

Academic:

1. Degree Offered –UG, PG, PhD

Title of degree:

Duration:

Eligibility Criteria:

Intake Capacity:

Opportunities:

2. Academic Regulations:

UG , PG, PhD (VCI, ICAR, IV, V Dean's and Corrigendum) – PDF Copies

3. Admissions:

UG, PG, PhD

List of Admitted Students – First Year to Final Year (Veterinary Year wise / Fishery and Dairy Semester wise) :

Sr. No.	Name of Student	Enrl. No.	Email Address	Name of Advisor
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4. Course offered :: UG, PG , PhD - Semester / Year wise

- List of UG Courses (B.V.Sc& AH) As per latest MSVE Guidelines) ,
B.Tech. (D.T.) and B.F.Sc as per ICAR – V Deans Committee – 2016.

Sr No	Course No.	Title	Credit	Course offered in the Year
1	VBC	Veterinary Biochemistry	2+1=3	Second

➤ List of PG Courses M.V.Sc. – **Veterinary Biochemistry**

Sr No	Course No .	Title	Credit	Core / Optional	Semester
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1	BCT-601	Biophysical chemistry	2 + 0 = 2	core	I
2	BCT-602	Biochemistry of Biomolecules	2+ 0 = 2	core	I
3	BCT-603	Enzymology	2+ 1 = 3	optional	I
4	BCT-604	Analytical techniques and instrumentation in Biochemistry	1 + 1 = 2	core	I
5	BCT-606	Intermediary metabolism and regulation	3 + 0 = 3	core	I
6	BCT-609	Endocrinology and Reproductive Biochemistry	2 + 0 = 2	optional	I
7	BCT-611	Introduction to Bioinformatics and computational biology	1+ 1 = 2	optional	I
8	BCT-605	Clinical Biochemistry of animals	2 + 1 = 3	optional	II
9	BCT-607	Molecular biochemistry	2+ 1 = 3	core	II
10	BCT-608	Nutritional and Industrial Biochemistry	2+0 = 2	optional	II
11	BCT-610	Biochemistry of ruminant and wild animals	1+1=2	optional	II
12	BCT-612	Master's Seminar	1+ 0 = 1	core	III
13	BCT-613	Masters Research	0+ 10 = 10	core	III
14	PGS-601	Technical writing and communication skills.	0+ 1 = 1	core	III
15	PGS-602	Agricultural Research ,Research Ethics and Rural development programmes	1+ 0 = 1	core	III
16	PGS-603	Basic concept in Laboratory techniques.	0+ 1 = 1	core	III
17	PGS-604	Intellectual property and its management in agriculture.	1+ 0 = 1	core	III
18	PGS-605	Library Information services	0+ 1 = 1	core	III
19	BCT-613	Masters Research	0+ 20 = 20	core	IV

List of Ph.D. Courses (Regular) – Veterinary Biochemistry

Sr No	Course No .	Title	Credit	Core / Optional	Semester
1	BCT-701	Applied Molecular Biochemistry and Systems Biology .	2 + 1 = 3	Core	I
2	BCT-702	Membrane Biochemistry	2 + 0 = 0	Core	I
3	BCT-703	Recent Trends in Enzymology	2 + 1 = 2	Optional	I
4	BCT-704	Diagnostic techniques in Clinical Biochemistry	0+2 = 2	Core	I
5	BCT-705	Recent Trends in Biochemical techniques and instrumentation	2 + 1 = 3	Core	I
6	BCT-707	Bioinformatics tools in biochemistry	1+ 1 = 2	Core	I
7	BCT-706	Developmental Biochemistry	2 + 0 = 2	Core	II
8	BCT-708	Environmental and toxicological Biochemistry	2 + 0 = 2	Core	II
9	BCT-709	Biochemistry of diseases and disorders	2+ 0 = 2	Optional	II
10	BCT-710	Immuno-biochemistry	2 + 0 = 2	Optional	II

11	BCT-711	Special problem	0 + 2 = 2	Core	II
12	RPE-700	Research and publication ethics	1 + 1 = 2	core	III
13	BCT-712	Doctoral seminar-I	1 + 0 = 1	Core	III
14	BCT-713	Doctoral seminar-II	1 + 0 = 1	Core	III
15	BCT-714	Doctoral Research	0 + 15 = 15	Core	III
16	BCT-714	Doctorate Research	0 + 20 = 20	Core	IV
17	BCT-714	Doctorate Research	0 + 20 = 20	Core	V
	BCT-714	Doctorate Research	0 + 20 = 20	Core	VI

5. Lecture Schedule – UG, PG , PhD - Theory / Practical Schedule – Approved by
BoS – Subject wise - **Veterinary Biochemistry**

LECTURE SCHEDULE (MSVE-2016)

Degree: B.V.Sc. & A.H.

Subject : Veterinary Biochemistry

Credit Hours : 2 + 1 = 3

Year: II

Lect. No	Sr. No.	Topics to be covered
UNIT –I General Veterinary Biochemistry		
1	1	Scope and importance of Biochemistry
2	2	Dissociation of acids,pH,Buffer system and Hendersson Hesselbalch equation
3	3	Structure of Biological membrane and transport across membrane
4	4	Donnan membrane Equilibrium
		Biochemistry of Carbohydrates
5	5	Classification and function of Carbohydrates.
6	6	Properties of monosaccharides (ribose, glucose,fructose,galactose mannose)
7	7	Diasaccharides(maltose,isomaltose,lactose,sucrose and cellulose)
8	8	Polysaccharides (starch,dextrins,dextrans,glycogen,cellulose,inulin,chitin)mucopolysaccharides including bacterial cell wall polysaccharides.
		Biochemistry of lipids
9	9	Classification ,properties and biological significance of simple lipids

10	10	Compound lipids and derived lipids and lipoproteins
11	11	Fat indices, structure and function of prostaglandins
		Biochemistry of Proteins
12	12	Classification and structure of protein viz primary, secondary, tertiary, and quaternary
13	13	Properties and biological significance of proteins
14	14	Physical and chemical properties of amino acids : amphoteric nature, optical activity and peptide bond formation.
		Biochemistry of nucleic acids
16	15	Chemistry of purine & pyrimidines, nucleoside and nucleotides, Biological significance of nucleosides and nucleotides
16	16	Structure and function of deoxyribonucleic acid (DNA)
17	17	Structure and function of typical ribonucleic acid (RNA)
		First Internal assessment/Examination
UNIT-II (INTERMEDIARY METABOLISM)		
18	18	Enzymes: Definition and classification, Coenzymes, cofactors and isoenzymes
19	19	Properties: Protein nature, Enzyme units: -International unit, katal, turnover number and specific activity
20	20	Enzyme-substrate complex formation
21	21	Modern concept of active centre of enzymes
22	22	Specificity of enzymes action: substrate specificity, group specificity, stereospecificity, optical specificity
23	23	Factors influencing enzyme action: effect of temperature, pH, concentration of substrate and enzyme
24	24	Enzyme inhibition: competitive, non-competitive and uncompetitive inhibition,
25	25	suicidal inhibition, Allosteric enzymes
26	26	Respiratory chain/electron transport chain

27	27	Oxidative phosphorylation
28	28	Inhibitors, uncouplers and other factors influencing electron transport chain.
		Carbohydrate metabolism
29	29	Glycolysis
30	30	Kreb cycle
31	31	HMP Shunt
32	32	Gluconeogenesis, cori cycle
33	33	Glycogenesis
34	34	Glycogenesis
35	35	Glycogenolysis
36	36	Bioenergetics of carbohydrate metabolism
		Lipid metabolism
37	37	Beta oxidation of fatty acid
38	38	Ketone body formation
39	39	Biosynthesis of long chain fatty acids
40	40	Biosynthesis of short chain fatty acids
41	41	Bioenergetics of lipid metabolism
		Protein metabolism
42	42	Biosynthesis of protein
43	43	Degradation of protein, Deamination
44	43	Transamination of amino acids
45	44	Decarboxylation of amino acids
45	45	Ammonia transport and urea cycle
		Nucleic acid metabolism
46	46	Metabolism of purine and pyrimidine
47	47	DNA biosynthesis

48	48	RNA biosynthesis
49	49	Regulation and repair of RNA during biosynthesis
50	50	Regulation and integration of metabolism
Second Internal Assessment/Examination		
		UNIT -III (VETERINARY ANALYTICAL BIOCHEMISTRY)
51	51	Hormonal control of carbohydrate metabolism and regulation of blood sugars.
52	52	Disorder of carbohydrate metabolism: Diabetes Mellitus, hyperinsulinism in dogs
53	53	Ketosis, Bovine ketosis
54	54	Pregnancy Toxemia, Hyperglycemia in baby pigs
55	55	Biochemical test for detection of disturbance in carbohydrate metabolism
56	56	Plasma protein and clinical significance of protein and dysproteinemia
57	57	Acute phase proteins
58	58	Lipid profile in disease diagnosis
59	59	Clinical Enzymology ; Diagnostic importance of non functional plasma enzymes, Isoenzymes
60	60	Liver function test; classification, Biochemical test for differential diagnosis of jaundice
61	61	Biochemical tests of renal function; Urine analysis, Role of BUN, Uric acid and creatinine in diagnosis
62	62	Disturbance in acid base balance and its diagnosis
63	63	Biochemistry of digestive disorder
64	64	Biochemistry of oxidative stress and shock
65	65	Biochemical basis of fluid therapy
66	66	Deoxygenation in the body; Metabolism of xenobiotics , General reactions for transformation of different groups of substances
67	67	General reactions for transformation of different groups of substances

68	68	Cytochrome p450 system enzymes
Third Internal Assessment /Examination		

DEPARTMENT OF VETERINARY BIOCHEMISTRY

PRACTICAL SCHEDULE (VCI-2016)

Degree: B.V.Sc. & A.H.

