh mipkj] vkS|ksfxd vif'k"Vh dk izlk/ku esa lw{e thoksa dk mi;ksx A
 ljQDVsuV ,oa ifLVlkbM lfgr thuksa ck;ksfVd ;kSfxdksa dk vi?kVu A ljQsDVsuV
 rFkk rsy iznw"kd] [kk] ifjj{k.k] lw{e tSfod Likbyst] vYdksgkWyh is;] fljdk]
 eksuksDyksuy ,UVhckWMh rFkk muds vuqiz;ksx A

iz'u i= 3 % dksf'kdk foKku] tSo jlk;u ,oa lw{enf'Zkdh

le; vof/k & 3 ?kaVs

iw.kkZad

& 50

iz'u i= rhu [k.Mksa $\frac{1}{4}$,] ch] lh $\frac{1}{2}$ ++dk gksxkA

[k.M&, % Nk=ks dks iz'u la[;k 1 ds IHkh nl Hkkx $\frac{1}{4}$ izR;sd bdkbZ esa ls nks
 iz'u $\frac{1}{2}$

yxHkx 20 'kCnksa esa gy djus gkasxs A

$\frac{1}{4}1/2 \times 10 = 5$ vad $\frac{1}{2}$

[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250

'kCnksa dh lhek esa dqya

ik;p iz'u gy djus gkasaxsA

$\frac{1}{4}5 \times 5 = 25$

vad $\frac{1}{2}$

[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dksbZ nks iz'u 500 'kCnksa es gy
 djus gksaxsA

$\frac{1}{4}10 \times 2 = 20$

vad $\frac{1}{2}$

bdkbZ & 1

v- dksf'kdk ifjp;] vkfo"dkj] dksf'kdk fl)kar] dksf'kdk foKku dk Lo.kZ;qx]
 izksdSfj;ksfVd

,oa ;wdSfj;ksfVd dksf'kdk] tUrqdksf'kdk dh yk{kf.kd fo'ks"krk,a A

c- thonzO; & bfrgkl] HkkSfrd] dkWyksbfM;y xq.k/keZ ,oa jklk;fud laxBu rFkk
 thonzO;

ds tSfod xq.k/keZ A

l- dksf'kdk vaxd & lykTekdyk] vUr%izn~oh; tkfydk] xksYthdk;] yk;lkslkse]
 jkbckslkse]

ekbVksdksfUM^a;k] dsUnzd ,oa dsfUnzdk dk jklk;fud laxBu] jpuk ,oa dk;Z A

bdkbZ & 2

v- lw=h foHkktu & dksf'kdk pdz] lelw=h midj.k] lsUV^ahvksy ,oa ,LVj] egRo A

c- v)Zlw=h foHkktu & ifjp;] v)Zlw=h pdz] fluSfll] thu fofue; $\frac{1}{4}$ dzksflax vksoj $\frac{1}{2}$ dh
 fØ;kfof/k] izkjEHk ,oa fu;a=.k] egRo A

l- ;qXed tuu & ifjp;] 'kqdzk.kqtuu ,oa v.Mtuu] egRo A

bdkbZ & 3

- v- U;wfDyd vEy & jklk;fudh] vk.kfod ekWMy] f}xq.ku] Mh-,u,- ds xq.k/keZ ,oa dk;Z vkj-,u,- ds izdkj] U;wfDyd vEy vkuqokaf'kd inkFkZ ds :i esa A
- c- U;wfDyd vEy la'ys"k.k & Mh-,u,- o vkj-,u,- dk la'ys"k.k] l;wjhu] ikbfjefMu o Mh vkDIhjbcks U;wfDy;ksVkbZM~l dk tSo la'ys"k.k A
- l- izksVhu la'ys"k.k & vkuqokaf'kd dwV] vuqd`fr o vuqokn] vkj-,u,- dh Hkwfedk] izksVhUI la'ys"k.k dh fdz;kfo/kh ,oa fu;eu A

bdkbZ & 4

- v- dksf'kdk jklk;fudh & ukekadj.k] fd.odksa dk oxhZdj.k] fdz;kfof/k ds fl)kar] fd.od fof'k"Vrk] lfdz;d] Inaed] fd.od fdz;kfof/k dk fu;eu ,oa fu;a=k A
- c- dksf'kdk mikip; & vi;ph o mip;h fdz;k,a] izksVhUI] dkcksZgkbMsV~l o olkvksa dk mikip;] dhVksu dk;
- l- ÅtkZ pdz & vkWDIh o vuvkWDIh 'olu] ÅtkZ LFkkukarj.k] fjMkWDI o lkbVksdzkse ra= A

bdkbZ & 5

- v- ekbZdzksLdksih rFkk dksf'kdh; rduhdsa & ifjp;] lw{enf'kZ;ksa ds izdkj A
- c- LojsfM;ks/kfeZrk A
- l- dksf'kdk la?kVdksa dk foyxu ¼i`FkDdj.k½ A

izk;ksfxd

- I. vd'ks:dh dk lkekU; losZ{k.k ¼izkn'kZ o LykbM½ %
- 1- izksVkstksvk & ,UVvfeck] iksfyLVksesyk ¼;k dksbZ Hkh QksjesuhQsjk ½ eksuksflLve] ;qfXyuk] uksDVhyqdk] yh'kesfu;k] fuDVksFksjl] isjkeh'k;e] oksjfVlsyk A
 - 2- iksjhQsjk & lk;dkWu] gk;yksfuek] ;qlysDVsyk] LikWftyk ,oa ;qLikWfUt;k A
 - 3- flysUV^asVk & vkscsfy;k dksyksfu ¼iksfyi vkSj esMwik½] Qk;lsfy;k] ikWjfiV] vksjsfy;k] jkttksLVksek] vyflvksfu;e] dksjfy;e] xkjxsuh;] isuUVyk] esM^ahiksik] esV^ahfM;e A
 - 4- lysVhgsyfeUFkl & Mqtsfl;k] Qslhvksyk] fVuh;k] flLVkslksek A
 - 5- fuesVksMk & fQysfj;k] M^asdudqyl] ,ulk;yksLVksek ¼oqpsfj;k½] ,UVhjksfcvkl A
 - 6- ,usfyMk & usjht ¼gsVsjksusjhl ikn lfgr½] ,ÝksMkbV] ,jsuhdksyk] isaVksCMsyk gh:Mhusfj;k] isjhisV~l ¼vks;kudksQksjk½ A
- II. vaxks ,oa ifjo/kZu voLFkkvksa ds dkV dk v/;u %
- 1- iksjfjQsjk&Ldk;Qk dk dkV A
 - 2- flysUVjsVk & tsyh fQ'k ds lysuqyk Ldk;QhLVksuk ,oa bfQjk ykjok ¼vkSjafy;k½
 - 3- lysfVgsyfeUFkl & fVuh;k ,oa Qsflvksyk ds vuqizLFk dkV] fVuh;k dk LdksysDI] fVuh;k ds ifjid o xzsfoM [kaM] gsDtkdsUFk] CysMjoeZ ,oa Vhuh;k ds flVhljdl voLFkk;] Qsflvksyk fejlflM;e] LiksjsfllV] jsMh;k ,oa ljdsfj;k ykjok A

4- ,usfyMk & yhp ,oa usjht ds fofHkUu {ks=ksa ds vuqizLFk dkV A usjht ,oa gsVsjsksusjht dh ik'oZ ikn] V^aksdksQksj ykjok A

III. foPNsnu % & pkVZ @ ekWMy @ QksVksxzkQ @ lh-Mh- }kjk v/;;u

- 1- fg:fMusfj;k
ckg~; y{k.k] lkekU; vkarfjdh] ikpu] raf=dk] mRltZu ,oa tuu ra= A
- 2- dsapqvk & ckg~; y{k.k] lkekU; vkarfjdh] ikpu ,oa rkaf=dk ra= A

IV. vkjksi.k & fuez ds LFkk;h vkjksi.k %
izksVkstksvk & ;qXyhuk] isjkfef'k;e] iksfyLVksesyk ;k vU; QksjfeuhQsjk A
iksjsQsjk & LihD;wyl] Qk;clZ] tsE;wy A
flysUVsjsVk & vkscsfy;e esMqlk A
lysfVgsyfeUFkl & Vhuh;k ¼izksXyksfVM½
,susfyMk & usjht & ikōZikn

v. vkuqaokf'kdh %

M^akslksfQyk & thou pdz ,oa bls lao/kZu dk Kku] uj ,oa eknk ,oa taxyh rFkk mRifjofrZr M^akslksfQyk dh igpku ¼ihys ,oksuh 'kjhj] vo'ksaih ia[k] IQsn us=½ vo'ksih mRifjofrZr] M^akslksfQyk dh lsDI dkWEc o ykj xzfUFk dh LykbM dk fuekZ.k] xq.klw=] ekuo xq.klw= dh ckj ckWMh A jDr oxZ dh igpku ¼, ch vks o vkj ,p dkjd½ ,dy ladj o f}ladj ij vk/kkfjr lly leL;k,a A
¼uksV % foPNsnu ds fy, iz;qDr tUrq dk;Z esa ysus ls iwoZ ;g lqfuf'pr dj ysa dh tUrq oU; tho lja{k.k vf/kfu;e ds vUrxZr izfrcfU/kr ugha gS A½

