5TH SEMESTER ZOOLOGY (HONOURS)

CODE	PAPER NAME	CREDIT	TYPE
ZOO-HC-5016	MOLECULAR BIOLOGY	4+2	CORE
ZOO-HC-5026	PRINCIPLES OF GENETICS	4+2	CORE
ZOO-HE-5016	COMPUTATIONAL BIOLOGY and BIOSTATISTICS	4+2	DSE (DISCIPLINE SPECIFIC ELECTIVE)
ZOO-HE-5046	PARASITOLOGY	4+2	DSE (DISCIPLINE SPECIFIC ELECTIVE)

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CORE COURSE XI

MOLECULAR

BIOLOGY

CODE: ZOO-HC-5016

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THEORY (CREDITS 4)

Unit 1:NucleicAcids 4

Salient features of DNA and RNA Watson and Crick model of DNA

Unit 2:DNAReplication 12

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear *ds*-DNA, replication of telomeres

Unit3:Transcription 10

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

Unit4:Translation 12

Geneticcode,DegeneracyofthegeneticcodeandWobbleHypothesis;Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptidechain;Inhibitorsofproteinsynthesis;Differencebetweenprokaryotic and eukaryotic translation

Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA 6

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Unit 6:GeneRegulation 10

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp*operon; Transcription
regulation in eukaryotes: enhance silencer
Activators, repressors, rs,
elements; Gene silencing, Genetic imprinting

Unit 7: DNA Repair Mechanisms 3

Pyrimidine dimerization and mismatch repair

Unit 8: Regulatory RNAs 3

Ribo-switches, RNA interference, miRNA, siRNA

MOLECULAR BIOLOGY

PRACTICAL   **(CREDITS 2)**

1. Study of Polytene chromosomes from Chironomous / Drosophilalarvae
2. *Preparation of liquid culture medium(LB)andraisecultureofE.coli*
3. Estimation of the growth kinetics of *E. coli* by turbidity method
4. Quantitative estimation DNA using colorimeter (Diphenylamine reagent)
5. Quantitative estimation of RNA using Orcinolreaction
6. Study and interpretation of electron micrographs/ photographshowing
   (a) DNA replication
   (b) Transcription
   (c) Splitgenes

SUGGESTED READINGS

□   Becker,W.M.,Kleinsmith,L.J.,Hardin.J.andBertoni,G.P.(2009).*TheWorld of the Cell.* VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

□   Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IVEdition.

□   CooperG.M.andRobertE.HausmanR.E.*TheCell:AMolecularApproach,*V Edition, ASM Press and SinauerAssociates.

□   De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*.VIIIEdition.LippincottWilliamsandWilkins,Philadelphia.

□   Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons.Inc.

□   Lewin B. (2008). *Gene XI*, Jones andBartlett

□   McLennanA.,BatesA.,Turner,P.andWhiteM.(2015).*MolecularBiology*IV Edition.GS,TaylorandFrancisGroup,NewYorkandLondon.

CORE COURSE XII

PRINCIPLES OF

GENETICS

CODE: ZOO-HC-5026

THEORY   **(CREDITS 4)**

Unit 1: Mendelian Genetics and its Extension   8

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex- influenced and sex-limited characters inheritance.

Unit 2: Linkage, Crossing Over and Chromosomal Mapping   12

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Unit3:Mutations   10

Typesofgenemutations(Classification),Typesofchromosomalaberrations (Classification, figures and with one suitable example of each), Molecular basisofmutationsinrelationtoUVlightandchemicalmutagens;Detection of mutations: CLB method, attached *X* method.

Unit 4:SexDetermination   4

Chromosomal mechanisms of sex determination in Drosophila and Man

Unit 5:Extra-chromosomalInheritance   6

Criteria for extra-chromosomal inheritance, Antibiotic resistance in *Chlamydomonas*, Mitochondrial mutations in *Saccharomyces,* Infective heredity in *Paramecium* and Maternal effects

Unit 6:PolygenicInheritance   3

Polygenic inheritance with suitable examples; simple numericals based on it.

Unit 7: Recombination in BacteriaandViruses   9

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Unit 8: TransposableGeneticElements   8

Transposons in bacteria, Ac-Ds elements in maize and P elements in *Drosophila,* Transposons in humans

PRINCIPLES OF GENETICS

PRACTICALS   **(CREDITS 2)**

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/*Drosophila*.
3. Linkage maps based on data from conjugation ,transformation and transduction.
4. Linkage maps based on data from *Drosophila* crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

☐ Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. WileyIndia

☐ Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and SonsInc

☐ Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. BenjaminCummings

☐ Russell, P. J. (2009). *Genetics- A Molecular Approach*.III Edition. BenjaminCummings

☐ Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll,S.B. *Introduction to Genetic Analysis*.IX Edition. W. H. Freeman and Co

☐ Fletcher H. and Hickey I. (2015). *Genetics.* IV Edition. GS, Taylor and Francis Group, New York andLondon.

DISCIPLINE CENTRIC ELECTIVE COURSES
CODE: ZOO-HE-5016
COMPUTATIONAL BIOLOGY and BIOSTATICS

THEORY (Credits 4)

Unit 1: Introduction to Bioinformatics 5

Importance, Goal, Scope; Genomics, Transcriptomics, Systems Biology, Functional Genomics, Metabolomics, Molecular Phylogeny; Applications and Limitations of Bioinformatics

Unit 2:BiologicalDatabases 10

Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD)

Unit 3: Data Generation andDataRetrieval 14

Generation of data (Gene sequencing, Protein sequencing, Mass spectrometry, Microarray), Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)

Unit 3: Basic Concepts of Sequence Alignment 14

Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences.