Year: II

Subject : Veterinary Biochemistry

Credit Hours : 2 + 1 =3

Pract. No.	Sr. No.	Topics to be covered
UNIT –I General Veterinary Biochemistry		
1	1	Concentration of solutions and system International (S.I.) Units: Preparation of Buffers
2	2	Preparation/standardization of acids and alkalies : Titration curve of acids versus base.
3	3	Qualitative test for carbohydrates and Identifications of unknown carbohydrates: Qualitative test for monosaccharides
4	4	Qualitative test for Diasaccharides and polysaccharides
5	5	Determination of acid number of oil
6	6	Precipitation reaction of protein
7	7	Colour reaction of protein
8	8	Estimation of amino acids(Sorenson's method)
9	9	Unit-II Intermediary metabolism
10	10	Effect of temperature and pH of enzyme activity
11	11	Estimation of blood plasma glucose
12	12	Estimation of serum protein
13	13	Estimation of serum albumin, globulin and A-G ratio
14	14	Estimation of serum inorganic phosphate
15	15	Estimation of serum calcium
16	16	Estimation of serum magnesium
17	17	Estimation of ascorbic acid by Dichlorophenol (DCPIP) method
18	18	Estimation of milk lactose by benedict quantative method
19	19	Estimation of sodium by flame photometer
20	20	Estimation of potassium by flame photometer
21	21	Paperchromatography of amino acids
22	22	Thin layer chromatography of amino acids
23	23	Estimation of vitamin A by colorimetry

Unit- III (Veterinary Analytical Biochemistry)			
24	24	Detection of pathological constituents of urine	
25	25	Estimation of Serum Creatinine	
26	26	Estimation of Serum Creatinine	
27	27	Estimation of Serum Creatinine	
28	28	Assay of ALT in serum	
29	29	Assay of AST in serum	
30	30	Estimation of serum bilirubin (Direct, Indirect and total)	
31	31	Practical on Acute Phase Protein	

Lecture Schedule – M.V.Sc. – Veterinary Biochemistry

Department of Veterinary Biochemistry

Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT-601

Credits: 2+0= 2

Course Title: Biophysical Chemistry

Aim of the course: Teaching of principles of physical chemistry as applicable to veterinary sciences

Lecture Schedule (Theory)

No . of Lectures	Name of Topic
2	Physical properties of water-the medium of life, Acids and bases, ionic strength and activity .
2	Henderson-Hasselbach equation, pH, indicators and buffers
3	Colloids and their properties, Mechanism of osmosis, osmotic pressure, Donnan membrane equilibrium, Viscosity, surface tension, surface forces, Adsorption and light scattering. .
2	Membrane filtration, dialysis, diffusion coefficient and partial specific volume
3	Laws of thermodynamics, Concepts of enthalpy, free energy and entropy in biochemical reactions, High energy compounds, Redox potential and free energy changes
4	Bioenergetics and biological oxidation, Components of mitochondrial electron transport chain. Formation of ATP and ATP cycle. Energy transformation in living cells
4	Basic Methods in Biophysical Chemistry: Basic Optical Principles, Optical Properties of Biomolecules, Optical spectroscopy

2	Basic Fluorescence Techniques
2	Chiroptical and Scattering Methods
3	Conventional and Confocal Fluorescence Microscopy
2	Basics of Super-Resolution Fluorescence Microscopy
2	Fluorescence spectroscopy.
1	Patch Clamping
Total -32	
Suggested Reading • David L Nelson and Cox Michael M. 2008. Lehninger's Principles of Biochemistry. 5th Ed. Freeman. • James P Allen. 2008. Biophysical Chemistry. 1st Ed. Wiley-Blackwell Publication. • Peter Jomo Walla. 2014. Modern Biophysical Chemistry: Detection and Analysis of Biomolecules. 2nd Ed. Wiley-VCH Publication.	

Department of Veterinary Biochemistry
Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT-602

Credits: 2+0= 2

Course Title: Biochemistry of Biomolecules

Aim of the course: Teaching molecular basis of structure and functional aspects of carbohydrates, lipids, amino acids and nucleic acids.

Lecture Schedule (Theory)

No. of Lecture	Name of Topic
1	Carbohydrates: Structure and Biological Significance of Important Monosaccharides: Ribose, Glucose, Fructose, Galactose, Mannose and Amino Sugars;
1	Chemical reactions of monosaccharides; Isomerism of carbohydrates; Structure and Biological Significance of Disaccharides (Maltose, Isomaltose, Lactose, Sucrose and Cellobiose);
1	Structure and Biological Significance of Polysaccharides (Starch, Dextrins, Dextrans, Glycogen, Cellulose, Inulin, Chitin), and Mucopolysaccharides including Blood group substances and Bacterial Cell Wall polysaccharides.
2	Glycoconjugates in cell surface, extra cellular matrix, sugar code functions, peptidoglycan-specific antibiotics.
1	Basic principles of separation, purification and characterization of carbohydrates.
1	Methods of Structural analysis of carbohydrates.
1	Definition, Classification, Properties and Biological Significance of simple, compound and derived lipids;
2	Fat indices; Structure and functions of prostaglandins, steroids, steroid hormones and fat soluble vitamins.
1	Basic principles of extraction and analysis of lipids;
2	Lipid bilayers, lipid motility, integral membrane proteins, lipid linked proteins, peripheral membrane protein
3	Fluid mosaic model, membrane skeleton, lipid asymmetry, cardiac glycosides, abnormalities in cell membrane fluidity, signaling biomolecules
1	Amino acids – Structure and classification.
1	Physical and chemical properties of amino acids – amphoteric nature, acid-base property, optical activity and peptide bond formation
2	Structure and geometry of peptide bond; Chemical synthesis of polypeptide; Oligopeptides of biological significance.
2	Classification of proteins; Structure – primary, secondary, tertiary and quaternary; Physico-chemical, acid-base and colloidal properties of proteins
1	Biological significance of proteins; Denaturation, extraction and purification criteria for proteins.
1	Chemistry of purines, pyrimidines, nucleosides and nucleotides;

1	Biological significance of nucleosides and nucleotides;
1	Structures and functions of Watson-crick model of deoxyribonucleic acid (DNA) and a typical ribonucleic acid (RNA).
2	Different types of DNA, acid-base properties, sedimentation behaviour
2	Hyperchromic effect, melting of DNA; Chemical and enzymatic hydrolysis of nucleic acids.
2	Base sequence analysis of DNA, Nucleic acid- protein interaction – histone and non-histone proteins.
Total-32	
Suggested reading • David L Nelson and Cox Michael M. 2017. Lehninger's Principles of Biochemistry. 7th Ed. Freeman. • Voet D, Voet JG and Pratt CW. 2016. Fundamentals of Biochemistry of Life at the Molecular Level. 5th Ed. John Wiley and Sons. • Berg JM, Tymoczko JL, Stryer L and Clarke ND 2015. Biochemistry. 8th Ed. WH Freeman and Co. • Zubay GL. 1998. Biochemistry. 4th Ed. WCB London.	

Department of Veterinary Biochemistry

Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT-603

Credits: 2+1= 3

Course Title: : Enzymology

Aim: To give thorough knowledge of molecular basis of enzyme action in relation to diagnostic importance.

Lecture Schedule (Theory)

No. of Lectures	Name of Topic
2	Introduction and historical perspective, Enzyme nomenclature and classification
1	Enzyme compartmentalization in cell organelles
2	Ribozymes, isozymes, abzymes, restriction endonucleases
1	Enzyme structure
2	Enzyme specificity, active site, active site mapping
2	Mechanism of enzyme catalysis
2	Cofactors, coenzymes- their structure and role

1	Enzyme kinetics
2	Enzyme inhibition and activation
2	Multienzyme complexes, allosteric enzymes and their kinetics, regulation of enzyme activity
2	Qualitative description of “concerted” and “sequential” models for allosteric enzymes. Half site reactivity, Flip-flop mechanism, positive and negative co-operativity. Monod Koshland Model.
2	Concept of ES complex, active site, specificity derivation of Michaelis-Menten equation for uni-substrate reactions.
2	Different plots for the determination of K_m and V_{max} and their physiological significances. Importance of K_{cat}/K_m .
2	Kinetics of zero and first order reactions. Significance and evaluation of energy of activation.
2	Isolation, purification and characterization of enzymes
2	Applications of enzymes in chemical and feed industry
2	Enzyme immobilization, biosensors, clinical and diagnostic applications of enzymes
Total-32	

Department of Veterinary Biochemistry

Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT-603

Credits: 2+1= 3

Course Title: : Enzymology

Aim: To give thorough knowledge of molecular basis of enzyme action in relation to diagnostic importance.

Lecture schedule (Practical)

No. of Practicals	Title of Practical
1	Enzyme assay by taking any model enzyme like alpha-amylase or alkaline phosphatase.
3	Isolation, purification and characterization of any model enzyme like E-galactosidase or acid phosphatase.
2	Study of the effect of enzyme and substrate concentrations and determination of K_m and V_{max} .
2	Determination of pH and temperature optima of alkaline phosphatase.
2	To study the effect of various inhibitors of enzymatic activity.
2	Determination of the pH and temperature stability of alkaline phosphatase.
1	Assay of Diagnostic enzymes from Clinical samples.

3	Application of enzymes in ELISA and Western Blotting.
Total-16	
Suggested Reading • Bergmeyer HU. 1983. Methods of Enzymatic Analysis. Vol. II. Verlag Chemie, Academic Press. • Dixon M, Webb EC, Thorne CJR and Tipton KF. 1979. Enzymes. 3rd Ed. Longman. • Maragoni AG. 2003. Enzyme Kinetics - A Modern Approach. John Wiley. • Palmer T. 2001. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. 5th Ed. Horwood Publ. • Price NC and Stevens L. 2003. Fundamentals of Enzymology. Oxford Univ. Press. • Wilson K and Walker J. (Eds.). 2000. Principles and Techniques of Practical Biochemistry. 5th Ed. Cambridge Univ. Press. • David L Nelson and Cox Michael M. 2008. Lehninger's Principles of Biochemistry. 5th Ed. Freeman. • Kaneko JJ, Harvey JH and Bruss ML. 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press.	

Department of Veterinary Biochemistry

Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT-604

Credits: 1+1= 2

Course Title: : Analytical Techniques and Instrumentation
in Biochemistry

Aim:. To make students well versed with certain basic methodologies used in biochemistry to carry out independent research.

