THE UNIVERSITYOF BURDWAN

COURSE MODULES

FOR THREE-YEAR DEGREE COURSE IN ZOOLOGY (HONS) UNDER CHOICE BASEDCREDITSYSTEM (CBCS)

SEMESTER III

(With effect from the session July 2018- December 2018)

3.9 Core T5- Chordates Course Module

Time: 2hrs **Full Marks: 50 (40 theory+10 internal assessment)**

Lectures: 50

Questions are to be set covering the entire syllabus;5questions (out of eight) of 2 marks each, tow questions(out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Chordates	**4 Credits**	**Class**	**TEACHER**
Unit1: Introduction to Chordates		**2**	
General characteristics		1	SM
Outline classification of Phylum Chordata		1	SM
Unit 2: Protochordata		**6**	
General characteristics and Classification of sub-phylum Urochordata up to Classes		1	SM
General characteristics and Classification of sub-phylum Cephalochordate up to Classes		1	SM
Retrogressive metamorphosis in Ascidia.		2	SM
Chordate Features in *Branchiostoma*		1	SM
Feeding in *Branchiostoma*		1	SM
Unit3: Origin of Chordata		**2**	
Dipleurula concept and the Echinoderm theory of origin of chordates		1	MM
Advanced features of vertebrates over Protochordata		1	MM
Unit 4: Agnatha		**2**	
General characteristics of cyclostomes		1	SM
Classification of cyclostomes up to order		1	SM
Unit 5: Pisces		**6**	
General characteristics and classification of Chondrichthyes up to Subclasses		1	AB
General characteristics and classification of Osteichthyes up to Subclasses		1	AB
Accessory respiratory organ of fishes		1	MM
Fish migration		1	AB
Parental caring in fishes		1	BM
Swim bladder in fishes.		1	AB
Unit 6: Amphibia		**6**	
General characteristics and classification unto living Orders		2	AB
Metamorphosis in Amphibia		2	AB
Parental care in Amphibia		2	AB
Unit 7: Reptilia		**8**	
General characteristics and classification up to living Orders		2	BM
Poison apparatus in Snake		3	BM
Biting mechanism in Snake		3	BM
Unit 8: Aves		**8**	
General characteristics and classification up to Sub-Classes		1	NR
Exoskeleton in Birds		2	NR
Migration in Birds		2	NR
Principles and aerodynamics off flight		3	NR
Unit 9: Mammals		**8**	
General characters and classification up to living orders		1	SC
Affinities of Prototheria		1	SC
Exoskeleton derivatives of mammals		2	SC
Adaptive radiation in mammals with reference to locomotory appendages		2	SC
Echolocation in Micro-chiropterans		1	SC
Echolocation in Cetaceans		1	SC
Unit 10: Zoogeography		2	
Zoogeographical realms, plate tectonic and Continental drift theory		1	MM
Distribution of Birds and Mammals in different realms		1	MM

Suggested Readings:
1. Arora, M.P. *Chordata I. Himalaya Pub House*
2. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
3. HallB.K.andHallgrimssonB.(2008).Strickberger'sEvolution.IVEdition.Jonesand Bartlett
4. Jordan, E.L. & Verma, P.S. (2003).Chordate Zoology. S. Chand &Company Ltd. New Delhi.
5. Kardong, K.V. (2002).Vertebrates: Comparative anatomy, function evolution. Tata McGraw Hill.
6. Kent, G. C. &Carr, R.K. (2001).ComparativeanatomyoftheVertebrates.9thEd.McGrawHill.
7. Nelson, J.S. (2006): Fishes of the World, 4th Edn. Wiley.
8. Parker, T.J. &Haswell, W. (1972).Text Book of Zoology, Volume II: Marshall and Willam (Eds.) 7thEd.MacmillanPress, London.
9. Pough H. Christine M. J. and B. Haiser (2002). Vertebrate life, VIII Edition, Pearson Internatl.
10. Rastogi, V.B. Ecology and Animal Distribution. Rastogi Publication.
11. Romer, A. S. &Parsons, T.S. (1986).The vertebrate body. 6th Ed.Saunders College Pub.
12. Sinha, K. S, Adhikari, S. Ganguly B.B. & Bharati Goswami, B.D. (2001).Biology of Animals. Vol. II. New Central Book Agency (p) Ltd.
13. Young, J. Z. (2004).The Life of Vertebrates. III Edition. Oxford university press.
14. Note: Classifications for Protochordata, Agnatha, Reptilia, Aves and Mammalia to be followed from Young (1981), for Pisces to be followed from Romer (1959), for Amphibia to be followed from Duellman and Trueb (1986).