Unit 4: Applications of Bioinformatics 7

Structural Bioinformatics (3-D protein, PDB), Functional genomics (genome- wide and high throughput approaches to gene and protein function), Drug discovery method (Basic concepts)

Unit5:Biostatistics 10

Introduction, calculation of standard deviation, standard error, Co-efficient of Variance, Chi-square test, Z test, t-Test

COMPUTATIONAL BIOLOGY

PRACTICAL   **(Credits 2)**

1.   Accessing biological databases

2.   Retrieval of nucleotide and protein sequences from the databases.

3.   To perform pair-wise alignment of sequences (BLAST) and interpret the output

4.   Predict the structure of protein from its amino acid sequence.

5.   To perform a "two-sample t- test" for a given set of data

6.   Tolearngraphicalrepresentationsofstatisticaldatawiththehel pofcomputers (e.g. MSExcel).

SUGGESTED READINGS

☐   Ghosh Z and Mallick B. (2008). Bioinformatics:
Principles and Applications, Oxford UniversityPress.

☐   Pevsner J. (2009). *Bioinformatics and Functional Genomic*s, II Edition, Wiley Blackwell.

☐   Zvelebil,MarketaandBaumO.Jeremy(2008).*Understanding Bioinformatics*, Garland Science, Taylor and Francis Group,USA.

☐   Zar, Jerrold H. (1999). *Biostatistical Analysis*, IV Edition, Pearson Education Inc and Dorling Kindersley Publishing Inc.USA

☐   Antonisamy, B., Christopher S. and Samuel, P. P. (2010). *Biostatistics: PrinciplesandPractice*.TataMcGrawHillEducationPrivateLimited,In dia.

☐   Pagana,M.andGavreau,K.(2000).*PrinciplesofBiostatistics,* DuxberryPress, USA

CODE: ZOO-HC-5026

ANIMAL BIOTECHNOLOGY

THEORY   **(Credits 4)**

ENDOCRINOLOGY

PRACTICAL   **(Credits 2)**

1. Dissect and display of Endocrine glands in laboratory bred rat* 2.Study of the permanent slides of all the endocrine glands

3. Demonstration of Castration/ovariectomy in laboratory bred rat* 4. Designing of primers of any hormone

SUGGESTED READINGS

◻   General Endocrinology C. Donnell Turner Pub- SaundersToppan

◻   Endocrinology: An Integrated Approach; Stephen Nussey andSaffron Whitehead.

◻   Oxford: BIOS Scientific Publishers;2001.

◻   Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice-Hall, Pearson Education Inc., NewJersey.

◻   Vertebrate Endocrinology by David O.Norris,

CODE: ZOO-HE-5046
PARASITOLOGY

THEORY   **(CREDITS 4)**

Unit I: Introduction to Parasitology   **3**

Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship

Unit II: Parasitic Protists   **15**

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica, Giardia intestinalis, Trypanoso magambiense, Leishmania donovani, Plasmodium vivax*

Unit III: Parasitic Platyhelminthes   **15**

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski, Schistosoma haematobium, Taenia solium* and *Hymenolepis nana*

Unit IV: Parasitic Nematodes 15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascarislumbricoides*, *Ancylostomaduodenale*,*Wuchereriabancrofti*and*Trichinellaspiralis.*Study ofstructure,life cycle and importance of *Meloidogyne*(root knot nematode), *Pratylencus*(lesion nematode)

Unit IV: Parasitic Arthropoda 10

Biology, importance and control of ticks, mites, *Pediculushumanus*(head and body louse), *Xenopsyllacheopis*and *Cimexlectularius*

Unit V: Parasitic Vertebrates 2

A brief account of parasitic vertebrates; Cookicutter Shark, Candiru, Hood Mockingbird and Vampire bat

PARASITOLOGY

PRACTICAL (Credits 2)

- ☐ Study of life stages of *Entamoeba histolytica, Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani* and *Plasmodium vivax* through permanent slides/microphotographs

- ☐ Study of adult and life stages of *Fasciolopsis buski, Schistoso mahaematobium, Taenia solium* and *Hymenolepis nana* through permanent slides/microphotographs

- ☐ Study of adult and life stages of *Ascarislumbricoides*, *Ancylostomaduodenale*, *Wuchereriabancrofti*and *Trichinellaspiralis*through permanent slides/microphotographs

- ☐ Study of plant parasitic root knot nematode, *Meloidogyne*from the soil sample

- ☐ Study of *Pediculushumanus*(Head louse and Body louse), *Xenopsyllacheopis*and*Cimexlectularius*throughpermanentslides/phot ographs

- ☐ Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of theindustry]

- ☐ Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a byproduct]

Submission of a brief report on parasitic

vertebrates SUGGESTEDREADINGS

- ☐ Arora, D. R and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications andDistributors

- ☐ E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea &Febiger

- ☐ Ahmed,N.,Dawson,M.,Smith,C.andWood,Ed.(2007)*BiologyofDisease.* Taylor and Francis Group

- ☐ Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai,Delhi

- ☐ RattanLalIchhpujaniandRajeshBhatia.MedicalParasitology ,IIIEdition,Jaypee Brothers Medical Publishers (P) Ltd., NewDelhi

☐   Meyer, Olsen & Schmidt's Essentials of Parasitology,
Murray, D. Dailey, W.C. BrownPublishers

K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS *Publishers* & Distributors (P)Lt