No. of Lecture	Name of Topic
1	Concentration of solution and units of expression . Preparation of solutions and buffer. Henderson Hasselbalch equation and its significance in preparation of buffers.
1	Introduction to spectroscopy and principle of colorimetry and spectrophotometry. Basics components, principle and applications of UV-Visible spectrophotometer. Reflectance spectrophotometer and spectro-fluorometer.
1	Basics components, principle and applications of flamephotometer and atomic absorption spectrophotometer.
2	Basics components, principle and applications of inductively coupled plasma atomic emission spectroscopy .
1	Introduction to chromatography-principle, types and applications. Components and

	application of paper chromatography, Thin layer chromatography, High performance thin layer chromatography.
1	Components and applications of column chromatography. Factors affecting chromatographic resolution and methods of preparation of biological sample for chromatographic analysis.
1	Methods for qualitative and quantitative chromatography of amino acids, lipids and sugars including elution and densitometry.
2	Molecular sieving and its application in biochemistry, general properties of dextran, acrylamide, agar and other media used for gel filtration.
1	Principle and application of ion-exchange gel filtration hydrophobic interaction planar chromatography and lateral flow immune-chromatographic assays.
2	Introduction to GLC and HPLC (Normal and Reversed phase)
3	Introduction to electrophoresis –Principle, types and applications. Factors affecting migration of charged particles.
1	Principle and application of moving boundary paper and gel electrophoresis. Common methods for electrophoresis of amino acids. Protein and nucleic acids with components of electrophoretic apparatus.
1	Use of SDS-PAGE in molecular weight determination. Isoelectric focusing, Isotachopheresis densitometry procedure and quantitative assay applied to electrophoresis. Introduction to immune-electrophoresis and 2-D gel electrophoresis
2	ELISA-RIA and immune blotting.
2	Basic principle and sedimentation –Types, care and safety aspects of centrifuges. Preparative and analytical introduction to ultracentrifugation and fractionation of sub cellular components.
1	Density gradient centrifugation and determination of relative molecular mass
Total-16	

	Department of Veterinary Biochemistry Maharashtra Animal & Fishery Sciences University, Nagpur Course No. : BCT-604 Credits: 1+1= 2 Course Title: : Analytical Techniques and Instrumentation in Biochemistry Aim:. To make students well versed with certain basic methodologies used in biochemistry to carry out independent research.
No. of Practical	Title of Practical
1	Preparation of solutions and buffer. Acids , Bases ,Phosphate Buffer etc.
2	Problems solving based on Henderson Hasselbalch equation .
3	Verification of Beer's Lambert's law.
4	Estimation of glucose and Estimation of total cholesterol in serum
5	Determination of absorption maxima and molar extinction coefficient of P-Nitrophenol from its absorption spectrum
6	Estimation of protein using biuret , folin –ciocalteau methods and UV spectrophotometry.
7	Estimation of enzyme activity by spectrophotometry-kinetic mode.
8	Separation of amino acids by paper chromatography.
9	Separation of protein by affinity chromatography.
10	Separation of protein by ion exchange chromatography.
11	Separation of protein by gel filtration chromatography.
12	Determination of GLC for separation of fatty acids.
13	Electrophoretic analysis of albumin using non-denaturing and denaturing conditions.
14	Detection of molecular weight of protein by SDS-PAGE.
15	Salt fractionation dialysis. PAGE of immunoglobulins
16	Demonstration subcellular fractionation by ultra centrifugation.
Total-16	

Suggested Reading –
David L Nelson and Cox Michael M. 2017. Lehninger's Principles of Biochemistry. 7th Ed.
Freeman.

- Wilson K and Walker J. (Eds.). 2010. Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed. Cambridge Univ. Press.
- Willard et al. 1988. Instrumental Methods of Analysis. 7th Ed. Wadsworth Pub Co.
- Garritty S. 1999. Experimental Biochemistry. 3rd Ed. Academic Press. • Gowenlock AH. 2002. Varley's Practical Clinical Biochemistry. 6th Ed. CBS.
- Holme DJ and Hazel P. 1998. Analytical Biochemistry. 3rd Ed. Longman.
- George W. Latimer, Jr. 2016. Official Methods of Analysis of AOAC International, 20th Ed. AOAC International.
- Carl A. Burtis, Edward R. Ashwood and David E. Burns, 2014. Tietz Textbook of clinical Biochemistry and Molecular Diagnostics. 5th Edition. Elsevier

Department of Veterinary Biochemistry
Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT-605

Credits: 2+1= 3

Course Title: : Clinical Biochemistry of Animals

Aim:. To give a detailed overview of role of biomolecules in health and diseases and aid in diagnosis and prognosis of diseases in animals and poultry.

Lecture schedule (Theory)

No. of Lectures	Name of Topic
1	Quality control and automation in clinical biochemistry
2	Disturbance in water, electrolytes and acid base balance electrolyte abnormalities.
3	Respiratory acidosis and alkalosis : compensation and biochemical tests for diagnosis
4	Metabolic acidosis and alkalosis: compensation and biochemical tests for diagnosis
5	Diabetes Mellitus, classification and diagnosis
6	Hyper Insulemia ,Galactosemia, Hypoglycaemia of baby pigs
7	Glycogen storage disease and glycated proteins
8	Carbohydrates balance in ruminants

9	Biochemical alterations in body fluids of ruminants in hypoglycemia
10	Disorders in lipid metabolism :Hypercholesterolemia,atherosclerosis, hyperlipidemia in canines, felines and equines
11	Pathophysiology of ketonemia
12	Disorders of proteins, amino acids and nucleic acid metabolism: normal and abnormal plasma proteins – dysprotenemias, acute phase proteins,
13	Inborn errors of amino acid metabolism- Phenylketonuria , alkaptonuria, albinism, Tyrosinosis, mepalsyrup urine disease, lesch-nyhan syndrome, sickle cell anaemia, histidinemia-defect in collagen biosynthesis.
14	Disorders of proteins, amino acids and nucleic acid metabolism: normal and abnormal plasma proteins – dysprotenemias, acute phase proteins
15	Inborn errors of amino acid metabolism- Phenylketonuria , alkaptonuria, albinism, Tyrosinosis, mepalsyrup urine disease, lesch-nyhan syndrome, sickle cell anaemia, histidinemia-defect in collagen biosynthesis
16	Abnormalities in nitrogen metabolism- uremia, hyperruricemia, porphyria and factors affecting nitrogen balance
17	Composition and diagnostic significance of cerebrospinal fluid and amniotic fluid.
18	Classification of tests –biochemical tests for liver function –serum enzyme activities to assess liver function.
19	Hepatic encephalopathy- hepatic photosensitivity-ascites.
20	Renal functions:direct and indirect test glomerular filtration –tests for tubular functions-test for kidney damage.
21	Gastrointestinal functions: disturbance in gastrointestinal function-disturbance in rumen function.
22	Gastrointestinal functions: disturbance in gastrointestinal function-disturbance in rumen function
23	Clinical enzymology-functional and nonfunctional plasma enzyme
24	Plasma enzymes of diagnostic importance- ALP,CK, LDH,AST, ALT, OCT-isoenzyme and their diagnostic importance
25	Oxidative stress:Biochemical basis of disease progression and diagnostic enzymes.
26	Biochemical markers of cardiac diseases : hypertension, myocardial infarction and heart

	failure.
27	Respiratory distress syndrome. COPD, ischemia, shock.
28	Disorders of mineral metabolism : hypercalcaemia ,hypocalcaemia, normocalcaemia, hypophosphatemia , hypophosphatemia
29	Biochemistry of tumors and various types of tumors, markers.
30	Role of tumor markers for the diagnosis of prostate cancer, ovarian cancer. Mammary tumor, lymphoma, bladder cancer and pancreatic cancer.
31	Biochemical basis and diagnosis of prevalent diseases and metabolic disorders in wild animal
32	Biochemical basis and diagnosis of prevalent diseases and metabolic disorders in poultry.
Total-32	

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University, Nagpur

Course No. : BCT 605

Credits: 2+1= 3

Course Title: Clinical Biochemistry of Animals

Aim:. To give a detailed overview of role of biomolecules in health and diseases and aid in diagnosis and prognosis of diseases in animals and poultry.

Lecture schedule (Practical)

No. of Practical	Title of Practical
1	Urine analysis- Volume, colour acidity, pH, specific gravity
2	Normal urinary constituents, pathological constituents and sediments.
3	Quality control – precision, accuracy, sensitivity and specificity
4	Estimation of blood glucose
5	Estimation of total protein and A/G ration

6	Estimation of cholesterol from serum.
7	Estimation of urea from serum.
8	Estimation of uric acid from serum.
9	Estimation of bilirubin from serum.
10	Estimation of creatinine from serum.
11	Estimation of serum enzymes-ALP, ACP
12	Estimation of serum enzyme- AST, ALT
13	Electrophoresis of plasma protein
14	Separation of isoenzymes.
15	Estimation of Ca, Mg, P,K, Na. in serum samples.
16	Estimation of vit.C
17	Estimation of Vit.D and Vit.E.
18	Estimation of total antioxidant activity.
Total-18	

Suggested Reading

David L Nelson and Cox Michael M. 2007. Lehninger's Principles of Biochemistry. 4th Ed. Freeman.

- Kaneko JJ, Harvey JH, Bruss ML. 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press.

- Racek J and Rajdl D. 2016. Clinical Biochemistry. 1st Ed. Karolinum Press.

- Voet D, Voet JG and Pratt CW. 2006. Fundamentals of Biochemistry of Life at the Molecular Level. 2nd Ed. John Wiley and Sons.

Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science Iniversity,Nagpur

Course No: BCT-606

Credits: 3+0=3

Course Title: Intermediary Metabolism and Regulation

Aim: To teach regulatory mechanisms concerned with the metabolism of carbohydrates, lipids, amino acids, proteins and nucleotides in health and diseases and to give exposure in inter-relationship of cellular metabolism of various macromolecules.