VI. ijh{k.k %

dksf'kdk foKku@tSo jlk;u

- v- izksVhu & ckb;qjsV ijh{k.k
- c- olk & lqMku IV ijh{k.k
- l- dkcksZgkbM^asV & csusfMDV ijh{k.k

n- izk.kh Ård esa dsVsyst ,Utkbe

;- dksf'kdkdyk ijxE;rk] lelw=h dksf'kdh; foHkktu dh ,lhVksdehZd fuekZ.k A

j- ekbVksdksfUM^a;k dk tSfod vfHkjatu dj] izn'kZuA

y- xzke /kukRed ,oa xzke _.kkRed thok.kq dk vfHkjatu dj] izn'kZu

uksV % foPNsnu ds fy, iz;qDr tarq dk;Z esa ysus ls iwoZ ;g lqfuf'pr dj ysa fd tarq oU; laj{k.k

vf/kfu;e ds vUrxZr izfrcfU/kr ugha gS A

izk;ksfxd

vadksa dk forj.k %

fu;fer@Lo;aikBh@iwoZ Nk=

- 1- foPNsnu pkVZ@ekWMy@QksVksxzkQ@lh-Mh- }kjk 10
- 2- LykbM cukuk & 07
- 3- dksf'kdk foKku 06

4- tSo jlk;u	06	
5- vkuqokaf'kdh		06
6- izkn'kZ ¼10½	20	
7- jsdkMZ	10	
8- ekSf[kd	10	
;ksx	75	

B.Sc. (Part II) - Zoology

(Scheme for Examination) – 2018

Paper	Duration	Max. Marks	Min. Pass Marks
I Animal Diversity (Part-2)	3 Hours	50	18
II Endocrinology and Ethology	3 Hours	50	18
III Animal Ecology and Biostatistics	3 Hours	50	18
Practical	5 Hours	75	27

225

PAPER-I : ANIMAL DIVERSITY (Part-2) **Arthropoda to Protochordata**

Duration : 3 Hours

Max. Marks : 50

The question paper comprises of three sections ,'A','B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each

unit) in about 20 words (1/2 X10 = 5 marks).

Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).

Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

Unit – I - Arthropoda

1. General characters and classification of phylum - Arthropoda up to subclass.
2. Habit, habitat, external features, appendages, digestive, respiratory, circulatory, excretory, reproductive and nervous system and sense organs of scorpion & prawn (*Palaemon*).
3. Larval forms of Crustacea.
4. Metamorphosis in Insects.

Unit – II- Mollusca

1. General characters and classification phylum - Mollusca upto subclass.
2. Habit, habitat, external features, coelom, general anatomy, digestive, respiratory, circulatory, excretory, reproductive systems, of snail (*Pila*) and unio.
3. Torsion in Gastropoda.
4. Larval forms of Mollusca.

Unit – III - Echinodermata

1. General characters and classification of phylum-Echinodermata upto subclass.
2. Habit, habitat, symmetry, external features, coelom, general anatomy, digestive, respiratory, circulatory, excretory, water vascular, reproductive, nervous system and sense organs of star fish (*Asterias*).
3. Larval forms of Echinodermata.
4. Autotomy and regeneration in Echinoderms.

Chordata : Primary chordate characters, invertebrate chordates (Protochordata), concept of invertebrate and nonchordates.

Hemichordata :

1. General characters and classification of Hemichordata.
2. Habit, habitat, external features, coelom, body wall, digestive, skeletal, respiratory, circulatory, excretory, nervous and reproductive system and sense organs of *Balanoglossus*.
3. Tornaria larva.
4. Affinities of Hemichordata.

Unit - IV

Urochordata and

1. General characters and classification upto class level.
2. Habit, habitat, general anatomy and various systems, including sense organs of *Herdmania*.
Ascidian tadpole and its metamorphosis; affinities of Urochordata.

Cephalochordata:

3. Habit, habitat, general anatomy and various systems, including sense organs of *Branchiostoma* (Amphioxus).
4. Affinities of Cephalochordata.

Unit - V

Applied Animal Science :

1. Harmful and beneficial insects.
2. Apiculture, lac-culture and sericulture.
3. Aquaculture : Prawn and molluscan fisheries; pearl culture.
4. Frontier areas of animal cell, tissue and organ culture; cloning and tissue - engineering.

PAPER-II : ENDOCRINOLOGY AND ETHOLOGY

Duration : 3 Hours
: 50

Maximum Marks

The question paper comprises of three sections , 'A', 'B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).

- Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).
- Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

UNIT : I

Endocrinology : Introduction, basics and functions

1. Glands : Exocrine and endocrine; Secretions : Autocrine and paracrine.
2. Hormones : Chemical nature and properties, role in homeostasis.
3. Structure and functions of major endocrine glands : Pituitary, thyroid, parathyroid, adrenal gland, pancreas; their hormones, role and abnormalities due to hyposecretion and hypersecretion.
4. Structure and functions of minor endocrine glands : Thymus, pineal, GIT, kidney, heart; endocrine glands in insects; their hormones and role.

UNIT : II

Endocrinology : Control and regulation of secretion and molecular mechanism

1. Regulation of hormone secretion; positive and negative feedback control mechanism.
2. Extra cellular and intracellular receptors.
3. Second messengers : Cyclic AMP, PIP₂, IP₃, DG, G-protein, protein kinase and role of Ca⁺⁺ as messenger; cell signalling; amplification of signal.
4. Molecular mechanism of insulin action .

UNIT : III

Endocrinology : Role in reproduction

1. Hormones from testis, ovary and placenta, their structure and functions.
2. Importance of hormones in sexual differentiation in embryo.
3. Hormonal control of menstrual cycle, implantation, pregnancy, parturition and lactation.
4. Different types of contraceptives, their composition and effects.

UNIT : IV

Ethology : Introduction and basics

1. Introduction and history of behaviour, approaches and study of animal behaviour (ecological, physiological, evolutionary and neural methods) MRI and CAT scan.
2. Genetic basic of animal behaviour and evolution of ethology.
3. Biological clock; circadian and circannual rhythms.
4. Learning and imprinting, instinct behaviour.

UNIT : V

Ethology : Areas of behaviour

1. Searching of food : Honey bee, rhesus monkey and langoor.
2. Social behaviour and organization : Honey bee, termite, mammals (black-buck and monkeys).
3. Communication, fights and alarm call : Vocal, visual, tactile, olfactory and acoustic; honey bee language; pheromonal and hormonal basis of

- aggression, brain hormone relation in sexual behaviour.
4. Migration in fishes and birds. Orientation : Taxes and kinesis.

PAPER - III : ANIMAL ECOLOGY AND BIOSTATISTICS

Duration : 3 Hours

Maximum Marks : 50

The question paper comprises of three sections , 'A', 'B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).

Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).

Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

UNIT - I

'Ecology' as a science, its meaning and history. Modern concept, scope, components of ecosystem, abiotic physical factors : temperature, light, water, soil and soil profile, current, pressure, gravity, biotic factors, intraspecific and interspecific relation, concept of limiting factors; Liebig's law of minimum, Shelford's law of tolerance, modern concept, importance.

UNIT - II

Population ecology : Determination of population density, factors affecting population density, demography, community ecology, characteristics of bio-community, interdependence for reproduction and protection , ecosystem homeostasis, ecosystem and productivity concept, its types and methods, energy flow, food chain and food web in ecosystem, ecological pyramids, ecological niche.

UNIT - III

Aquatic ecology, fresh water lotic and lentic fresh water habitat, fresh water biota, marine habitat, zonation, marine water biota, ecology and biota of deep sea zone, estuarine habitat and biota, terrestrial habitat, forest and desert ecosystem and biomes, ecology and human future, growth rate, role of man in modification of natural communities.

UNIT - IV

Natural resources, renewable resources (forest/wild life), non-renewable resources (water, mineral resources), aqua-culture and Mariculture, conservation, management of natural resources - renewable resources, non-renewable resources, environmental pollution, types (water, air, soil, pollution by insecticides, noise). Basic concepts of bioaccumulation, biomagnification, and biodegradation of pollutants, impact of urbanization, characteristics of urbanization in India, urban problems.

UNIT - V

Functions and importance of biostatistics, frequency - distribution, presentation of data, mean, mode, median, deviation, error, probability-distribution, correlation, significance-tests, biostatistical analysis of gene distribution in populations.

ZOOLOGY PRACTICAL SYLLABUS

1. Study of animal diversity through museum specimens :-

Arthropoda - *Peripatus* , *Limulus*, spider, *Lepas*, crab, lobster, *Balanus*, *Saculina*, *Lepisma*, moth, butterfly, rice weevil, centipede, millipede, locust, cyclops.

Mollusca - *Chiton, Neopilina, Patella, Aplysia, Dentalium, Ostrea, Teredo*, slug, *Loligo, Octopus, Nautilus, Mytilus*, pearl oyster.

Echinodermata - *Antedon, Cucumaria, Echinus, Astropecten, Ophiothrix, Holothuria*.

Invertebrate chordates - *Balanoglossus, Herdmania, Doliolum, Salpa, Oikopleura, Amphioxus*.