3.10. CoreP5–Chordates Lab

Chordates	**2 Credits**		Class	Teacher
List of Practical				
1. Spot identification of:				
a. Protochordata : *Balanoglossus, Herdmania, Branchiostoma*				SM
b. Agnatha: *Petromyzon, Myxine*				SM
c. Fishes: *Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Catla, Cirrhinus, Hypopthalmichthys, Cyprinus, Ctenopharyngodon,Exocoetus, Echeneis, Anguilla, Hippocampus,Tetrodon/Diodon, Anabas, Clarias*				SM
d. Amphibia: *Necturus, Bufo, Hyla, Alytes, Axolotl larva, Tylototriton*				AB
e. Reptilia: *Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Mabuya, Draco, Bungarus, Vipera, Naja, Hydrophis*				AB
f. Mammalia: Bat (Insectivorous and Frugivorous), *Funambulus*				AB
2. Key for Identification of poisonous and non-poisonous snake				AB
3. Mounting of Pecten from Fowl head				SM
4. Dissection of brain and pituitary of any major carp				SM
5. Power point presentation on study of any two animals from two different classes by students				
Time:2Hrs **Full Marks: 20** **Examination Pattern:** One question on Dissection (Item No. 4) ---------- (6X 1) = 06 One question (From Item 2 or 3) ---------- (4 X 1) = 04 Spot Identification of Four Specimen (2X3) = 06 Power point Presentation = 02 Laboratory Note Book ---------- = 02				
Suggested Readings: 1. Chatterjee and Chatterjee Practical Zoology 2. Ghosh, K.C. and Manna, B. (2015): Practical Zoology, New Central Book Agency, Kolkata 3. Sinha, J.K. , Chatterjee, A.K. and P. Chattopadhyay Advanced Practical Zoology				

3.11 Core T6- Animal Physiology: Controlling &Coordinating Systems Course Module

Time: 2hrs **Full Marks:50 (40 theory+10 internal assessment)**

Lectures: 50

Questions are to be set covering the entire syllabus; 5 questions (out of eight) of 2 marks each, tow questions (out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Animal Physiology: Controlling& Coordinating Systems	**4 Credits**	**Class**	**TEACHER**
Unit1: Tissues		**4**	
Structure, location, classification and functions of epithelial tissue		1	MM
Structure, location, classification and functions of connective tissue		1	MM
Structure, location, classification and functions of muscular tissue		1	MM
Structure, location, classification and functions of nervous tissue		1	MM
Unit 2: Bone and Cartilage		**4**	
Structure and types of bones		1	AB
Structure and types of cartilages		1	AB
Ossification		2	AB
Unit3: Nervous System		**10**	
Structure of neuron, resting membrane potential		1	BM
Origin of action potential		2	BM
Propagation of action potential across the myelinated nerve fibers		2	BM
Propagation of action potential across the unmyelinated nerve fibers.		2	BM
Types of synapse, Synaptic transmission and Neuro-muscular junction;		2	BM
Reflex action and its types		1	BM
Unit 4: Muscular system		**10**	
Histology of different types of muscle		3	NR
Ultra structure of skeletal muscle		2	NR
Molecular and chemical basis of muscle contraction		3	NR
Characteristics of muscle fibre		2	NR
Unit 5: Reproductive System		**6**	
Histology of testis		2	SM
Histology of ovary		2	SM
Physiology of Reproduction		2	SM
Unit 6: Endocrine System		**16**	
Histology and function of pituitary		2	SC
Histology and function of thyroid		2	SC
Histology and function of pancreas		2	SC
Histology and function of adrenal		2	SC
Classification of hormones		1	SC
Mechanism of Hormone action: Signal transduction pathways for Steroidal hormones		2	SC
Mechanism of Hormone action: Signal transduction pathways for Non-steroidal hormones		2	SC
Hypothalamus(neuro-endocrine gland)-principal nuclei involved in neuro-endocrine control of anterior pituitary and endocrine system		2	AB
Placental hormones		1	MM