Lecture Schedule (Theory)

No. of Lecture	Name of Topic
1	Glycolysis - Reactions, functions and its control
2	Metabolism and regulation of other sugars – Fructose and Galactose
3	Metabolism and regulation of other sugars - Mannose and Lactose
4	Pyruvate dehydrogenase Complex, Reactions of Citric acid cycle and its regulation
5	Anaplerotic reactions - Energetics of Glucose oxidations; Introduction to Alternate pathways of Glucose metabolism
6	Reactions of HMP pathway and its regulation
7	Glucuronic acid cycle and its regulation
8	Gluconeogenesis with its regulation – Substrates - Pyruvate and Lactate
9	Gluconeogenesis with its regulation – Substrates - Glucogenic amino acids, Glycerol and Propionate
10	Glycogen metabolism – Reactions and regulation of Glycogenolysis
11	Glycogen metabolism - Reactions and regulation of Glycogenesis
12	Metabolic disorders – Glycogen Storage Diseases (GSD)
13	Lipid transport and storage – Metabolism of Plasma Lipoproteins
14	Role of liver and adipose tissue in fat metabolism
15	Role of brown adipose tissue in thermogenesis
16	Catabolism of Triacylglycerols and its regulation
17	Beta oxidation of Fatty acids and its regulation
18	Ketogenesis and utilization of ketone bodies
19	Biosynthesis of Fatty acids and its regulation

20	Biosynthesis of Triacylglycerols and Phospholipids and their regulation
21	Biosynthesis of Cholesterol and its regulation – Production of Bile acids
22	Metabolism of Eicosanoids
23	Lipid Storage Diseases
24	Introduction to protein turnover and amino acid pools – Meister cycle
25	Catabolism of amino acids - Deamination, transamination reactions and Ammonia carriers/ transport
26	Excretion of nitrogen - Urea cycle and its regulation
27	Catabolism of carbon skeletons of amino acids and its regulation
28	Conversion of amino acids to specialized products - Heme Biosynthesis
29	Conversion of amino acids to specialized products - Physiologically active amines
30	Biosynthesis of non-essential amino acids and its regulation
31	Metabolic disorders – phenylketonuria, methyl malonic aciduria, alkaptonuria, maple syrup urine disease, parkinson's disease, homocystinuria, hartnup's disease
32	Catabolism and regulation of Purine nucleotides
33	Catabolism and regulation of Pyrimidine nucleotides
34	Biosynthesis and regulation of Purine nucleotides
35	Biosynthesis and regulation of Pyrimidine nucleotides
36	Biosynthesis of nucleotide coenzymes and regulation
37	Inhibitors of purine and pyrimidine metabolism – Role in Cancer therapy
38	Metabolic disorders - hyperuricemia and gout
39	Structural and functional relationships of specialized tissues and organs, viz., Brain, muscle, adipose tissue, liver and kidney
40	Organ specialization in fuel metabolism of brain, muscle, adipose tissue, liver and kidney
41	Inter-organ metabolic pathways

42	Hormonal control of fuel metabolism
43	Tracing metabolic fates - perturbing the system
44	Metabolic interrelationships in obesity, diabetes, cancer, aerobic and anaerobic exercise in horses, pregnancy, lactation and stress injury
Total-44	
Suggested Reading • Berg JM, Tymoczko JL, Stryer L and Clarke ND 2015. Biochemistry. 8th Ed. WH Freeman and Co. • David L Nelson and Cox Michael M. 2017. Lehninger's Principles of Biochemistry. 7th Ed. Freeman. • Kaneko JJ, Harvey JH and Bruss ML. 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press. • Metzler DE. Biochemistry. John Wiley. • Swenson MJ and Reece WO. 2015. Dukes' Physiology of Domestic Animals. 13th Ed. Panima. • Voet D, Voet JG and Pratt CW. 2016. Fundamentals of Biochemistry of Life at the Molecular Level. 5th Ed. John Wiley and Sons. • Zubay GL. 1998. Biochemistry. 4th Ed. WCB London.	

Department of Veterinary Biochemistry

Maharashtra Animal And Fishery Sciences University, Nagpur

Course No: BCT-607

Credits: 2+1=3

Course Title: Molecular Biochemistry

Aim: To provide knowledge regarding genes, their functions, expression, regulation and transfer in heterologous systems.

Lecture schedule (Theory)

No.of lectures	Name of Topic
1	Historical Development of Molecular Biology
2	Nucleic acids as genetic material, Chemistry and Structure of DNA and RNA
3	Genome organization in prokaryotes and eukaryotes
4	Repetitive and non-repetitive DNA, Satellite DNA
5	Chromatin structure and function
6	DNA replication mechanisms in prokaryotes and Eukaryotes DNA polymerases, DNA ligase
7	Topoisomerases

8	Transcription mechanisms in Prokaryotes and Eukaryotes, RNA Pol
9	RNA editing
10	Post-transcriptional RNA processing
11	Recombination mechanisms
12	DNA repair mechanisms
13	Reverse transcriptase
14	Telomeres, Telomerase, Role of Telomeres in Cancer 1
15	Translation mechanisms in Eukaryotes and Prokaryotes
16	Post - translational modification
17	Ribosomes - structure and function, organization of ribosomal proteins
18	Genetic code
19	Aminoacyl tRNA synthases
20	Inhibitors of replication, transcription and translation.
21	Regulation of gene expression in prokaryotes and eukaryotes
22	Recombinant DNA technology - Introduction
23	Plasmid biology, Cloning Vectors, selection of recombinants
24	Nucleases and restriction enzymes
25	Polymerase Chain Reaction and its variants
26	Expression vectors
27	Heterologous protein expression systems
28	Recombinant protein purification
29	Site Directed Mutagenesis, In-vitro transcription
30	Gene Silencing
31	Transgenic Animals

32	Introduction to Systems Biology
Total-32	

Department of Veterinary Biochemistry
Maharashtra Animal And Fishery Sciences University, Nagpur
Course No: BCT-607 **Credits: 2+1=3**

Course Title: Molecular Biochemistry

Aim: To provide knowledge regarding genes, their functions, expression, regulation and transfer in heterologous systems.

Lecture schedule (Practical)

No.of Practicals	Title of practical
2	Isolation and purification of DNA
2	Plasmid isolation
2	Isolation and purification of RNA
1	Determination of concentration of DNA and RNA by spectrophotometry
1	Determination of TM of DNA by spectrophotometry
2	Polymerase chain reaction
2	Restriction Digestion of DNA
1	Agarose gel electrophoresis
2	RAPD analysis of DNA
2	cDNA synthesis using PCR
Total-10	

Suggested Reading

- Jocelyn E Krebs et al. 2017. Lewin's Genes XII. Jones and Bartlett Publishers Inc.
- Watson JD et al. 2017. Molecular Biology of the Gene. 7th Ed. Pearson Education.
- Eberhard. O. Voit. 2017. A First Course in Systems Biology, 2nd Edition. Garland Science Publishers.
- Genome Editing and Engineering: From TALENs, ZFNs and CRISPRs to Molecular Surgery, Ed.

Krishnarao Appasani, Cambridge University Press, 2018

- Molecular Cell Biology, 8th Ed, Lodish et al. WH Freeman and Co., 2016
- Molecular Biology of the Cell, 6th Ed. Bruce Alberts et al, WW Norton and Company, 2014
- Transgenic Animal Technology: A laboratory handbook, 3rd Edition, Ed. Carl. A. Pinkert, Academic Press, 2014.
- Molecular Biology, 4th Ed, Robert F. Weaver, McGraw Hill Higher Education, 2007.

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University, Nagpur

Course No: BCT - 608

Credits: 2+0=2

Course Title: Nutritional and Industrial Biochemistry

Aim: To give exposure about biochemical principle as applicable to nutrition in animals and industry.

Lecture schedule (Theory)

No. of Lectures	Name of Topic
1	Nutrients and their importance in ruminants.
2	Nutrients and their importance in Non ruminants and poultry
3	Energy value of various nutrients their importance and calorimetry
4	Nutrient absorption and biochemical changes involved
5	Introduction to BMR, SDA, PER and Biological value for protein.
6	Requirements of different nutrients in animals
7	Role of nutrients in growth and production of animals
8	Bio-availability of nutrients in different food sources

9	An overview of metabolism of different nutrients
10	An overview of regulation of nutrient absorption and utilization
11	Alterations that occur in nutritional requirements during diseases.
12	Alterations in biochemical reactions due to Toxic factors in feed
13	Biochemical role of Macro minerals in animal production
14	Biochemical role of Micro minerals in animal production
15	Vitamins and their role as co enzymes in metabolism
16	Deficiencies of nutrients that cause metabolic disorders in animals
17	Biochemical alterations occurring due to phyto toxins in ruminants
18	Biochemical importance of different feed additives
19	Agonists and antagonists of minerals
20	Agonists and antagonists of vitamins
21	Nutrient control of gene expression
22	Clinical issues of micro mineral metabolism
23	Nutrients (minerals) that resist digestion process in animals
24	Energy releasing and hematopoietic water soluble vitamins
25	Industrial biochemistry- applications of biological molecules for medical, industrial, environmental, agricultural or analytical purposes
26	Generation of gene-mediated industrial/ medical products.
27	Introduction and application of fermentation technology for ethanol and biogas production
28	Introduction to industrial microorganisms and products, growth and product formation in biocatalysis
29	Conversion of sunlight into biomass (bioreactors and bio-photolysis)
30	Significance of pharmaceuticals products of animal origin, sex hormones, oestrogens, progesterone, corticosteroids
31	Significance of pharmaceuticals of plant origin, Alkaloids, atropine, morphine, cocaine, ergot alkaloids, flavonoids, xanthenes and terpenoids

32	Physical, chemical and biological treatment of waste water, bioremediation of contaminated soils.
Total-32	Suggested reading- Nutritional Biochemistry, 2nd Edition, Tom Brody, Elsevier pub.2009 • Text book of Biochemistry with clinical correlations. 6th edition, Thomas M Devlin, Wileys liss. Press. • A textbook of industrial microbiology 2nd edition, Crueger W and Crueger A. 2000, Panima Publishing Corp. • Principle of fermentation technology, 1997, Stanbury PF, Ethitaker H, Hall S, Aditya Books (P) Ltd. • Bioprocess Engineering: Basic Concepts. Shuler M and Kargi F. Second Edition. Pearson Education. 2002 • Nutritional Biochemistry of the vitamins, by David a Bender, 2nd Edition, Cambridge University Press.

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University, Nagpur

Course No: BCT-609

Credits: 2+0=2

Course Title: Endocrinology and Reproductive Biochemistry

Aim: To impart knowledge on the role of hormones in signalling and their biochemical role in reproduction of animals.