2. Study of sections of organs and developmental stages :

Arthropoda - Larval stages of crustacea and insecta - *Nauplius, Zoea, Megalopa, Mysis, Cypris* larva, mosquito larvae and instars of flies. Book lung, trachea, malpighian tubule, pectins (scorpion),

Mollusca - Veliger and glochidium larvae. Sections of unio through different regions, unio gill T.S.

Echinodermata - Pedicellaria, pluteus larva, bipinnaria larva.

Hemichordata - T.S. through proboscis, collar and trunk regions of *Balanoglossus*, tornaria larva.

Urochordata : Pharyngeal wall, spicules and tadpole larva of *Herdmania*.

Cephalochordata: T.S. of *Branchiostoma* through oral hood, pharynx, gonads and caudal region.

3. Dissections : Through Chart / Model / Photograph / CD

a. Major -

Palaemon - digestive and nervous system.

Scorpion - digestive, reproductive and nervous system.

Pila - general anatomy, nervous system.

Unio - nervous system.

b. Minor -

Palaemon - hastate plate, appendages, alimentary canal and statocyst.

Scorpion - appendages, book lungs.

Pila - gill lamella, radula, osphradium and pallial complex.

Unio - gill lamella and pallial complex.

4. Permanent slide preparation/mounting :

Daphnia, cyclops, crustacean larvae, book lung of scorpion, statocyst and hastate plate of prawn, Mouth parts, wings, appendages and salivary glands of cockroach and wasp gill lamella, radula and osphradium of *Pila*, gill lamella of unio, glochidium larva; spicules and pharyngeal wall of *Herdmania*, W.M. of *Branchiostoma*.

5. Endocrinology :

- Demonstration of major endocrine glands using models/ charts / computer software.
- Histological slides of major endocrine glands (pituitary, thyroid, parathyroid, adrenal glands, testes, ovary, pancreas), kidney, insect endocrine glands.

6. Ethology :

- Thigmotactic, phototactic and chemotactic response of *Paramecium*.
- Antennal grooming in cockroach.
- Phototactic response in *Tribolium* and *earthworm*.
- Chemotactic response of Cockroach and Ant. (using synthetic pheromone)

7. Ecology (Environment) :

- Water analysis, pH, acidity, alkalinity, dissolved O₂ and free CO₂, chloride (salinity)

- b. Soil analysis - pH.
- c. Qualitative estimation of zooplanktons in a given sample of water (permanent slide preparation of zooplanktons).

8. Biostatistics :

- a. Frequency tables, bar diagrams, histograms, polygons, pie charts.
- b. Exercises on mean, median and mode.
- c. Standard error of mean and standard deviation.

Note: Animals used for practical work must not be banned under the wild life protection act.

B.Sc. (Part-II) - Zoology Practical - Distribution of Marks

Regular / Non-collegiate /Ex-students

1.	Dissection - Through Chart / Model / Photograph / CD	10
2.	Dissection - Through Chart / Model / Photograph / CD	05
3.	Slide Preparation	05
4.	Ecological	05
5.	Ethological exercise	05
6.	Biostatistics	05
7.	Spots (10)	20
8.	Record	10
9.	Viva-voce	10_____
	Total	75 _____

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¼ijh{kk dk çk:i½ & 2019

ç'ui=	vof/k	iw.kkZad	U;wure
mÙkh.kkZad			
I tUrq fofu/krk ¼Hkkx&2½	3 ?kUVs	50	18
II var%lzkfodh ,oa O;kogkfjdh	3 ?kUVs	50	18
III izk.kh ifjfLFkfrdh ,oa tSo&lkj[f;dh		3 ?kUVs	50
18			
çk;ksfxd	5 ?kUVs	75	27

**iz'ui=&izFke % tUrq fofu/krk ¼Hkkx&2½ vkFkkZsiksMk Is
izksVksdkWMSZVk**

le; vof/k & 3 ?kaVs iw.kkZad
 & 50
 iz'u i= rhu [k.Mksa ¼,] ch] lh½ dk gksxkA
 [k.M&, % Nk=ksa dks iz'u la[;k 1 ds IHkh nl Hkkx ¼izR;sd bdkbZ esa Is nks
 iz'u½ yxHkx
 20 'kCnksa esa gy djus gkasxs ¼1/2 X10 =
 5 vad½sA
 [k.M&ch % Nk=ksa dks izR;sd bdkbZ Is ,d iz'u p;u djrs gq,s 250
 'kCnksa dh lhek esa dqya
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 vad½A
 [k.M&lh % Nk=ksa dks pkj iz'uksa esa Is dksbZ nks iz'u 500 'kCnksa eas gy
 djus gksaxs
 ¼10 X 2 = 20 vad½A

bdkbZ & I

vkFzkksZiksMk %

1- la?k vkFzkksZiksMk ds lkekU; y{k.k ,oa oxhZdj.k ¼mioxZ rd½A

2- fcPNw vkSj izkWu ¼isyhekWu½ ds LoHkko] vkokl] ckáy{k.kksa] mikaxksa] ikpu] 'olu]

ifjlapj.k] mRltZu] tuu rFkk raf=dk ra= vkSj laosnkaxA

3- dzLVsf'k;k ds ykjok izk#iA

4- dhVksa esa dk;kUrj.kA

bdkbZ & II

eksyLdk %

1- la?k eksyLdk ds lkekU; y{k.k ,oa oxhZdj.k ¼moixZ rd½A

2- ?kksa?ks ¼ikbyk½ vkSj ;wfuvks ds LoHkko] vkokl] ckáy{k.kksa] lhykse] lkekU; 'kkjhfdh]

ikpu] 'olu] ifjlapj.k] mRltZu] tuu] raf=dk ra= ,oa laosnkaxA

3- xSLV^aksiksMk esa ?kw.kZu ¼,saBu½A

4- eksyLdk ds ykjok izk#iA

bdkbZ & III

bdkbudsMesZVk %

1- la?k bdkbudsMesZVk ds lkekU; y{k.k vkSj oxhZdj.k ¼mioxZ rd½A

2- flrkjk eNyh ¼,LVsfj;kl½ dk LoHkko] vkokl] ckáy{k.k] ikpu] 'olu] ifjlapj.k] mRltZu] tylaogu] tuu

vkSj raf=dk ra= ,oa laosnkaxA

3- bdkbZuksMesZVk ds ykjok izk#i A

4- bdkbudsMesZVk esa LoPNsnu ,oa iqu#n~Hkou A

dkWMsZVk %

izkFkfed dkWMsZV y{k.k] vd'ks#dh dkWMsZV] vd'ks#dh vkSj ukWu dkWMsZV dh vo/kkj.kkA

gsehdkWMsZVk %

1- la?k gsehdkWMsZVk ds LkkeU; y{k.k ,oa oxhZdj.k A

2- csysuksXykWll dk LoHkko] vkokl] ckáy{k.k] lhykse] nsgfHkfÜk] ikpu] dadky] 'olu] ifjlapj.k] mRltZu] tuu

vkSj raf=dk ra= ,oa laosnkaxA

3- VkWusZfj;k ykjokA

4- gsehdkWMsZVk dh ca/kqrk,iA

bdkbZ & IV

;wjksdkWMsZVk %

1- lkekU; y{k.k vkSj oxhZdj.kA

2- gMZekfu;k dk vkokl] LoHkko] lkekU; 'kkjhfdh vkSj fofHkUu ra=] laosnkaxksa ds

lfgr]

,lhfM;u VsMiksy vkSj bldk dk;kUrj.k] ;wjksdkWMsZVk dh ca/kqrk,iA

flQsyksdkWMsZVk %

3 lkekU; y{k.k vkSj oxhZdj.kA

4- cSzaFd;ksLVksek ¼,EQhvkWDll½ dk vkokl] LoHkko] lkekU; 'kkjhfdh vkSj fofHkUu

ra= laosnkaxksa ds lfgr] flQsyksdkWMsZVk dh ca/kqrk,iA

bdkbZ & V

vuqiz;qä tUrq foKku %

- 1- gkfudkj d vkSj ykHknk;d dhVA
- 2- e/kqeD[kh ikyu] yk[k&lao/kZu vkSj js'kedhV ikyu A
- 3- tylao/kZu % >haxk vkSj eksyLd fQ'kjht A
- 4- eksrh laoZ/ku A
- 5- dksf'kdk] mrd vkSj vax lao/kZu ds vxzLFk {ks=} Dyksfuax vkSj mrd&vfHk;kaf=dhA

iz'ui=&f}rh; % vUr%lzkfodh ,oa O;kogkfjd

le; vof/k & 3 ?kaVs iw.kkZad & 50

iz'u i= rhu [k.Mksa ¼,] ch] lh½ ++dk gksxkA

[k.M&, % Nk=ksssssssssssssssssssa dks iz'u la];k 1 ds lHkh nl Hkkx ¼izR;sd bdkbZ esa ls nks iz'u ½ yxHkx

20 'kCnksa esa gy djus gkasxs ¼1/2

X10 = 5 vad½sA

[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250 'kCnksa dh lhek esa dqya

ik;ip iz'u gy djus gkasaxsA ¼5 X 5 = 25

vad½A

[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dskbZ nks iz'u 500 'kCnksa es gy djus gksaxs