Suggested Readings:

1. Cui, Naftel, Daley, Lynch, Haines, Yang and Fratkun (2011). Atlas of Histology with Functional and Clinical Correlations. Lippincoat, Williams and Wilkins.
2. Cormack, D.H (2003). PDQ Histology. B.C. Decker Ins., London
3. Gartner and Hiatt (2011). Concise Histology. Saunders Elsvier
4. Gunasegaran, JP (2010). A Text book of Histology and a Practical Guide. Elsevier
5. Junqueria and Cameiro (2005). Basic Histology: Text and Atlas.
6. Ross & Pawlina Histology: A Text and Atlas. Sixth Edition. Lippincott Williams &Wilkins.

7. Randall, D. and Warren Burggren. Eckert Animal Physiology 4th edition. W.H. Freeman.
8. Sembulingam and Sembulingam (2012) Essentials of Medical Physiology. 6th Edn. Jaypee Pub, New Delhi
9. Vasudeva and Mishra (2014). Inderbir Singh's Text book Of Human Histlogy 7th Edn Jaypee Publisher N. Delhi.

3.12. CoreP6– Animal Physiology: Controlling &Coordinating Systems

Animal Physiology: Controlling &Coordinating Systems	**2 Credits**		Class	Teacher
List of Practical				
1. Recording of simple muscle twitch with electrical stimulation(or Virtual)				SC
2. Demonstration of the unconditioned reflex action(Deep tendon reflex suchas knee jerk reflex)				SC
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres				SC
4. Identification of permanent slides of Mammalian Cartilage, Bone, Pituitary, Liver, Kidney, Intestine, Lung, Pancreas, Testis, Ovary, Adrenal, Thyroid				BM
5. Microtomy: Preparation of permanent slide of any five mammalian(Goat/white rat)tissues				BM
Time:2Hrs **Full Marks: 20** **Examination Pattern:** Preparation of stained temporary mount (Item No. 3) ---------- (6×1) = 06 One question (From Item 1, 2 or 5) ---------- (6×1) = 06 Spot Identification of Four Specimen (2×3) = 06 Laboratory Note Book ---------- = 02				
Suggested Readings: Scudamore C.L. (2014). A Practical Guide to the Histology of Mouse. Wiley Blackwell.				

3.13 Core T7- Fundamentals of Biochemistry Course Module

Time: 2hrs **Full Marks: 50 (40 theory+10 internal assessment)**

Lectures: 50

Questions are to be set covering the entire syllabus;5questions (out of eight) of 2 marks each, tow questions(out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Fundamentals of Biochemistry	**4 Credits**	**Class**	**TEACHER**
Unit1: Carbohydrates		**8**	
Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosachharides		2	SC
Carbohydrate metabolism: Glycolysis		2	SC
Carbohydrate metabolism: Citric acid cycle		2	SC
Carbohydrate metabolism: Pentose phosphate pathway		1	SC
Carbohydrate metabolism: Gluconeogenesis		1	SC
Unit 2: Lipids		**7**	
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri- acyl glycerols, Phospholipids, Sphingolipid, Glycolipids		2	SM
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Steroids, Eicosanoids and terpinoids.		1	SM
Lipid metabolism: β-oxidation of fatty acids		2	SM
Fatty acid biosynthesis		2	SM
Unit3: Proteins		**10**	
Amino acids : Structure, Classification, Physiological importance of essential and non-essential amino acids		1	NR
General and Electrochemical properties of α-amino acids		2	NR
Bonds stabilizing protein structure; Protein: Levels of organization		2	NR
Protein metabolism: Transamination, Deamination,		2	NR
Urea cycle		2	NR
Fate of C-skeleton of Glucogenic and Ketogenic amino acids		1	NR
Unit 4: Nucleic acids		**10**	
Structure: Purines and pyrimidines, Nucleosides, Nucleotides,		1	AB
Structure: Nucleic acids (DNA)		3	AB
Structure: Nucleic acids (RNA)		2	AB
Types of DNA and RNA, Complementarity of DNA		1	AB
Hypo-Hyper chromaticity of DNA		1	AB
Basic concept of nucleotide metabolism		2	BM
Unit 5: Enzymes		**6**	
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes		1	MM
Mechanism of enzyme action		1	MM
Enzyme kinetics; Derivation of Michaelis- Menten Equation,		1	MM
Lineweaver-Burk plot; Factors affecting rate of enzyme- catalyzed reactions		1	MM
Enzyme inhibition; Allosteric enzymes		1	MM
Strategy of enzyme action: Catalytic and Regulatory (Basic concept with one example each)		1	MM
Unit 6: Oxidative Phosphorylation		**2**	
Redox systems; Review of mitochondrial respiratory chain		1	BM
Inhibitors and un-couplers of Electron		1	BM