Lecture Schedule (Theory)

No .of Lectures	Name of Topics
2	Classification, secretion, transport and regulation of hormones.
2	Mechanism of hormone action and intracellular signalling after receptor activation.
2	Releasing factors from hypothalamus and their effects on pituitary gland and metabolism.
2	Hormones from Pituitary, secretion, regulation, metabolic functions and physio-pathology.
1	Synthesis ,secretion, regulation,metabolic functions and physio pathology of thyroid hormones.
2	Parathyroid gland, its hormone and effect on calcium and phosphate concentrations in the extracellular fluid

2	Endocrine Pancreas,Hormone synthesis,secretion ,regulation, metabolic function, and physiopathology.
2	Endocrine Pancreas: Hormone synthesis, secretion, regulation, metabolic functions and physio-pathology.
1	The Pineal Gland and Melatonin secretion, regulation and function.
2	Female hormonal system - Effect on ovaries - Synthesis, secretion, regulation, functions, and physio-pathology of ovarian hormones.
2	Synthesis, secretion, regulation, metabolic functions and physio-pathology of male sex hormones
2	Prostaglandins: Chemistry, Functions and Clinical Importance
2	Hormones concerned with animal production.
2	Endocrine aspects in reproduction status in domestic animals.
2	Hormones concerned with poultry production.
2	Endocrine aspects of reproduction in poultry.
2	Hormones involved in development of Ductal and Lobule-Alveolar System of mammary gland - Endocrine control of milk secretion and its biosynthesis
Total-32	Suggested Reading • Dukes' Physiology of Domestic Animals, 13th edition/ editor, William O Reece, Wiley Blackwell. • Guyton and Hall Textbook of Medical Physiology, 13th edition/ editor, John E Hall, Elsevier. • Applied Animal Endocrinology, E. James Squires, CABI • Endocrinology: An Integrated Approach, by SS Nussey, SA Whitehead, 1st edition, CRC Press. • Biochemistry of Lactation, TB Mepham, Elsevier.

Department Of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University,Nagpur.

Course No: BCT-610

Credits: 1+1=2

Course Title: Biochemistry of Ruminants and Wild Animals

Aim: To acquaint the students about comparative metabolism in ruminant species and the common metabolic disorders in ruminants; to impart a basic knowledge about biochemistry of wild animals.

Lecture Schedule(Theory)

No. of Lectures	Name of Topic
2	Comparative metabolism of carbohydrates, proteins and lipids in ruminants
1	Metabolism of nutrients by rumen microflora
1	Blood biochemistry of ruminants
2	Disorders associated with carbohydrate, protein and lipid metabolism
1	Liver dysfunction and tests
1	Kidney dysfunction and tests
2	Diseases associated with major and trace elements
1	Blood biochemistry and blood typing of wild animals

2	Fluid balance and electrolyte maintenance in wild animals
1	Biomarkers for assessment of diseases in wild animals
1	Diabetes in primates
1	Neurological diseases in cheetah
Total	16

Department Of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University, Nagpur.

Course No: BCT-610

Credits: 1+1=2

Course Title: Biochemistry of Ruminants and Wild Animals

Aim: To acquaint the students about comparative metabolism in ruminant species and the common metabolic disorders in ruminants; to impart a basic knowledge about biochemistry of wild animals.

Lecture Schedule (Practical)

No. of Practicals	Title of Practical
1	Methods of examining fluids and tissue in wild animals
2	Pancreatic function test
3	Estimation of Serum amylase
4	Estimation of Serum Bilirubin
5	Estimation of serum Inorganic Phosphate
6	Estimation of serum Calcium
7	Estimation of serum Magnesium
8	Estimation of Vitamin A
9	Estimation of serum LDH
10	Estimation of rumen volatile fatty acid
11	Estimation of rumen lactic acid
12	Estimation of Cellulolytic activity
13	Estimation of milk ketone bodies (acetone) by microdiffusion method

14	Estimation of milk lactose
Total-14	Suggested reading • Dvorak AM and Harris W. 1991. Blood Cell Biochemistry. 2nd Ed. Plenum. • Clinical Biochemistry of Domestic Animals, 6th Edition/ Editors: Jiro Kaneko John Harvey Michael Bruss, Elsevier. • Lipid Metabolism in Ruminant Animals, 1st Edition/ Editors: William W Christie, Elsevier. • Digestive Physiology and Metabolism in Ruminants, Editors: Ruckebusch Y, Thivend. • Energy Nutrition in Ruminants, Editors: Orskov ER. • Zoo and Wild Animal Medicine (Current Therapy 3) by Murray E Fowler, 5th edition. • Textbook of Veterinary Biochemistry, by RS Dhanotiya, JAYPEE.

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University, Nagpur

Course No: BCT 611

Credits: 1 + 1=2

Course Title: Introduction to Bioinformatics and Computational Biology

Aim: To impart an introductory knowledge of Bioinformatics and Computational biology to postgraduate students studying any discipline of veterinary/ agricultural science.

Lecture Schedule (Theory)

No. of Lectures	Name of Topic
1	Introduction to bioinformatics - Scope and applications of bioinformatics
2	Introduction to biological databases: primary, secondary and structural databases
3	Basic concept of Protein and Gene Information Resources-PIR, SWISS-PROT, PDB, GenBank, DDBJ
4	Basic concept of computational biology, applications in different subfields of biology
5	Basic concept of sequence search algorithm and alignment tools: BLAST and

	FASTA; DNA and protein sequence analysis, local and global alignment
6	Dot Matrix method, dynamic programming methods
7	Pairwise and multiple sequence alignment and its application
8	Tools of Multiple sequence alignment: ClustalW
9	Basic concept of Phylogeny study
10	cDNA libraries and EST, EST analysis
11	Database search engines - introduction and application
12	Commercial databases and software packages, GPL software for Bioinformatics
13	Computer aided drug design - basic principles
14	Introduction of Molecular docking and QSAR
15	2DQSAR, 3DQSAR, their basic concept and applications
16	Machine learning tools for QSAR
Total-16	Department of Veterinary Biochemistry Maharashtra Animal and Fishery science University, Nagpur Course No: BCT 611 Credits: 1 + 1=2 Course Title: Introduction to Bioinformatics and Computational Biology Aim: To impart an introductory knowledge of Bioinformatics and Computational biology to postgraduate students studying any discipline of veterinary/ agricultural science
	Lecture Schedule (Practical)
No.of Practical s	Title of practical
2	Basic concept of computer hardware and software, computer operating systems: Linux and Windows
1	Nucleotide information resource: EMBL, GenBank, DDBJ
1	Protein information resource: SwissProt, TrEMBL, Uniprot
1	Structure databases: PDB, MMDB
1	Basic concept of molecular search Engines: Entrez, ARSA, SRS
2	Usage of NCBI resources
1	Retrieval of sequence/structure from databases

1	Database searching
1	Visualization of structures of DNA and Proteins using Rasmol
1	Sequence similarity search using BLAST
2	Multiple sequence alignment tools: ClustalW, Bioedit, etc.
1	Phylogeny study using different software tools
1	Primer designing using different software tools
Total-16	Suggested Reading
	• Introduction to Bioinformatics 2003. Attwood TK and Parry-Smith DJ, Pearson Education. • Essential bioinformatics 2006. Xin Xiong. Cambridge University Press. • Bioinformatics: Concepts, Skills and Applications 2004. Rastogi SC, Mendiratta N and Rastogi P. CBS. • Principles of Genome Analysis and Genomics 2003. SB Primrose and RM Twyman, Blackwell Publishing • Molecular Analysis and Genome Discovery 2004. Ralph Rapley and Stuart Harbron (Eds.), John Wiley and Sons. • Bioinformatics 2001. Andreas D Baxeavanis and BF Francis Ouellette (Eds.) • Wiley Interscience Proteins and Proteomics 2003. Richard J. Simpson, Cold Spring Harbor Laboratory

Lecture Schedule – Ph.D. – Veterinary Biochemistry

Department of Veterinary Biochemistry
Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT- 701

Credits: 2+1= 3

Course Title: Applied Molecular Biochemistry and Systems Biology

Aim: To impart latest information on the molecular biochemistry of isolation, transfer and expression of genes and biochemical approaches employed in gene therapy and computational approaches to biology/ synthetic biology .

Lecture Schedule (Theory)

No.of Lectures	Name of Topic
1	Organization of prokaryotic genome

2	Nuclear and organelle genes
3	Concept of genome mapping and Organization
4	Molecular evolution
5	Prokaryotic and Eukaryotic gene regulation
6	RNA editing
7	Comparative genomics
8	Functional genomics
9	Transcriptomics and transcriptional network
10	Application of genomics, Livestock genomics, Buffalo Genome Initiative, Dog genome projects, Role of genomics in Wild life conservation and Reconstruction of species
11	Bioethics and biosafety guidelines and IPR in recombinant DNA research
12	Transgenics, Gene Knock-out technology
13	Site specific nucleases, Zinc-Fingers, TALENS and CRISPR – Cas 9
14	Applications of Gene knock out, Development of Knock-out Animal models
15	Gene silencing, Applications of gene silencing
16	Antisense oligos, Ribozymes
17	RNAi, 3'UTR and miRNA, Site directed mutagenesis
18	Gene targeting and gene therapy
19	Nucleic acid sequencing: Various methods of sequencing including automated sequencing and Microarrays
20	Whole Genome Sequencing, epigenetic regulation
21	Protein sequencing, Peptide synthesis
22	Peptide arrays
23	Protein engineering
24	Directed evolution of proteins

25	Mathematical modelling, Static Network models
26	Mathematics of Biological systems, Parameter estimation
27	Gene systems, Gene regulation models
28	Protein systems, Metabolic systems
29	Signalling systems, Population systems
30	Physiological modelling
31	Systems biology in Medicine and Drug development
32	Basic design of biological systems
33	Introduction to Nutrigenomics - Applications in Veterinary Science
34	Pharmacogenomics - Applications in Veterinary Science
Total- 34	

Department of Veterinary Biochemistry
Maharashtra Animal & Fishery Sciences University, Nagpur

Course No. : BCT- 701

Credits: 2+1= 3

Course Title: Applied Molecular Biochemistry and Systems Biology

Aim: To impart latest information on the molecular biochemistry of isolation, transfer and expression of genes and biochemical approaches employed in gene therapy and computational approaches to biology/ synthetic biology .