¼10 X 2 = 20 vad½A

bdkbZ & I

vUr% lzkfodh % ifjp;] vk/kkj ,oa dk;Z

1- xzafFk;kj % ckálkzfod ,oa var%lzkfod lzko % Lolzkoh ,oa ijlzkoh

2- gkeksZu % jklk;fud izd`fr ,oa xq.k/keZ] leLFkkiu esa Hkwfedk A

3- izeq[k var% lzko xzafFk;ksa dh lajpuk ,oa dk;Z% ih;w"k] Fkk;jks;M ¼vcVq½] iSjkFkk;jks;M]

vf/ko`Dd] vXU;k'k;(muds gkWeksZu] Hkwfedk ,oa v?k%lzko o vfrlko ds dkj.k vlkekU;rk,;A

- 4- mi var%lzkoh xzafFk;ksa dh lajpuk ,oa dk;Z % Fkkbel] ihfu;y] vkek'k;&vkU=h; uky ¼th-vkbZ-Vh-½ o`Dd] ân;A dhVksa esa vUr% lzkoh xzafFk;ka] muds gkWeksZu o HkwfedkA

bdkbZ & II

vUr% lzkfodh % Izo.k dk fu;U=.k ,oa fu;eu rFkk vk.kfod fdz;kfof/k

- 1- gkWeksZu Izo.k dk fu;eu % /kukRed ,oa _.kkRed QhM cSd] fu;U=.k fdz;kfof/kA
 2- ckádksf'kdh; ,oa vUrjkdksf'kdh; laosnkaxA
 3-- f}rh; lans'k okgd % pdzh; ,-,e-ih-] ih-vkbZ-ih₂] vkbZ-ih₃] Mh-th]] th&izksVhu(izksVhu dkbust ,oa dsfY'k;e⁺⁺ dh lans'k okgd ds :i esa Hkwfedk] dksf'kdk ladsru] ladsr vfHko/kZuA
 4- bUlqfyu fdz;k dh vk.kfod fdz;kfof/k A

bdkbZ & III

vUr% lzkfodh % iztuu esa Hkwfedk

- 1- o`"k.k] v.Mk'k; vkSj vijk ds gkWeksZu rFkk mudh lajpuk ,oa dk;Z A
 2- Hkzw.k esa ySafx foHksnu esa gkWeksZuksa dk egRo A
 3- jtpdz] vkjksi.k] xHkZkoLFkk] izlo ,oa nqX/klzko dk gkWeksZu fu;U=.k A
 4- fofHkUu izdkj ds xHkZfujks/kd] mudk laxBu vkSj izHkko A

bdkbZ & IV

O;kogkfjdh % ifjp; ,oa vk/kkj

- 1- O;kogkfjdh dk ifjp; ,oa bfrgkl] izkf.k O;ogkj ds v;;u ds rjhds ¼i;kZoj.kh;] dkf;Zdh;] mf}dklh; ,oa raf=dh; fof/k;ka½] ,e-vkj-vkbZ- ,oa lh,-, -Vh- ¼dSV½ LdsuA
 2- tUrq O;ogkj dk vkuqoaf'kd vk/kkj ,oa O;kogkfjdh dk mf}dklA
 3- tSfod ?kM+h] ldsZfM;u ,oa ldsZuqvy fjn~eA
 4- vf/kxe vkSj bfEizfUVax(Loizsfjr O;ogkjA

bdkbZ & V

O;kogkfjdh % O;kogkfjdh ds {ks=

- 1- Hkkstu dh [kkst % e/kqeD[kh] jhll canj ,oa yaxwj A
 2- lkekftd O;ogkj ,oa laxBu % e/kqeD[kh] nhed] canj vkSj yaxwj A
 3- lapkj] yMkbZ ,oa vykeZ dkWY % ekSf[kd] n`';] Li'kZ] ?kzk.k vkSj Jo.;(e/kqeD[kh Hkk"kk] vkdzked O;ogkj dk Qsjkseksuh; ,oa gkWeksZuh; vk/kkj] ySafx O;ogkj esa efLr"d ,oa gkWeksZu dk laca/k A
 4- if{k;ksa ,oa eNfy;ksa esa izolu A
 vfHkeq[khdj.k % VsfDII ,oa dkbusfll A

iz'ui=&r`rh; % izk.kh ifjfLFkfrdh ,oa tSo&lkjfdh

le; vof/k 3 ?akVs iw.kkZad & 50 vad
 iz'u i= rhu [k.Mksa ¼,] ch] lh½ ++dk gksxkA

[k.M&, % Nk=ksssssssssssssssssa dks iz'u la;k 1 ds IHkh nl Hkkx ¼izR;sd
bdkbZ esa ls nks iz'u ½ yxHkx
20 'kCnksa esa gy djus gkasxs ¼1/2

X10 = 5 vad½sA
[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250 'kCnksa dh lhek
esa dqya
ik;ip iz'u gy djus gkasaxsA ¼5 X 5 = 25

vad½A
[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dksbZ nks iz'u 500 'kCnksa es gy djus
gksaxs
¼10 X 2 = 20 vad½A

bdkbZ & I

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izokg] nkc] xq:Ro] tSfod dkjd vUr%tkrh; ,oa vUrtkZrh; IEcU/k] lhekdkjh dkjdska dh
vo/kkj.kk] yhfcx dk U;wurerk dk fl)kUr] 'kSYQksMZ dk lgu'khyrk dk fl)kUr] vk/kqfud
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bdkbZ & II

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tukafddh] leqnk; ikfjfLFkfrdh] tSo leqnk; ds y{k.k] iztuu ,oa lqj{kk ds fy, vkJ;rk]
ifjrU= lefLFkjr] ifjrU= vkSj mRikndrk vo/kkj.kk] mRikndrk izdkj ,oa ekiu fof/k]
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ikfjfLFkfrdh; fudsra

bdkbZ & III

tyh; ikfjfLFkfrdh % vyo.kh; ty xfrd ,oa LFkk;h ty vkokl] vyo.k tyh; thotkr] yo.kh;
¼leqnzh;½ vkokl] {ks=hdj.k] leqnzh thotkr] xgjs leqnzh {ks= dh ikfjfLFkfrdh ,oa
thotkr] osyklaxe vkokl vkSj izk.khtkr] LFkyh; vkokl] ou ,oa e:LFkyh; ikfjfLFkfrdh
rU= o thokse ikfjfLFkfrdh ,oa ekuo Hkfo"; % o`f) nj] izkd`frd leqnk;ksa ds :ikUrj.k
esa ekuo dh HkwfedkA

bdkbZ & IV

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vuohdj.k lalk/ku] i;kZoj.kh; iznw"k.k] izdkj ¼ty] ok;q] e`nk] dhVuk'kdksa }kjk
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dh lkekU; vo/kkj.kk,a] uxjhdj.k dk izHkko] Hkkjr esa uxjhdj.k dh fo'ks"krk,a]
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e;/dk] fopyu] =qfV] IEHkkO;rk&caVu] lg&IEcU/k] lkFkZdrk&ijh{k.k] lef"V;ksa esa
thu caVu dk lkaf[;dh; fo'ys"k.kA

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¼'kye½] frryh] pkoy dk dhMk ¼ohfoyl½] du[ktwjk] fxtkbZ] fVik] lkbDyksIIA

eksyLdk & dkbVu] fuvksfifyuk] iVsyk] ,lykbfI;k] MsUVsfy;e] vkWfLV^a;k] VsjhMks] Lyx] ykshxks] vkWDVksil]

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bdkbuksMesZVk & ,UVhMkWu] dqdqesfj;k] bdkbul] ,LV^aksisDVsu] vkWfQ;ksfFkzDI] gksyksFkwfj;k A

vd'ks:dh dkWMsZVk & csysuksXykWWII] gMZekfu;k] Mksfy;ksye] IkYik] vkWbdkslywjk],fEQvkWDIIA

2- vaxksa dh dkVksa rFkk ifjo/kZu voLFkkyksa dk v/;;u %

vkFkzksZiksMk & dhVksa o ØLVsf'k;k dh ykjok voLFkk,; & ukWfly;l] tksb;k] esxkyksik] ekbfll] lkbfizl

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eksyLdk & osyhtj o XyksdhfM;e ykjok] ;wfuvks ds dkV ¼fofHkUu {ks=ks ls½] ;wfu;ks fxy dh dkVA

bdkbuksMesZVk & isMhflysfj;k] ckbfiusfj;k] lywfV;l ykjok A

izksVksdkMsZVk & csysuksXykWII ds 'kq.M] dkyj o /kM+ {ks= ls xqtjrs vuqizLFk dkV] vkWusZfj;k ykjok]

gMZekfu;k dh xzluh fHkfRRk] dafVdk,a o VsMiksy ykjok] ,fEQvkWDII ds eq[k gqM] xzluh] tun ,oa iqPN {ks= ls xqtjrs vuqizLFk dkVA

3- foPNsnu % pkVZ @ ekWMy @ QksVksxzkQ @ lh-Mh- }kjk v/;;u

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4- LFkk;h vkjksi.k @ LykbM cukuk %

Msf¶uvk] lkbDyksII] dzLVsf'k;u ykjok] fcPNw ds iqLrd Qq¶QqI] izkWu ds LVsVksfllV vkSj gsLVsV lysV; ØkWDjksr rFkk okLi ds eq[kkax] ia[k] mikax rFkk ykxzfUFk;ka; XykWdhfM;e ykjok; fxy iVfydk; ¼ikbyk o ;wfuvks½] ikbyk dk vkWLQjsfM;e rFkk jsM~;wyk] gMZekfu;k dh xzluh fHkfUk] o dafVdk,a A