Suggested Readings:

1. Berg, J.M., Tymoczko, J.L.andStryer, L (2007).Biochemistry, VI Edition, W.H. Freeman and Co., New York.

2. Campbell and Farrell (2012). Biochemistry. 7th Edn. Brooks and Cole.

3. Chatterjee, MN and Shinde, R (2012). A Textbook of Medical Biochemistry. 8th Edn. Jaypee Pub., N. Delhi

4. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co. New York.
5. Das, D. (200). Biochemistry. Central Book Agency, Kolkata
6. Hames, B.D. and Hooper, N.M. (2000).Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
7. Jain, J.L., Jain m S and N. Jain. Fundamentals of Biochemistry. S. Chand Pub. N. Delhi
8. Maheswari, N (2008). Clinical Biochemistry. Jaypee Pub., New Delhi
9. Metzler D.E. (2001). The chemical reactions of living cells –2nd edition, 2001, Academic Press.
10. Murray, R.K. ,Bender , D.A., Botham, K.M., Kennelly ,P.J., Rodwell, V.W. and Well, P.A. (2009).Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
11. Sathyanarayana U. and Chakrapani, (2002). Biochemistry –Books & Allied (P) Ltd, Kolkata
12. Voet. D & Voet. J.G, (2004). Biochemistry –3rd edition, 2004, John Wiley & Sons, Inc.
13. Zubay G.L, (1998). Biochemistry –4th edition, Mc Graw-Hill.

3.14. CoreP7– Fundamentals of Biochemistry Lab

Fundamentals of Biochemistry	**2 Credits**		Class	Teacher
List of Practical				
1. Qualitative tests of functional groups in a) carbohydrates (Benedict's test) b) proteins (Biuret's test) and c) lipids (Saponification number)			NR	
2. Paper chromatography of amino acids.			MM	
3. Quantitative estimation of protein by Lowry Method			NR	
4. Demonstration of protein separation by SDS-PAGE.			MM	
5. To study the enzymatic activity of a) Salivary amylase and b) Catalase in *Cajanus cajan.*			NR	
Time: 2Hrs **Full Marks: 20** **Examination Pattern:** One question on Qualitative test (Item No. 1 & 5) ---------- (6X 1) = 06 One question on quantitative test (From Item 3) ---------- (8X 1) = 08 One question from item no. 2 & 4 (4X1) = 04 Laboratory Note Book ---------- = 02				
Suggested Readings: ?				

5.1 SEC T1- Apiculture Course Module

Time: hrs **Full Marks: (theory+ internal assessment)**

Lectures: 25

Questions are to be set covering the entire syllabus; 5 questions (out of eight) of 2 marks each, tow questions (out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Apiculture	**2 Credits**	**Class**	**TEACHER**
Unit1: Biology of Bees		**2**	
History, Classification and Biology of Honey Bees		1	MM
Social Organization of Bee Colony		1	MM
Unit 2: Rearing of Bees		**10**	
Artificial Bee rearing (Apiary), Beehives–Newton and Langstroth		2	SM
Bee Pasturage		2	SM
Selection of Bee Species for Apiculture		2	NR
Bee Keeping Equipment		2	NR
Methods of Extraction of Honey (Indigenous and Modern)		2	BM
Unit 3: Diseases and Enemies		**5**	
Bee Diseases and Enemies		3	AB
Control and Preventive measures		2	AB
Unit 4: Bee Economy		**2**	
Products of Apiculture Industry and its Uses(Honey, Bees Wax, Propolis), Pollen etc		2	BM
Unit 5: Entrepreneurshipin Apiculture		**6**	
Bee Keeping Industry–Recent Efforts		2	MM
Modern Methods in employing artificial Beehives for cross pollination in horticultural		4	SC

Reference Books

1. Cramp, D. (2012). The Complete Step by Step Book of Beekeeping. Anness Publishing.
2. Prost, P.J. (1962).Apiculture. Oxford and IBH, New Delhi.
3. Bisht D.S, Apiculture, ICAR Publication.
4. Singh S. Beekeeping in India, Indian council of Agricultural Research, New Delhi.