Lecture Schedule (Practical)

No. of Practicals	Title of Practical
1	DNA methylation protocols
2	Genome Editing protocols, In-vitro Site Directed Mutagenesis
2	Gene silencing protocols
1	Next Generation sequencing platforms

1	Quantitative PCR, SAGE, Massively Parallel Signature Sequencing (MPSS)
2	Oligonucleotide synthesis and quality control
2	Cap Analysis of Gene Expression (CAGE)/ deep CAGE
2	Chip-Chip assay Proteomics
1	2D-PAGE, MSMS, MALDI-TOF
2	Protein-protein interaction (Hybrid assay, DNA-Protein interaction and gene regulation (EMSA and Chip assay), DNA Microarrays, Protein sequencing protocols
Total-17	

Suggested readings-

- Molecular Biology of the Gene, 7th Ed. JD Watson et al., Pearson Education, 2017
- Lewin's Genes XII, Jocelyn E Krebs et al., Jones and Bartlett Publishers Inc., 2017
 - A First Course in Systems Biology, 2nd Edition, Eberhard. OVoit, Garland Science publishers 2017
 - Directed Enzyme Evolution: Advances and Applications, Ed. Miguel Alcalde, Springer International Publishing, 2017
 - Genome Editing in Animals: Methods and Protocols, Ed. Izuho Hatada, Springer Protocols, 2017
 - Genome Editing and Engineering: From TALENs, ZFNs and CRISPRs to Molecular Surgery, Ed. Krishnarao Appasani, Cambridge University Press, 2018
 - Molecular Cell Biology, 8th Ed, Lodish et al., WH Freeman and Co., 2016
 - Nutrigenomics, Eds. Carsten Carlberg, Stine Marie Ulven and Ferdinand Molnar, Springer Intl. Pub, 2016
 - CRISPR: Methods and Protocols, Eds. Magnus Lundgren, Emmanuelle Charpentier, Peter C Fineran, Humana Press, 2015
 - Genome Analysis: Current Procedures and Applications, Ed Maria S Poptava, Caister Academic Press, 2014
 - Transgenic Animal Technology: A laboratory handbook, 3rd Edition, Ed. Carl A Pinkert, Academic Press, 2014
 - Molecular Biology of the Cell, 6th Ed. Bruce Alberts et al, WW Norton and Company, 2014
 - Bovine Genomics, Ed. James E Womack, Wiley Blackwell, 2012
 - The Genetics of the Dog, Eds. Elaine A Ostrander and Anatoly Ruvinsky, CABI press, 2012
 - An Introduction to Systems Biology. Ed. Sangdun Choi, Humana Press, 2010
 - Genome Mapping and Genomics in Domestic Animals, Eds. Noelle E Cockett, Chittaranjan Kole, Springer Verlag, 2009.
 - Gene Knockout protocols, Eds. Ralf Kuhn, Wolfgang Wurst, 2009, Springer
 - Molecular Biology, 4th Ed, Robert F. Weaver, McGraw Hill Higher Education, 2007
 - Comparative Genomics, Ed. Nicholas H Bergman, Humana press, 2007
 - Molecular Biology and Genomics, Cornel Mulhardt, Academic Press, 2007
 - The Dog and Its Genome, Eds. Elaine A. Ostrander, Urs Giger, Kerstin Lindblad-Toh, CSHL press, 2006
 - Life: An Introduction to Complex Systems Biology, Springer, 2006
 - An Introduction to Systems Biology: Design principles of Biological circuits, Uri A

Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science University ,Nagpur

Course No. : BCT-702

Credits: 2+0= 2

Course Title:Membrane Biochemistry

Aim: To teach structure and functions of biomembranes, structure-function relationships, membrane biogenesis

Lecture Schedule (Theory)

No .of Lecture	Name of Topic
2	Concepts of bio membranes and their classification based on cellular organelles
1	Physico-chemical properties of different biological and artificial membranes
2	Membrane biogenesis and differentiation
2	Trafficking of Membrane Components - lipids, carbohydrates, and proteins
1	Cell surface receptors and antigen
2	Distribution and organization of membrane components-lipids; proteins, intrinsic and extrinsic: their arrangement
1	Cell membrane structure and the Fluid-mosaic model
1	Restoration and maintenance of cell membrane integrity and permeability
2	Methods for analysis of plasma membrane integrity
1	Separation of different membrane components

2	Molecular basis of biochemical behaviours of membranes
1	Various membrane movements
2	Transport across membrane-Active transport, passive transport, diffusion, osmosis, exocytosis and endocytosis
1	Fick's law of diffusion and its physiological importance
1	Energy transduction
1	Role of membrane in cellular metabolism
1	Role of membrane in cell recognition
2	Cell to cell interaction
2	Signal transduction
2	Molecular mechanisms, ion translocating antibiotics, valinomycin, gramicidin, ouabain, group translocation, ionophores, electrical gradient, energy coupling mechanism
3	Recent trends and tools in membrane research
Total-33	

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University ,Nagpur

Course No. : BCT-703

Credits: 2+1= 3

Course Title: Recent Trends in Enzymology

Aim: -----

Lecture Schedule (Theory)

No. of lectures	Name of Topic
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3	Enzyme: Structure, mechanism, and regulation.
2	Three dimensional structure of enzyme, flexibility and conformational mobility of enzymes
1	Enzyme families, dehydrogenase and dinucleotide fold, Multienzyme complexes
2	Features and mapping of active site of enzymes, methods of examining enzyme-substrate complexes
1	Reaction mechanism of lysozyme, chymotrypsin, carboxypeptidase A and ribonuclease A.
2	Regulation of enzyme activity by zymogen activation, covalent modification and feedback inhibition.
1	Allosteric enzyme with special reference to aspartate trans carbomylase. Concerted and sequential models of allosteric enzymes
2	Enzyme catalysis: general acid-base, covalent electrostatic and metal ion catalysis, orbital steering
2	Principles of kinetic equivalence and kinetic isotopic effects, transition state theory-application and significance of enzyme catalysis. Hammond postulate
2	Enzyme kinetics and inhibition: factors influencing enzyme reaction velocity, steady-state kinetic of enzyme catalyzed reaction, significance of Michacelis-Menten parameters
2	Extension and modification of the Michacelis-Menten mechanism. Kcat/ Km and kinetic perfection in enzyme catalysis
2	Kinetics of multi-substrate system-random, sequential, ordered Theorell-chance and the ping-pong mechanisms.
1	Competitive, non-competitive enzyme inhibition, suicide substrates and anti-metabolites.
1	Recent developments: Industrial application of Enzymes
1	Enzyme immobilization methods and application.
1	Restriction endonucleases
1	Enzyme engineering, use of site-directed mutagenesis for detection of enzyme mechanisms
1	Abzymes and ribozymes, Enzyme linkering. Biosensors.
1	Diagnostic enzymology: Assay of enzymes in clinical cases

1	Enzymes in Pathogenesis, Enzyme histochemistry and cytochemistry
1	Application of microscopy in enzymology
2	Enzyme immuno diagnostics, Cholinesterase, lipase, amylase, GGT, GPx, arginase, AST, ALT and SDH in diagnosis of diseases of animals. Therapeutic Enzymes
Total-33	

Suggested Reading-Alberts B, Johnson A, Lewis J, Raff M, Roberts HK and Walter P. Molecular Biology of the Cell. Garland Science, Taylor and Fransis Group.

• Cooper GM and Hausam RE. 2015. The Cell: A Molecular Approach. Oxford University Press. ISBN: 9781605352909

Lodish H, Berk A, Zipursky SA, Matsudaira P, Baltimore D and Darnel J. 1999. Molecular Cell Biology. WH Freeman

. • Nelson DL and Cox MM. 2000. Lehninger Principles of Biochemistry. 3rd Ed. Replika Press Pvt. Ltd., New Delhi for Worth Publ., New York.

• Selected articles from journals.

**Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science University, Nagpur**

Course No. : BCT- 703

Credits: 2+1= 3

Course Title:Recent Trends in Enzymology

Aim:-To teach current developments in actions of enzymes and their applications.

Lecture schedule (Practicals)

No. of Practicals	Title of Practicals
3	Estimation of Antioxidant Enzymes (Superoxide dismutase, Glutathione Peroxidase, Catalase, Glutathione S-transferase) from tissue samples
4	Isolation, purification and characterization of enzymes from biological samples.
2	Application of enzymes in competitive bioassays (ELISA, RIA)

2	Determination of Enzyme activity in Native Gel Electrophoresis
2	Estimation of Diagnostic enzymes from Clinical samples.
3	Application of Restriction enzymes in cloning experiments.
Total -16	

Suggested Reading-

David L Nelson and Cox Michael M. 2008. Lehninger's Principles of Biochemistry. 5th Ed. Freeman.

- Kaneko JJ, Harvey JH and Bruss ML. 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press.

- Maragoni AG. 2003. Enzyme Kinetics - A Modern Approach. John Wiley.
- Palmer T. 2001. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. 5th Ed. Horwood Publ.

- Price NC and Stevens L. 2003. Fundamentals of Enzymology. Oxford Univ. Press.
- Voet D, Voet JG and Pratt CW. 2006. Fundamentals of Biochemistry of Life at the Molecular Level. 2nd Ed. John Wiley and Sons.

- Wilson K and Walker J. (Eds.). 2000. Principles and Techniques of Practical Biochemistry. 5th Ed. Cambridge Univ. Press.

- Selected articles from standard journals

Department of Veterinary Biochemistry Maharashtra Animal and Fishery science University, Nagpur

Course No:BCT-704

Credits: 0+2=2

Course Title: Diagnostic Techniques in Clinical Biochemistry

Aim: -To give exposure about biochemical changes in diseases of animals and current developments of diagnostic techniques in clinical biochemistry.