5- var%lzkfodh %

¼,½ ekWMy] pkVZ ,oa dEI;wVj dk mi;ksx djrs gq, izeq[k var%lzkoh xzafFk;ksa dk izn'kZuA

¼ch½ izeq[k var%lzkoh xzafFk;ksa ¼ih;w" k] Fkk;jkWbM] iSjkFkk;jkWbM] vf/ko`Dd xzafFk] o`"k.k] v.Mk'k;] o`Dd ,oa dhVksa dh var%lzkoh xzafFk;k;½ dh vkSfrdh; LykbM~IA

6- O;kogkfjdh %

¼,½ iSjkehfl;e dh Li'kZ] izdk'kh; ,oa jlk;fud mn~nihu ds izfr izfrfØ;kA

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7- i;kZoj.k dk fo'ys"k.k %

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fuekZ.k½

8- tSo lkaf;dh %

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uksV% izk;ksfxd dk;Z esa iz;qDr tUrq oU; tho lqj{kk vf/kfu;e }kjk izfrcaf/kr ugha gksus pkfg;saA

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- 3- LykbM+ fuekZ.k 05
- 5- ikfjfLFkfrdh 05
- 6- O;kogkfjdh ij vk/kkfjr vH;kl 05
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- 8- LikWV¼10½ 20
- 9- jsdkMZ 10
- 10- ekSf[kdh 10

dqy -----
75

B.Sc. (PART-III) - ZOOLOGY
SCHEME FOR EXAMINATION- 2019

Paper	Duration	Max.Marks	Min. Marks
I. Animal Diversity(Part-III , Vertebrates) and Evolution	3 Hours	50	18
II. Mammalian Physiology and Immunology	3 Hours	50	18
III. Developmental Biology	3 Hours	50	18
Practical	5 Hours	75	27
		----- 225	

PAPER-I: ANIMAL DIVERSITY
(PART-III:VERTEBRATES) AND EVOLUTION

Duration: 3 Hours

M.M: 50

The question paper comprises of three sections ,'A','B' and 'C'

- Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).
- Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).
- Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

UNIT-I Cyclostomata and Pisces

- Origin, ancestry and diversity of vertebrates.
- Cyclostomata: Classification and characters with suitable examples.
Petromyzon: General morphology and Ammocoete larva.
- Pisces-I:Classification and characters with suitable examples; differences between cartilagenous and bony fishes; *Latimaria*; Dipnoans.
- Pisces-II: General morphology of *Scoliodon* and *Labeo rohita*; types of scales and caudal fin; electric organs, air bladder; aquatic adaptations in fishes.
- Pisciculture: Introductory knowledge of Psciculture; important fresh water and marine fishes as food.

UNIT-II Tetrapoda

- Amphibia: Classification and characters with suitable examples, adaptations for amphibious life, neoteny and paedogenesis.
- Reptilia: Classification and characters with suitable examples, difference between lizards and snakes, identification of poisonous and non- poisonous snakes, biting mechanism in snakes, snake venom; Dinosaurs, *Sphenodon*.
- Aves: General classification and characters with important examples; difference between Ratitae and Carinatae; flight muscles, flight mechanism, flight adaptations, perching mechanism, migration, *Archaeopteyx* as a connecting link.
- Mammalia-I: Classification and characters with suitable examples; oviparity; ovoviviparity and viviparity in mammals.
- Mammalia-II: Dentition; adaptive radiation; convergent evolution of placentals and Australian mammals.

UNIT-III Comparative Anatomy of Vertebrates-I

Comparative anatomy of the following organ systems of *Scoliodon*, *Rana*, *Uromastix / Varanus*, *Collumba* and *Oryctolagus*:

1. Integument and integumentary derivatives.
2. Alimentary canal and accessory digestive glands.
3. Respiratory organs.
4. Heart, aortic arches and their evolution.
5. Comparative structure and evolution of urinogenital system (pro, meso and metanephric kidney and genital ducts in males and females).

UNIT-IV Comparative Anatomy of Vertebrates-II

Comparative anatomy of the organ systems of *Scoliodon*, *Rana*, *Uromastix / Varanus*, *Collumba* and *Oryctolagus* and miscellaneous:

1. Brain and cranial nerves, evolution of brain, spinal cord and ANS.
2. Osteology: Girdles, limb bones, ribs and sternum; jaw suspension in vertebrates.
3. Comparative anatomy of eye.
4. Membranous labyrinth; sound production; hearing; Echolocation in bats.
5. Parental care in vertebrates.

UNIT-V Evolution

1. Basics and origin of life: Definition, pre-darwinian theories of evolution; Oparin-Haldane concept of origin of life; Miller-Urey experiment; molecular evolution of RNA, proteins and DNA; characters of coacervates.
2. Micro-evolution: Work and theories of Lamarck, Weisman and Darwin; theory of natural selection of Darwin and Wallace, industrial melanism, DDT resistance in mosquitoes; neo-darwinism.
3. Evidences of evolution: Various evidences favouring evolution: Homology, analogy, vestigial organs; palaeontological, embryological, biogeographical and biochemical evidences; adaptive radiations, mimicry.
4. Genetic basis of evolution and speciation :
Hardy-Weinberg law, gene frequency, genetic drift, factors affecting Hardy-Weinberg law, Founder effect, bottle neck effect, Sewall-Wright effect; speciation; role of various isolating mechanisms in speciation.
5. Macro-evolution: Geological time scale and imperfection of geological record, types of fossils and fossilization, continental drift, extinction, replacement; human evolution.

PAPER-II: MAMMALIAN PHYSIOLOGY AND IMMUNOLOGY

Duration: 3 Hours

M.M: 50

The question paper comprises of three sections, 'A', 'B' and 'C'

- Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X 10 = 5 marks).
- Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).
- Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

UNIT-I Physiology

1. Digestion:
 - a. Nutrients: Carbohydrates, lipids, proteins, vitamins.

- b. Digestive enzymes and hormones of GIT.
 - c. Digestive mechanism: Mechanical and chemical digestion.
 - d. Absorption and assimilation of end products of digestion.
 - e. Balanced diet, malnutrition (PEM), obesity; endoscopy.
2. Respiration:
- a. Aerobic and anaerobic respiration.
 - b. Structure of respiratory organs.
 - c. Mechanism and regulation of breathing.
 - d. Transport of O₂ and CO₂.
 - e. Respiratory disorders: Emphysema, asthma, occupational disorders, spirometry.

UNIT-II Physiology

3. Circulation:
- a. Circulatory fluids: Blood, lymph; blood cells; structure of haemoglobin.
 - b. Blood circulation through heart, arteries, arterioles, capillaries, venules and veins.
 - c. Cardiac cycle and its regulation.
 - d. Blood clotting mechanism, blood pressure.
 - e. Cardiac disorders, ECG, heart transplantation (an introductory idea).
4. Excretion:
- a. Excretory products: NH₃, urea, uric acids, amino acids.
 - b. Structure of kidney, nephron; mechanism of urine formation; micturition.
 - c. Autoregulation, counter-current mechanism, renin-angiotensin system.
 - d. Accessory excretory organs: Skin, liver, lungs etc.
 - e. Excretory disorders, dialysis, Kidney transplant.

UNIT-III -Physiology

5. Muscle and Neural Physiology:
- a. Structure of smooth, skeletal and cardiac muscles; myofibrils.
 - b. Isotonic and isometric contraction of muscles, sliding- filament theory of muscle contraction; relaxation of muscle fibres; Properties of muscles (muscle twitch, fatigue, summation, treppe, tetanus, rigor mortis), myopathy.
 - c. Kinds of neuron, structure of myelinated and nonmyelinated nerve fibres.
 - d. Origin and propagation of nerve impulse through different types of neurons and synapse.
 - e. Reflex action, types.
6. Sensory Physiology:
- a. Tactile receptors, pain receptors, thermoreceptors, chemoreceptors.
 - b. Structure of human eye; image formation and colour vision.
 - c. Eye disorders, lenses used in eye care.
 - d. Structure of human ear, mechanism of hearing, kinds of deafness.
 - e. EEG, MRI, CT-scan, mental health (epilepsy, neurosis, psychosis).

UNIT-IV- Immunology

7. Basics of Immunity:

- Types of immunity: Active, passive, innate and aquired immunity.
- Antigens and antibodies.
- Types of antibodies and their structure.
- Interferons, cytokines (haptens).
- Mechanism of reactions: Precipitation, agglutination, neutralisation, opsonisation.

8. Cells and Organs in Immunity:

- Humoral and cell- mediated immunity.
- B and T cells.
- Lymphocytes: Helper, killer, memory and suppressor cells.
- Complement system, secondary lymphoid organs; tonsils, adenoids, thymus, bone marrow, bursa fabricus, macrophages.
- Antigen - antibody reaction.

UNIT-V- Immunology

9. Immune disorders and techniques:

- Basic idea of immune disorders.
- Auto-immune diseases
- AIDS, mechanism of HIV infection.
- Monoclonal antibodies and their poduction.
- Applications of monoclonal antibodies; ELISA.