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COURSE MODULES

FOR THREE-YEAR DEGREE COURSE IN ZOOLOGY (HONS) UNDER CHOICE BASEDCREDITSYSTEM (CBCS)

SEMESTER IV

(With effect from the session January 2019- June 2019)

3.15. Core T8-Comparative Anatomy of Vertebrates

Time: 2hrs **Full Marks: 50 (40 theories+10 internal assessment)**

Lectures: 50

Questions are to be set covering the entire syllabus; 5 questions (out of eight) of 2 marks each, tow questions (out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Comparative Anatomy of Vertebrates	**4 Credits**	**Class**	**TEACHER**
Unit1:Integumentary System		**6**	
Structure, function and derivatives of integument in amphibian		2	AB
Structure, function and derivatives of integument in birds		2	AB
Structure, function and derivatives of integument in mammals		2	AB
Unit2:SkeletalSystem		**6**	
Overview of axial and appendicular skeleton		2	MM
Jaw suspension		2	MM
Visceral arches		2	MM
Unit3:DigestiveSystem		**8**	
Comparative anatomy of stomach		4	SM
Dentition in mammals		4	SM
Unit4:Respiratory System		**6**	
Respiratory organs in fish		2	NR
Respiratory organs in amphibian		1	NR
Respiratory organs in birds		2	NR
Respiratory organs in mammals		1	NR
Unit5:CirculatorySystem		**8**	
General plan of circulation		2	BM
Comparative account of heart		3	BM
Comparative account of aortic arches		3	BM
Unit6:UrinogenitalSystem		**6**	
Succession of kidney		2	MM
Evolution of urinogenital ducts		2	MM
Types of mammalian uteri		2	MM
Unit7:NervousSystem		**6**	
Comparative account of brain		3	SC
Cranial nerves in mammals		3	SC
Unit8:Sense Organs		**4**	
Classification of receptors		1	SC
Brief account of auditory receptors invertebrate		3	SC

Suggestive Readings

1. Hilderbrand, Mand Gaslow G.E. Analysis of Vertebrate Structure, JohnWiley and Sons
2. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education
3. Kent, G.C. and Carr R.K. (2000).Comparative Anatomy of the Vertebrates. IX Edition.
4. McGraw-Hill Companies
5. Saxena, R.K. & Saxena, S.C. (2008): Comparative Anatomy of Vertebrates, Viva Books Pvt. Ltd.

3.16. Core T8-Comparative Anatomy of Vertebrates

Comparative Anatomy of Vertebrates	**2 Credits**	**Class**	**TEACHER**
List of Practical			
1. Study of placoid, cycloid and ctenoid scales through permanent slides /photographs			AB
2. Study of disarticulated skeleton of Toad, Pigeon and Guineapig			MM
3. Demonstration of Carapace and plastron of turtle from model/chart			AB
4. Identification of mammalian skulls: One herbivorous(Guineapig) and one carnivorous animal (Dog)			MM
5. Study and Dissection of Afferent arterial system, brain, pituitary in Carp			BM
Full Marks: 20 **Examination Pattern:** One question on Dissection (Item No. 5) ---------- (8X 1) = 08 One question (From Item No. 1) ---------- (4 X 1) = 04 Spot Identification of Four Specimen (from item 2,3,and 4) (1.5X4) = 06 Laboratory Note Book ---------- = 02			