Lecture schedule (Theory)

No. of Lectures	Name of Topic

2	Scope of diagnostic techniques in disease diagnosis. Fractionation of cell organelles
1	Molecular basis of cell injury and diseases
3	Molecular basis of autoimmunity, immunodeficiency, Immunochemical techniques - Immunochemical protein analysis-immunoelectrophoresis, immunofixation and immunoassays
2	Oncogenesis and tumour markers
1	Comparative ruminant metabolism, metabolism of various nutrients by microflora
1	Postruminal digestion of dietary and microbial biomolecules
1	Metabolic disorders of rumen and recent development in disorders of ruminants associated with protein
2	Metabolic disorders of rumen and recent development in disorders of ruminants associated with carbohydrates
2	Metabolic disorders of rumen and recent development in disorders of ruminants associated with fat, mineral and electrolyte metabolism
1	Photometric methods: spectrophotometry (UV, visible) atomic reflectometry, turbidimetry, nephelometry, spectrofluorimetry, atomic emission, etc.
1	Spectrometric methods: AAS, mass spectrometry, nuclear magnetic resonance (NMR), infra-red (IR) spectroscopy
1	Functional tests: Nucleic acid extraction, DNA fingerprinting, micro and mini satellites
1	PCR, RT-PCR, RFLP, Fluorescent In-situ hybridization (FISH)
1	Genome mapping, DNA microarrays
1	Biomolecular prospecting and molecular designing in clinical biochemistry
2	Tests for cardiovascular diseases: Involvement of enzymes in diagnostics of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin
1	Myocardial infarction and shock; enzyme patterns and marker proteins
1	Diagnostic use of serum enzyme assays
1	Radioactive isotopes in radiodiagnosis

1	Liver function tests (LFT)
1	Liver function tests (KFT)
1	Tests for drugs of abuse
1	Case Based Learning and selected articles from journals pertaining to disease diagnosis
Total-30	

Suggested Reading-• Bishop ML, Fody EP and Schoeff LE. 2004. Clinical Chemistry: Principles, Procedures, Correlations 5th edition, Lippincott Williams and Wilkins Press

- Nelson DL and Cox MM. 2007. Lehninger's Principles of Biochemistry. 4th Ed. Freeman.
- Kaneko JJ, Harvey JH and Bruss ML. 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press.
- Voet D, Voet JG and Pratt CW. 2006. Fundamentals of Biochemistry of Life at the Molecular Level. 2nd Ed. John Wiley and Sons.
- Racek J and Rajdl D. 2016. Clinical Biochemistry. 1st Ed. Karolinum Press

**Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science University, Nagpur.**

Course No: BCT-705

Credits: 2+1=3

Course Title: Recent Trends In Biochemical Techniques And Instrumentation

Aim: To expose students about current developments in techniques used in animal biochemistry.

Lecture schedule (Theory)

No. of Lectures	Name of Topic
4	Gas Chromatography (GC) - Types of pumping systems and their essential features; Column packing; Normal and modified stationary phases; Detection systems

4	High performance liquid chromatography (HPLC) - Types of pumping systems and their essential features; Column packing; Normal and modified stationary phases; Detection systems
1	Western blotting of proteins
1	2-D gel electrophoresis of proteins – IPG-DALT, IEF-SDS PAGE
2	NMR spectrometry
2	X-ray crystallography
2	ESR Spectroscopy
2	CD Spectroscopy
3	Mass Spectrometry (LC/ MS, GC/ MS, MALDI-TOF, SELDI-TOF)
3	Electron microscopy – SEM/ TEM/ STEM
1	Atomic force microscopy (AFM)
1	Scanning Tunneling Microscopy (STM)
2	Radiotracers in study of biological processes
3	Tissue Culture: Setting up a cell culture laboratory; Principles of aseptic handling; Cell line derivation; Cell freezing and quantitation; Contamination control; Cell freezing and thawing; Cell culture media constituents and their functions; Designing serum-free medium. Techniques for short-term and long-term culture of organs, etc.
1	Any other current technique
Total-32	

Suggested reading: • Bishop ML, Fody EP and Schoeff LE. 2004. Clinical Chemistry: Principles, Procedures, Correlations 5th edition, Lippincott Williams and Wilkins Press

• Nelson DL and Cox MM. 2007. Lehninger's Principles of Biochemistry. 4th Ed. Freeman.

• Kaneko JJ, Harvey JH and Bruss ML. 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press.

• Voet D, Voet JG and Pratt CW. 2006. Fundamentals of Biochemistry of Life at the Molecular Level. 2nd Ed. John Wiley and Sons

• Racek J and Rajdl D. 2016. Clinical Biochemistry. 1st Ed. Karolinum Press

Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science University, Nagpur

Course No:BCT-705

Credits: 2+1=3

Course Title: Recent Trends In Biochemical Techniques And Instrumentation

Aim:. To expose students about current developments in techniques used in animal biochemistry.

Lecture schedule (Practical)

No. of Practicals	Title of practical
1	Gas Chromatography (GC)
1	High performance liquid chromatography (HPLC)
1	Western blotting of proteins
1	2-D gel electrophoresis of proteins
1	NMR spectrometry
1	X-ray crystallography
1	ESR Spectroscopy
1	CD Spectroscopy
1	Mass Spectrometry (LC/ MS, GC/ MS, MALDI-TOF, SELDI-TOF)
1	Electron microscopy – SEM/ TEM/ STEM
1	Atomic force microscopy (AFM)
1	Scanning Tunneling Microscopy (STM)
1	Radiotracers
3	Tissue Culture
Total-16	

Suggested Reading-

- Burtis CA, Ashwood ER and Burns DE. 2014. Tietz Textbook of clinical Biochemistry and Molecular Diagnostics. 5th Edition. Elsevier
- Nelson DL and Cox MM. 2017. Lehninger's Principles of Biochemistry. 7th Ed. Freeman
- Garrity S. 1999. Experimental Biochemistry. 3rd Ed. Academic Press.
- Gowenlock AH. 2002. Varley's Practical Clinical Biochemistry. 6th Ed. CBS.
- George W Latimer Jr. 2016. Official Methods of Analysis of AOAC International, 20th Ed. AOAC International.
- Holme DJ and Hazel P. 1998. Analytical Biochemistry. 3rd Ed. Longman.
- Wilson K and Walker J. (Eds.). 2010. Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed. Cambridge Univ. Press.
- Willard et al. 1988. Instrumental Methods of Analysis. 7th Ed. Wadsworth Pub Co.
- Selected articles from standard journals. Course Outline S. No. Topic

Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science University, Nagpur
Course No : BCT-706 **Credits: 2+0=2**
Course Title: Developmental Biochemistry

Aim:-To understand the developmental processes in embryogenesis and its gene expression.

Lecture schedule (Theory)

No. of lectures	Name of Topic
1	Biochemistry of fertilization.
3	Sperm-egg structure. Acrosome reaction and capacitation
3	Sperm-egg interaction – receptors involved; sperm entry into egg; zygote formation.
3	Formation of multicellular and multi-layered embryo: factors affecting cleavage of

	zygote; Types of cleavage
5	Blastula formation; gastrulation; neurulation; somite formation and cell migration; factors affecting cell migration; cell-cell interactions and their expression; involvement of extracellular matrix during development (cell movement and regulation of shape); growth factors and their role
3	Organogenesis-biochemistry and molecular biology.
3	Application of “OMICS” techniques in developmental biology.
4	Development and differentiation: Genes involved in the development of Drosophila and C. elegans and their regulation
4	Expression of genes during differentiation of anterior and posterior and dorsal and ventral halves, head; thorax and abdomen.
3	Pattern formation and positional information: Inductive interaction in the development of epithelia and body parts.
Total-32	

Suggested reading: • Scott F Gilbert. 2010. Developmental Biology, 9th edition. Sunderland (MA): Sinauer Associates.

• Scott Freeman 2014. Biological Science, 5th edition. Publisher: Benjamin-Cummings Publishing Co.

• Selected articles from standard journals

**Department of Veterinary Biochemistry
Maharashtra Animal and Fishery Science University**

Course No: BCT-707

Credits: 1+1=2

Course Title: : Bioinformatics Tools in Biochemistry

Aim: To impart knowledge of Bioinformatics applicable to biochemistry

Lecture Schedule (Theory)

No. of Lectures	Name of Topic
1	Biological databases: nucleic acid and protein sequence databases

1	Pairwise sequence alignment, global and local alignments, matrices, gap penalties
1	Multiple sequence alignment: methods and programs
1	Phylogenetic analysis: methods and applications
1	Genome sequencing technologies-traditional and next generation sequencing (NGS)
1	Assembly and comparison of genome: Human genome, livestock and bacterial genomes
1	Computational gene discovery, Gene and promoter prediction
1	Microarray technology: basic concept and application
1	Protein structure- secondary and tertiary structure prediction
1	Homology and ab-initio based tertiary structure prediction
1	Protein structure validation tools, Ramachandran Map
1	Protein motifs and domain prediction
1	RNA folding and secondary structure predictions
1	Metabolomics: concepts and principles
1	Nutrigenomics: bioinformatics in nutrition and health
1	Pharmacogenomics: introduction, applications, current and future perspectives
Total-16	

Suggested Reading--

- Essential bioinformatics 2006. Xin Xiong. Cambridge University Press
- Discovering Genomics, Proteomics and Bioinformatics 2007. A. Malcolm Campbell and Laurie J Heyer. Benjamin Cummings.
- Proteins: Structures and Molecular Properties 1993. Creighton TE. W.H. Freeman.
- Bioinformatics: Sequence and Genome Analysis 2001. Mount DW. Cold Spring Harbor.
- Introduction to Computational Molecular Biology 1997. Setubal Joao and Meidanis Joao. PWS Publishing Company.

- Bioinformatics: Concepts, Skills and Applications 2004. Rastogi SC, Mendiratta N and Rastogi P. CBS.
- Principles of Genome Analysis and Genomics 2003. SB. Primrose and R.M. Twyman, Blackwell Publishing.
- Molecular Analysis and Genome Discovery 2004. Ralph Rapley and Stuart Harbron (Eds.), John Wiley and Sons.
- BioInformatics 2001. Andreas D. Baxevanis and B. F. Francis Ouellette (Eds.).
- Online Resources available on Internet and Selected articles from standard journals

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery science University.Nagpur

Course No: BCT- 707

Credits: 1+1=2

Course Title:

Aim:-- To impart knowledge of Bioinformatics applicable to biochemistry.