10. Vaccines and Transplants:

- Vaccination and immunisation.
- Surface antigens; vaccines; hepatitis vaccine, attenuation (oral polio vaccine).
- Antivenoms.
- Organ transplants: Various types of transplant (allograft, xenograft, autograft).
- Major histocompatibility complex.

PAPER-III: DEVELOPMENTAL BIOLOGY

Duration: 3 Hours

M.M: 50 Marks

The question paper comprises of three sections ,'A','B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).

Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).

Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

UNIT-I- Basics of Embryology

- Histoical perspective and scope of developmental biology.
- General idea of asexual reproduction (fission, budding, gemmule formation, metagenesis,

- polyembryony etc.).
- An introduction to animal development in sexually reproducing animals.
 - Development of sex and its success over asexual reproduction.
 - Neuroendocrine regulation of reproductive organs; estrous and menstrual cycles.

UNIT-II - Gametogenesis and fertilization

- Gametogenesis: Definition; structure of gametes (sperm and egg).
- Spermatogenesis and oogenesis.
- Types of eggs; detailed structure of amphibian, avian and mammalian egg.
- Fertilization: Events of fertilization, polyspermy and preventing mechanism.
- Significance of fertilization; parthenogenesis; evolution of viviparity.

UNIT-III - Cleavage and Gastrulation

- Cleavage, creating multicellularity; definition of embryonic cleavage, morula; blastula, patterns and planes of cleavage; blastulation, types of blastula.
- Types of gastrulation mechanisms.
- Fate maps (with suitable examples); cell lineage.
- Reorganization of embryonic cells, gastrulation in amphibians, birds and mammals.
- Morphogenetic cell movements and their significance in gastrulation.

UNIT-IV- Induction, Differentiation, Organogenesis and Regeneration

- Embryonic induction, organizers, competence.
- Mechanism of cellular differentiation; sex determination during development. Government rules against sex determination during pregnancy.
- Neurula formation, growth and organogenesis.
- Elementary idea of molecular aspects of developmental biology; cell interaction in embryonic development.
- Regeneration: types and mechanism. Senescence and ageing.

UNIT-V- Embryonic adaptations

- Role of jelly in amphibian spawn; cleidoic eggs; viviparity.
- Salient features of development of frog/toad; amphibian metamorphosis and its endocrine regulation.
- Extraembryonic membranes in chick, salient features of development of chick upto 72 hours of incubation.
- Placentation in mammals: Definition, types; classification on the basis of morphology and histology; functions of placenta.
- Changes in foetal circulation and respiration during birth in a mammal.

B.Sc (Part-III) – Zoology - Practical

1. Study of museum specimens / models / chart / photograph:

Petromyzon, Myxine/Bdellostoma, ammocoete larva, Acipenser, Amia, Lepidosteus, Labeo, Clarius, Anguilla, Hippocampus, Exocoetus, Echineis, Protopterus, Ichthyophis, Proteus, Ambystoma, axolotl larva, Siren, Alytes, Hyla, Chelone, Testudo, fresh water tortoise, Sphenodon, Hemidactylus, Phrynosoma, Draco, Chamaelion, Eryx, Hydrophis, Naja, Vipera, Bungarus, Cocodylus, Alligator, Archaeopteryx, Pavo cristatus, Psittacula,

Collumba, Mylva, great Indian bustard, saras crane, vulture, crow, *Ornithorhynchus*, *Tachyglossus*, *Macropus*, bat, *Loris*, *Manis*, *Herpestes*, *Erinaceus*.

2. Permanent slides:

Mammalian Histology: V. S. skin, T.S. spinal cord, stomach, duodenum, ileum, rectum, pancreas, liver, lung, kidney, bone, cartilage, testis, ovary, placenta, pituitary gland, V. S. eye; striated muscle fibre.

3. Dissection: Through Chart / Model / Photograph / CD.

Any bony fish : External features, general anatomy, afferent and efferent branchial vessels, brain, cranial nerves, eye ball, its muscles and innervation, internal ear, urinogenital system.

4. Permanent mounting:

Cycloid scales, striated, nonstriated and cardiac muscle fibres, filoplume, blood film.

5. Osteology:

A comparative study of articulated and disarticulated (original / artificial) bones of frog, *Varanus*, fowl and rabbit.

6. Developmental Biology:

Study of development of chick: Whole mounts and sections of 18 to 72 hour's embryo. Histological study of development of frog/toad : Egg, early cleavage, blastula, gastrula, neurula and different stages of tadpole. Study of spermatogenesis, oogenesis, fertilization and metamorphosis of frog/toad. Development of mammalian embryo through charts/models.

7. Physiology:

- a. Demonstration of catalase and ptyalin enzyme activity.
- b. Haematocrit value.
- c. RBC counting.
- d. WBC counting.
- e. Differential counting.
- f. Haemoglobin percentage.

Note: Animals used in practical are subject to the condition that these are not banned under the Wild Life Protection Act.

Scheme of distribution of marks:

	Regular/Non-collegiate/Ex	
1. Major Dissection	- Through Chart / Model / Photograph / CD	10
2. Minor Dissection	- Through Chart / Model / Photograph / CD	05
3. Preparation		07
4. Exercise in Developmental Biology		07
5. Physiology		06
6. Spots (10)		20
7. Record		10
8. Viva-voce		10
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- 2- jsIVhfy;k $\frac{1}{4}$ ljl' i $\frac{1}{2}$ % x.k Lrj rd oxhZdj.k ,oa mfpr mnkgj.kksa lfgr y{k.k]
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 liZfo"k] Mk;ukslkWj]
 LQhuksMkWuA
- 3- i{kh $\frac{1}{4}$,Ot+ $\frac{1}{2}$ % mioxZ rd lkekU; oxhZdj.k ,oa mnkgj.kksa lfgr y{k.k] jsfVVh ,oa
 dsfjusVh esa vUrj]
 m;u fdz;kfof/k] m;u vuqdwyu] if{klkn $\frac{1}{4}$ ifpZax $\frac{1}{2}$ fdz;kfof/k] izoklu] la;kstd dM+h
 ds :i esa vkjfd;kslVsfjDIA
- 4- eSesfy;k&I % mioxZ rd lkekU; oxhZdj.k ,oa mnkgj.kksa lfgr y{k.k] v.Miztuu]
 vifjiDo f'k'kqiztuu

,oa f'k'kqiztuuA
5- eSesfy;k&II % nUrdze] vuqdwuyh; fofdj.k] lyslsUVy ,oa vkWLV^asfy;u
Lru/kkfj;ksa esa lekfHk:i mf}dkIA

bdkbZ&III d'ks#fd;ksa dh rgyukRed 'kkjhfdh

Ldksfy;ksMkWu] jkuk] ;wjksesfLVDI@oSjsul] dksyEck ,oa vksfjDVksysxl ds
fuEu vaxrU=ksadk rgyukRed v/;;u%

- 1- Ropk ,oa Roph; O;qRiUuA
- 2- vkgkj uky ,oa lgk;d xzafFk;kaA
- 3- 'olu vaxA
- 4- ân; ,oa egk/keuh pkiksa dh lajpuk rFkk mf}dkIA
- 5- ew=tuu rU= dh lajpuk ,oa mf}dkl ¼uj ,oa eknk esa izks] eht+ks rFkk
eSVkusQzksl o`Dd rFkk tuu ufydk,½-

bdkbZ&IV d'ks#fd;ksa dh rgyukRed 'kkjhfdh ,oa fofok

Ldksfy;ksMkWu] jkuk] ;wjksesfLVDI@oSjsul] dksyEck ,oa vksfjDVksysxl ds
vaxksa dk rgyukRed v/;;u %

- 1- efLr"d ,oa diky rFU=dk,a] efLr"d] diky rFU=dkvksa ,oa Lok;Ûk rFU=dk rU= dk
mf}dkIA
- 2- vfLFk foKku % es[kyk,a] ikn vfLFk;k;a] ilfy;kj ,oa o{kfLFk] d'ks#fd;ksa esa
guq&fuyEcuA
- 3- us= ,oa budh rFU=dk,aA
- 4- dykxgu ¼esEczsul ySfcfjUFk½] /ofu mRiknu] Jo.k] pexknM+ksa esa
bdksyksds'kuA
- 5- d'ks#fd;ksa esa iSr`d j{k.k ¼isjsUVy ds;j½A

bdkbZ&V mf}dkl

- 1- ifjp; ,oa thou dh mRifÛk % ifjHkk"kk] mf}dkl ds iwoZ MkfoZfu;u okn] thou
mRifÛk dh
vksisfju&gsYMu vo?kkj.kk] feyj&;wjs dk ç;ksx(vkj-,u,-,] çksVhu ,oa Mh-,u,-, dk
vk.kfod mf}dkl(
dks,ljosV~l ds y{k.k A
- 2- lw{e&mf}dkl % ySekdZ] oht+eSu o MkfoZu ds dk;Z ,oa fl)kUr] MkfoZu ,oa
oSysl dk izkd`frd oj.k
dk fl)kUr(izkd`frd oj.k ds mnkgj.k % vkS|ksfxd eSysfuT+e] ePNjksa esa Mh-Mh-
Vh- izfrjks?kdrk] uo
MkfoZuoknA
- 3- mf}dkl ds izek.k % mf}dkl ds i{k esa fofHkUu izek.k ¼letkrrk] leo`Ûkrk] vo'ks"kh
vax] thok'eh;]
- 4- Hkzw.kh;] tSoHkkSxksfyd o tSojklk;fud½(vuqdwuyh; fofdj.k] vuqgj.k@vuqd`frA
mf}dkl dk vkuqoaf'kd vk/kkj ,oa tkfr mn~Hkou] gkMhZ&osUcxZ dk fu;e] thu
vko`fÛk] vkuqoaf'kd
foiFku] gkMhZ&osUcxZ fu;e dks izHkkfor djus okys dkjd] QkmUMj izHkko]
ckWVvy&uSd izHkko]
Isoky&jkbV izHkkoAtkfr mn~Hkou (tkfr mn~Hkou esa fofHkUu i`FkDdj.kh;

fdz;kfof/k;ksa dh HkwfedkA

5- o`gn~&mf}dki % HkwxHkhZ; dkydze] HkwoSKkfud vkys[k dh viw.kZrk] thok'eksa ds izdkj] thok'ehdj.k]

egk}hih; foLFkkiu] foyqIrhj.k ,oa izfrLFkkiu (ekuo dk mf}dkIA

iz'ui=&II % Lruh&dkf;Zdh ,oa izfrj{kk&foKku

le; vof/k & 3 ?kaVs

iw.kkZad

& 50

iz'u i= rhu [k.Mksa ¼,] ch] lh½ ++dk gksxkA

[k.M&, % Nk=ks dks iz'u la;k 1 ds IHkh nl Hkkx ¼izR;sd bdkbZ esa ls nks iz'u ½

yxHkx 20 'kCnksa esa gy djus gkasxs A

¼1/2 X 10 = 5 vad½

[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250 'kCnksa dh lhek esa dqya

ik;ip iz'u gy djus gkasaxsA

¼5 X 5 = 25

vad½

[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dksbZ nks iz'u 500 'kCnksa es gy djus gksaxsA¼10 X 2 =20 vad½

bdkbZ&I

1- ikpu %

a. iks"kd rRo % dkcksZgkbM^asV] olk,a] izksVhu ,oa foVkfueA

b. ikpd fd.od % gkbM^aksyst+st+ ,oa vkek'k;h&vkU=h; uky ds gkWeksZuA

c. ikpu fdz;kfof/k % ;kfU=d ,oa jklk;fud ikpuA

d. ikpu ds vUR; mRiknksa dk vo'kks"k.k ,oa Lokaxhdj.kA

e. IUrqfyr&vkgkj (U;wu iks"kdrk ¼ekyU;wV^ah'ku] ih bZ ,e½] LFKwyrk (,UMksLdksihA

2- 'olu %

a. ok;oh; ,oa vok;oh; 'oluA

b. 'olu vaxksa dh lajpukA

c. 'olu dh fdz;kfof/k ,oa fu;U=.kA

d. vkWDIhtu ,oa dkcZu MkbZ vkWDIkbM dk ifjoguA

e. 'olu fodkj ¼O;kf/k;k;½% ,EQkblhek] nek] Lik;jkseV^ahA

bdkbZ&II

3- ifjlapj.k %

a. ifjlapj.k ?kVd % jä] yfldk] jä dksf'kdk,a] gheksXyksfcu dh lajpukA

b. jä ifjlapj.k % /kefu;ka] /kefudk,a] dsf'kdk,a] f'kfjdk,a ,oa f'kjk,a (jä ifjlapj.k dh fdz;kfof/kA

c. ân;h pdz ,oa bldk fu;U=.kA

d. jä nkc] ân; izR;kjksi.k ¼ifjp;kRed tkudkj½] jä&LdUnu dh fdz;kfof/k] 'kjhj rki fu;U=.k dh fdz;kfof/kA

e. ân; fodkj ¼O;kf/k;k;½(bZ-lh-th-A

4- mRItZu %

a. mRlthZ mRikn % veksfu;k] ;wfj;k] ;wfjd vEy] vehuks vEyA

b. Lruh o`Dd dh lajpuk] o`Dd dksf'kdk,a ¼usQzksu½] ew= fuekZ.k dh fdz;kfof/k]

ew=ksRltZuA

- c. Lor%fu;U=.k] izfr/kkj xq.kd rU= dh fdz;kfof/k] jsfuu ,fUt;ksLVsfVu rU=A
- d. lgk;d mRlthZ vax % Ropk ¼Losn xzfUFk½] ;d`r] Qq¶Qql vkfnA
- e. Mk;ykbfill] o`Dd izR;kjksi.k] mRlthZ fodkj ¼O;kf/k;k½A

bdkbZ&III dkf;Zdh

5- is'kh dkf;Zdh ,oa rfU=dh dkf;Zdh %

- a. vjsf[kr] jsf[kr ,oa ân;h isf'k;ksa dh lajpuk(is'kh rUrqa
- b. vkblksVksfud o vkblksesfV^ad is'kh ladqpu] is'kh ladqpu dk vilihZ lw= fl)kUr(f'kfFkyuA
isf'k;ksa ds xq.k ¼,dy is'kh LQqj.k] ladyu] lksiku] fVVsul] is'kh; JkfUr½(ek;ksisFkhA
- c. rfU=dk dksf'kdk ds izdkj] eTtk&vkPNn o eTtk&foghu rfU=dk rUrq dh lajpukA
- d. fofHkUu izdkj dh RkfU=dk dksf'kdkvksa ,oa ;qXeUkkad esa rfU=dk vkosx dk mn~Hko ,oa lapj.k¼izs"k.k½A
- e. izfrorhZ fdz;k] izdkj ,oa dsUnzh; fu;U=.kA

6- laosnh dkf;Zdh %

- a. Li'kZ laosnkax] ihM+k laosnkax] rki laosnkax o jklk;fud laosnkaxA
- b. ekuo us= dk lajpuk] izfrfcEc fuekZ.k ,oa o.kZ n`';kaduA
- c. us= fodkj ¼O;kf/k;k½] us= lqj{kk esa iz;qä yssala
- d. ekuo d.kZ dh lajpuk] Jo.k dh fdz;kfof/k] cf/kjrk ds izdkjA
- e. bZ-bZ-th-] ,e-vkj-vkbZ] lhVh Ldssu] ekufld LokLF; ¼fexhZ] U;wjksfill] lkbdkfill½A

bdkbZ&IV izfrj{kk foKku

7- jks/kd {kerk ds vk/kkj %

- a. jks/kd {kerk ds izdkj % izR;{k ,oa vizR;{k(tUetkr o mikftZr jks/kd {kerkA
- b. izfrtu ,oa izfrj{khA
- c. izfrj{kh ds izdkj ,oa lajpukA
- d. bUVjQsjksUI] lkbVksdkbUI ¼gsIVsUI½A
- e. vfHkfdz;kvksa dh fdz;kfof/k% vo{ksi.k] lewgu] mnklhuhdj.k o vkWllksuhdj.kA

8- izfrj{kk dh dksf'kdk,a ,oa vax %

- a. áweksjy ,oa dksf'kdk e;/LFk izfrj{kkA
- b. ch ,oa Vh dksf'kdk,aA
- c. fyEQkslkbV ¼lgk;d] ekjd] Le`fr o 'keu dksf'kdk,aA
- d. iwjd rU=] f}rh;d fyEQks;M vax] VkWfUIYI] ,MhUkkW;M]Fkkbel] vfLFk eTtk] clkZ QsfczdIA
- e. esdzksQstst+] izfrtu izfrj{kh vfHkfdz;kA

bdkbZ&V izfrj{kk foKku

9- izfrtu O;kf/k;kj %

- a. izfrj{kk O;kf/k;k;ksa dh vk/kkjHkwr tkudkjA
- b. Lor% çfrj{kk jksxA
- c. ,M~l] ,p-vkbZ-oh-ladze.k dh fdz;kfof/kA
- d. ,dy&Dyksuh; izfrj{kh ,oa mudk mRiknuA
- e. ,dy&Dyksuh; izfrj{kh ds vuqiz;ksx (,yht+kA