Lecture Schedule (Practical)

No of Practical	Title of Practical
3	Practical application of NCBI resources
1	Web-based tools: Expasy, SwissProt, EBI
2	Local alignment using different BLAST variants
1	Multiple sequence alignment using ClustalW, T Coffee
2	Commercial bioinformatics databases and packages, GPL software for Bioinformatics
1	Database searching
1	Phylogenetic analysis by PHYLIP and MEGA tools
1	Protein structure visualization tools: RASMOL, SWISSPDB viewer, UCSF ChimeraX
1	Homology modelling and structure validation of protein structures
2	Practice on tools for protein secondary and tertiary structure prediction: SANJIVNI, BHAGIRATH, SWISS Model, MODELLER, ROSETTA, I-TASSER, etc.
1	Biomolecule chemical structure creation and modification using ChemSketch
Total-16	

Suggested Reading: • Essential bioinformatics 2006. Xin Xiong. Cambridge University Press

- Discovering Genomics, Proteomics and Bioinformatics 2007. A. Malcolm Campbell and Laurie J Heyer. Benjamin Cummings.
- Proteins: Structures and Molecular Properties 1993. Creighton TE. W.H. Freeman.
- Bioinformatics: Sequence and Genome Analysis 2001. Mount DW. Cold Spring Harbor.
- Introduction to Computational Molecular Biology 1997. Setubal Joao and Meidanis Joao. PWS Publishing Company.
- Bioinformatics: Concepts, Skills and Applications 2004. Rastogi SC, Mendiratta N and Rastogi P. CBS.
- Principles of Genome Analysis and Genomics 2003. SB. Primrose and R.M. Twyman, Blackwell Publishing.
- Molecular Analysis and Genome Discovery 2004. Ralph Rapley and Stuart Harbron (Eds.), John Wiley and Sons.
- BioInformatics 2001. Andreas D. Baxevanis and B. F. Francis Ouellette (Eds.).
- Online Resources available on Internet and Selected articles from standard journals

**Department of Veterinary Biochemistry
Maharashtra Animal and Fishery science university.Nagpur**

Course No: BCT-708

Credits: 2 + 0=2

Course Title-Environmental and Toxicological Biochemistry

Aim:-- To impart awareness on environmental pollutants and toxicants affecting livestock and poultry; Clinical Biochemistry in Toxicology.

Lecture Schedule (Theory)

No. of Lectures	Name of topic
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2	Introduction to environmental pollutants and toxicants, their classification
2	Sources and impact of pollutants and toxicants on animal health including poultry
2	Effect of various pollutants on animal and microbial metabolism
2	Detoxification mechanism in animals and birds
1	Biochemical basis of pollutant tolerance
1	Soil enzymes, their source and role in environment
1	Methods for measurement of pollution
1	Pesticide residues and its effect on animal health
1	Environmental chemo-dynamics
2	Heavy metals and metalloids, industrial chemicals and biotoxins on animal health and productivity
1	Water pollution, biochemical basis for measuring water pollution
1	Chemical properties of water-physical, chemical and biological treatment process
1	Biochemical oxygen demand and water quality assessment
1	Biochemical aspects of water quality
1	Distribution and storage of toxicants in animal body
1	Target organ toxicity
1	Introduction to environmental pollutants and toxicology
2	Biotransformation and elimination of toxicants
1	Methods for measurement of toxin level in animals
1	Clinical Biochemistry in Toxicology
1	Hepatotoxicity and biochemical changes due to hepatotoxicity
1	Nephrotoxicity and its effect
2	Effects of toxins on lungs, respiratory tract, endocrine system, nervous system, erythrocyte and haematopoietic system
2	Toxins affecting haemoglobin and oxidative metabolism
Total-32	

Suggested Reading-• Casarett, Louis J.; Doull, John. Casarett and Doull's Toxicology: The Basic Science of Poisons 8th ed.: New York: McGraw-Hill, 2013. ISBN:9780071769235

• Hayes AW, Kruger CL. Hayes' principles and methods of toxicology 6th ed. ISBN:9781842145364

• Kaneko JJ, Harvey JW and Bruss ML. Clinical Biochemistry of Domestic Animals, Academic press, ISBN 13:978-0-12-370491-7.

• Selected articles from journals.

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery Science University, Nagpur

Course No: BCT-709

Credits: 2 + 0=3

Course Title: Biochemistry of Diseases and Disorders

Aim: -To update general biochemical concepts for an understanding of biological and chemical principles underlying health, disease and disorders of animals and poultry.

Lecture Schedule (Theory)

No. of Lectures	Name of Topic
1	Scope of biochemistry and its applications in understanding the development of diseases and their control
3	Biochemical basis of Immunological diseases: Equine immunodeficiency, neutrophil function defects and its testing, Autoimmune Diseases, Primary Immune Deficiency Diseases, Secondary Immuno deficiency, Hypersensitivity Diseases
2	Endocrine diseases arising from over or underproduction of hormones or from resistance to a particular hormone; Thyroid disorders; Pancreatic disorders; Cushings disease.
2	Hemostatic diseases: Role of Vascular Endothelium, Platelets, Coagulation Proteins, Complexes, and Thrombin Activation; Fibrinolysis, Hereditary and Acquired disorders of hemostasis.
4	Nutritional diseases arising from over or under-nutrition of fat and water soluble vitamins and minerals: Night blindness, pernicious anaemia, iron overload, metabolic disorders of iron metabolism, rickets, osteomalacia, milk fever, swayback, anaemia of Inflammatory disease.
4	Toxic diseases: Hepatotoxicity, Nephrotoxicity; Toxins affecting: Skeletal and Cardiac

	muscle; Lung and Respiratory tract; Gastrointestinal tract; Erythrocytes, Haematopoietic system, Hemoglobin and oxidative metabolism; Endocrine system, Nervous system and neuromuscular disorders.
4	Neoplastic diseases: Biochemical changes in development of various neoplasms, Deranged glucose metabolism in cancerous tissue, oncogenesis.
4	Degenerative diseases: Neurodegenerative diseases – including amyotrophic lateral sclerosis, Parkinson's disease, Alzheimer's disease, and Huntington's disease; Molecular basis of cell injury and diseases by Free Radicals.
5	Biochemical basis of cardiomyopathies in dogs and birds, Prions disease (Scrapie), Bovine spongiform encephalopathy, Reticuloendotheliosis in poultry, Avian Influenza; Retinitis pigmentosa, retinal degeneration and Lysosomal storage diseases in animals.
3	Comparative medical genetics: Genome sequences, Disease Gene Mapping, Genetic diseases, Gene therapy.
Total-32	

Suggested Reading: • Charles A Janeway Jr, Paul Travers, Mark Walport and Mark J Shlomchik. 2001. Immunobiology, The Immune System in Health and Disease, 5th edition, New York.

• David L Nelson and Cox Michael M. 2017. Lehninger's Principles of Biochemistry. 7th Ed. Freeman.

• Kaneko JJ, Harvey JW and Bruss ML. Clinical Biochemistry of Domestic Animals, Academic press, ISBN 13:978-0-12-370491-7.

• Kenneth M Murphy and Casey Weaver 2016. Janeway's Immunobiology, 9th Edition ISBN: 978-0-815-34505-3.

• Thomas M. Devlin (Ed) 2011. Textbook of Biochemistry with Clinical Correlations, John Wiley and Sons.

• Voet D, Voet JG and Pratt CW. 2016. Fundamentals of Biochemistry of Life at the Molecular Level. 5th Ed. John Wiley and Sons.

• Selected articles from standard journals.

Department of Veterinary Biochemistry

Maharashtra Animal and Fishery science University, Nagpur

Course No.: BCT-710

Credits: 2+0= 2

Course Title: Immunobiochemistry

Aim: --To impart knowledge about fundamental principles and applications of immunology and immunochemical research techniques.

Lecture Schedule (Theory)

Lecture No.	Name of Topic
2	History and scope of immunology, cellular basis of immunity - adaptive and non-adaptive immunity, memory, specificity and diversity, self and non-self-discrimination
3	Immune system, organs, tissues and cells, cell mediated vs humoral immunity, immunoglobulins
1	Concept of antigen, immunogen, adjuvant, hapten
3	Classes of antibodies, Antibody diversity, theories of generation of antibody diversity
4	Monoclonal antibodies, polyclonal antibodies, Hybridoma, Recombinant antibodies, Single chain and single domain antibodies in immunodiagnostics and immunotherapy, Phage display library
2	Complement system - classical and alternate
4	Cellular interactions in the immune response, affinity, avidity, B-cell and T-cell response, major histocompatibility complex, cell mediated immune response, cytokines
3	Vaccine Nanoparticles in vaccine development and delivery, Nanomedicine in immunodiagnostics and immunotherapy
2	Immunoregulation, immunological tolerance, hypersensitivity, innate resistance and specific immunity
1	Current immunological techniques: Raising of antisera and antibody purification
2	Immunodiffusion, Immuno electrophoresis, immunofluorescence, rocket electrophoresis
1	Immunological markers and fluorescence-activated cell sorting
2	Radioimmuno assay (RIA) and different types of ELISA
1	Immunohistochemistry
1	Immunoinformatics techniques
Total-32	

Suggested Reading• Abbas AK and Lichtman AH. 2003. Cellular and Molecular Immunology. 5th Ed. WB Saunders.

• David J Dabbs. 2018. Diagnostic Immunohistochemistry. 5th Ed. Elsevier.

- Goldsby RA, Kindt TJ and Osborne BA. 2003. Immunology. 4th Ed. WH Freeman.
- Harlow and Lane D. (Eds.). 1988. Antibodies: A Laboratory Manual. Cold Spring Harbor Laboratory.
- Immunochemistry: Edited by CJ van Oss and MHV van Regenmortel. pp 1069. Marcel Dekker, New York. 1994. ISBN 0 8247 9123 1; TR O'Brien.
- Ivan Roitt (Eds.). 1997. Essential Immunology Publisher -Blackwell Scientific Publication, Oxford.
- Kuby J. 1996. Immunology. 3rd edition WH Freeman.
- Male D, Brostoff J, Roth DB and Roitt I. 2006. Immunology. 7th Ed. Elsevier.
- Manson MM. (Eds.). 1992. Immunochemical Protocols: Methods in Molecular Biology Vol. 10- Humana Press Totowa NJ.
- Mariusz Skwarczynski, Istvan Toth. 2017. Micro and Nanotechnology in Vaccine Development. 1st ed. Elsevier.
- Mathew Sebastian, Neethu Ninan AK. Haghi. 2012. Nanomedicine and Drug Delivery. 1st Ed. Apple Academic Press.
- Selected articles from standard journals

6. Academic Calendar – UG, PG, PhD -Year wise / Semester Wise
7. College Classes Time Table :UG, PG , PhD - Year wise / Semester Wise
8. Examination Time Table – UG, PG , PhD - Semester / Year wise - Theory and Practical
9. Result –UG, PG , PhD - Semester Wise / Year Wise