10- Vhds ,oa izR;kjksi.k %

- a. Vhdkdj.k ,oa izfrj{kkdj.kA
- b. lrgH ifrtu (Vhds] ihfy;k ds Vhds] ,Vsuq,'ku eq[kh; iksfy;ks VhdkAA
- c. izfrfo"KA
- d. vax izR;kjksi.k] fofHkUu izdkj ds izR;kjksi.k] ,yksxzk¶V] t+huksxzk¶V] vfvksxzk¶VA
- e. izeq[k Årdh; lejlrk ladqyA

iz'ui=&III % ifjo/kZu tSfodh

le; vof/k & 3 ?kaVs & 50

iw.kkZad

iz'u i= rhu [k.Mksa ¼,] ch] lh½ ++dk gksxkA

[k.M&, % Nk=ks dks iz'u la;k 1 ds lHkh nl Hkkx ¼izR;sd bdkbZ esa ls nks iz'u ½

yxHkx 20 'kCnksa esa gy djus gkasxs A
¼1/2 X 10 = 5 vad½

[k.M&ch % Nk=ksa dks izR;sd bdkbZ ls ,d iz'u p;u djrs gq,s 250 'kCnksa dh lhek esa dqya

ikjp iz'u gy djus gkasaxsA ¼5 X 5 = 25

vad½

[k.M&lh % Nk=ksa dks pkj iz'uksa esa ls dksbZ nks iz'u 500 'kCnksa es gy djus gksaxsA¼10 X 2 =20vad½

bdkbZ&I ifjo/kZu tSfodh dk vk/kkj

- a.ifjo/kZu tSfodh dk ,sfrgkfld ifjizs{; ,oa mi;ksfxrkA
- b. vySafxduu dh lkekU; /kkj.kk ¼f}xq.ku] eqdqyu] tsE;wy fuekZ.k] esVktsusfll] cgqHkzw.krk vkfn ½A
- c. ySafxduu izn'kZd tUrqvksa esa ifjo/kZu dk ifjp;A
- d. fyax dk ifjo/kZu ,oa bldh vySafxduu ij lQyrkA
- e. tuu rU= dk rfU=dk&vUr%lzkoh fu;eu(,LVªl ,oa jt&pdzA

bdkbZ&II ;qXed tuu ,oa fu"kspu

- a. ;qXedtuu dh ifjHkk"kk(;qXedksa dh lajpuk ¼'kqdzk.kq ,oa v.M dksf'kdk½A
- b. 'kqdzk.kqtuu ,oa v.MtuuA
- c. v.Mksa ds izdkj] ,EQhfc;u] ,fo;u ,oa Lru/kkjh v.M dksf'kdk dh foLr`r
- d. lajpukA
- e. fu"kspu% fu"kspu ds pj.k(cgq'kqdzk.kqrk o jks/kd fdz;k,aA
fu"kspu ds egRo(vfu"ksduu(f'k'kqiztuu dk mf}dklA

bdkbZ&III fonyu ,oa xsLVªwykHkou

- a. cgqdk'skh;rk mRiknd fonyu(Hkzw.kh; fonyu dh ifjHkk"kk(dUnqd(dksjd(fonyu ds izk:i ,oa ry(dksjdHkou(dksjdksa ds izdkjA
- b. xsLVªwykHkou fdz;kfof/k ds izdkjA
- c. lEHkkoh vkjs[k ¼mfpr mnkgj.kksa lfg½(dksf'kdk yhf;stA
- d. Hkzw.k dksf'kdkvksa dk iqulZaxBu mHk;pjksa if{k;ksa ,oa Lru/kkfj;ksa esa xsLVªwykHkouA

e. vkdkfjdh&tud dksf'kdk xeu ,oa budk xsLV^awykHkou esa egRoA

bdkbZ&IV izsj.k] foHksnu] vaxtuu ,oa iqu#n~Hkou

- a. Hkzw.kh; izsj.k] vkWxsZukbt+] lkeF;ZA
- b. dksf'kdh; foHksnu dh fdz;kfof/k] xHkkZoLFkk esa fyax fu/kkZj.k] f'k'kq ifjo/kZu dky esa fyax fu/kkZj.k gsrq jktdh; fu;eA
- c. U;w:ykHkou] o`f) ,oa vaxtuuA
- d. ifjo/kZu tssfodh ds vk.kfod igyqvksa dk lkekU; Kku] Hkzw.kh; ifjo/kZu esa dksf'kdkvksa dh vUrjfdz;k,aA
- e. iqu#n~Hkou% izdkj ,oa fdz;kfof/k (ifjo/kZu fo:irk,a] th.kZrk ,oa o`)koLFkka

bdkbZ&V Hkzw.kh; vuqdwyu

- aa. mHk;pj LikWu esa tssyh dh Hwfedk(esa<d@ VksM ds ifjo/kZu ds izeq[k y{k.k] mHk;pjksa esa dk;kUrj.k ,oa bldk var%lzkoh fu;euA
- b. DyhMksbd vaM] f'k'kq iztuu ¼tjk;qtrk½A
- c. eqxhZ ds Hkzw.k esa vfrfjDr Hkzw.kh; f>fYy;ka] fpd ds ifjo/kZu esa 72 ?k.Vs rd ds Hkzw.kksa ds izeq[k y{k.kA
- d. Lru/kkfj;ksa esa vijk ifjo/kZu% ifjHkk"kk] izdkj(vkdkfjdh ,oa vkSfrdh ds vk/kkj ij oxhZdj.k] vijk ds dk;ZA
- e. Lru/kkfj;ksa esa izlo ds le; Hkzw.kh; ifjlapj.k ,oa 'olu dkf;Zdh esa ifjorZuA

ch- ,llh- ikVZ&r`rh;] izkf.k'kkL= izk;ksfxd ikB~;dze

le;kof/k % 5 ?k.Vs
% 75

vad

1-tUrqvksa ds izfrn'kZ@ ekWMMy@ pkVZ@ Nk;kfp= dk v/;;u %
isV^aksekb+ksu] feDlhu@ MsyksLVksek] ,ekslhV ykjok] ,flisUl] ,fe;k]
ysfiMksfLV;l] ysfc;ks] Dysfj;kl] ,fUXoyk] fglikdsEil] ,Dt+kslhVI] ,dhuht+]
izksVksIVs]l] bfDFk;ksfQ+l] izkfV;l] ,EckbLVksek] ,Dt+ksyksVy ykjok] lk;jsu]
,ykbfVI] gk;yk] VsLV~;wMks] psyksu] LoPN&tyh; dPNi] LQhuksMksu]
gsehMsDVkbyl] Qzkbukslksek] M^asdk] pseyfy;u] bfjDI] gkbM^aksfQI] uktk]
okbisjk] caxsjl] dzksdksMkbyl] ,fyxsvj] vkjfd;kslVsfjDI] isoks fdzLVsVI]
lhVkd;qyk] dksyEck] feYol] xksMko.k] lkj] dzsu] oYpj] dzks] vkWfuZFkksfjadl]
VsdhXykWII] esdzksil] cssV] yksfj] esful] gjisfLVI] ,fjuf'k;l A

2-LFkk;h vkjksi.k dk v/;;u %

Lru/kkfj;ksa dh vkssfrdh % Ropk] o`Dd ,oa us= dh [kM+h dkV(es#&jTtq]
vkek'k;] xzg.kh] {kqnzkU=]

eyk'k;] vXU;k'k;] ;d`r] Qq¶Qq] o`Dd] vfLFk] mikfLFk] o`"k.k] v.Mk'k;] vijk ,oa
ih;w"k&xzfUFk

ds vuqizLFk dkV(jsf[kr is'kh rUrqa

3- foPNsnu % pkVZ @ ekWMMy @ QksVksxzkQ @ lh-Mh- }kjk v/;;u

dksbZ Hkh vfLFky eNyh% cká y{k.k] lkekU; vkUrjfdh] vfHkokgh o viokgh
Dykse laofgdk,a] efLr"d] diky rfU=dk,a] us=&isf'k;ka o budh rfU=dk,a]

- vkUrfjd d.kZ] ew=&tuu rU=A
- 4- LFkk;h vkjksi.k %
lkbDykW;M 'kYd] jsf[kr] vjsf[kr o ân;h isf'k;ka] fQykslywe] jä fQYeA
- 5- vfLFk&foKku ¼dadky&rU=½ %
esa<d] osjsul] eqxsZ ,oa [k]xks'k dh la;qä ,oa i`FkDd`r vfLFk;ksa dk rgyukRed v/;;uA
- 6- ifjo/kZu&tSfodh %
eqxsZ ds ifjo/kZu dk v/;;u 18 ls 72 ?k.Vs rd ds Hkzw.kksa ds iw.kZ vkjksi.k ,oa dkVA18]24]36] 48 o 72 ?k.Vs ds Hkzw.kksa dk ltho v/;;uA esa<d@Hksd ds ifjo/kZu dk vsksfrdh; v/;;u% v.M] izkjfEHkd fonyu] dksjd] xsLV^awyk] U;w:yk ,oa VsMiksy ykjok dh fofHkUu voLFkk,aA 'kqdzk.kqtuu] v.Mtuu] fu"kspu] esa<d@Hksd esa dk;kUrj.k dk pkVZ@ ekWMy }kjk v/;;uA Lruh Hkzw.k ds ifjo/kZu dk pkVZ@ ekWMy }kjk v/;;uA
- 7- dkf;Zdh %
dsVsyst+ o Vkbfyu fd.od dh fdz;k'khyrk dk izn'kZuA ghesVksfdzV osY;w] yky jä df.kdk ,oa 'osr jä df.kdk x.ku] 'osr jä df.kdk foHksnd x.ku] gheksXyksfcu izfr'krrkA
- uksV % **izk;ksfxd dk;Z esa iz;qä tUrq oU; tho laj{k.k vf/kfu;e }kjk fuf"k) ugha gksus pkfg;saA**

**izk;ksfxd ijh{kk gsrq vadksa ds forj.k dk izk:i
fu;fer@ Lo;aikBh @iwoZ Nk=**

1- nh?kZ foPNsnu pkVZ@ekWMy@QksVksxzkQ@lh-Mh- }kjk v/;;u	10
2- y?qk foPNsnu pkVZ@ekWMy@QksVksxzkQ@lh-Mh- }kjk v/;;u	05
3- LFkk;h vkjksi.k	07
5- ifjo/kZu tSfodh	07
6- dkf;Zdh ds vH;kl	06
7- LikWV ¼10½	20
8- fjdkWMZ	10
9- ekSf[kd	10 &&&&&& 75 &&&&&&