3.17. Core T9- Animal Physiology: Life Sustaining Systems

Time: 2hrs **Full Marks: 50 (40 theory+10 internal assessment) Lectures: 50**

Questions are to be set covering the entire syllabus; 5 questions (out of eight) of 2 marks each, tow questions (out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Animal Physiology: Life Sustaining Systems	**4 Credits**	**Class**	**TEACHER**
Unit1:Physiology of Digestion		**12**	
Structural organization and functions of Gastrointestinal tract and Associated glands		2	SM
Mechanical digestion of food		2	SM
Chemical digestion of food		2	SM
Absorption of Carbohydrates		1	SM
Absorption of Lipids		1	SM
Absorption of Proteins		1	SM
Absorption of Nucleic Acids		1	SM
Digestive enzymes		2	SM
Unit2:Physiology of Respiration		**10**	
Mechanism of Respiration		1	NR
Respiratory volumes and capacities		1	NR
Transport of Oxygen in blood		2	NR
Transport of Carbon dioxide in blood		2	NR
Dissociation curves and the factors influencing it		2	NR
Respiratory pigments		1	NR
Carbon monoxide poisoning		1	NR
Unit3:Physiology of Circulation		**12**	
Components of Blood and their functions		1	AB
Structure and functions of haemoglobin		1	AB
Homeostasis (Definition, different pathways, components etc.)		2	AB
Blood clotting system (Intrinsic pathway)		2	AB
Blood clotting system (Extrinsic pathway)		2	AB
Fibrino lytic system		1	AB
Haemopoiesis; Basic steps and its regulation		2	AB
Blood groups; ABO and Rh factor		1	AB
Unit4:Physiology of Heart		**8**	
Structure of mammalian heart		2	BM
Coronary Circulation		1	BM
Structure and working of conducting myocardial fibres		2	BM
Origin and conduction of cardiac impulses		1	BM
Cardiac Cycle and cardiac output		1	BM
Blood pressure and its regulation		1	BM
Unit5:Thermoregulation&Osmoregulation		**10**	
Physiological classification based on thermal biology		2	SC
Thermal biology of endotherms		3	SC
Osmoregulation in aquatic vertebrates		3	SC
External osmoregulatory organs invertebrates		2	SC

Unit6:RenalPhysiology	**8**	
Structure of Kidney and its functional unit	2	MM
Mechanism of urine formation	3	MM
Regulation of acid-base balance	3	MM

Suggested Readings:

1. Costanzo, L.S. BRS Phyiology.4th Edn. Lippincoat Williams and Wilkins.
1. Fox, S.I. (2011). Human Physiology. 12th Edn. Mc Graw Hill.
2. Gunstream, S.E. (2010). Anatomy and Physiology with integrated study guide. 4th Edn., Mc Graw Hill
3. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edn. Hercourt Asia PTE Ltd. W.B. Saunders Company.
4. Hill, Wyese and Anderson (2012). Animal Physiology. 3rd Edn. Sineuer Associaes.
5. Randall, Burggren and French Eckert Animal Physiology: Mechanisms and adaptations
6. Rastogi, S.C. (2007). Essentials of Animal Physiology4th Edn. New Age Pub., N. Delhi
7. Sembulingam and Sembulingam (2012) Essentials of Medical Physiology. 6th Edn. Jaypee Pub, New Delhi
8. Sherwood, L. (2013). Human Physiology from cells to systems. 8th Edn., Brooks & Cole
9. Tortora, G.J. & Grabowski, S. (2006).Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
10. VictorP. Eroschenko. (2008). DiFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. &Wilkins.
11. Vander A, Sherman J.and Luciano D. (2014).Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

3.18. Core P9–Animal Physiology: Life Sustaining Systems Lab

Animal Physiology: Life Sustaining Systems	**2 Credits**	**Class**	**TEACHER**
List of Practical			
1. Determination of ABO Blood group			AB
2. Enumeration of red blood cells and white blood cells using haemocytometer			BM
3. Estimation of haemoglobin using Sahli's haemoglobinometer			BM
4. Preparation of haemin crystals			AB
5. Recording of blood pressure using a sphygmomanometer			AB
Full Marks: 20 **Examination Pattern:** One Experiment from Item No. 3 or 4 ---------- (6X 1) = 06 One Experiment from Item No. 2 ---------- (7X 1) = 07 One experiment from Item No. 1 or 5 (1 X5) = 05 Laboratory Note Book ---------- = 02			

3.19. Core T10-Immunology

Time: 2hrs **Full Marks: 50 (40 theory+10 internal assessment) Lectures: 50**

Questions are to be set covering the entire syllabus; 5 questions (out of eight) of 2 marks each, tow questions (out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Immunology	**4 Credits**	**Class**	**TEACHER**
Unit 1: Overview of Immune System		**2**	
Basic concepts of health and diseases, Historical perspective of Immunology		1	NR
Cells and organs of the Immune system		1	NR
Unit 2:Innate and Adaptive Immunity		**8**	
Anatomical barriers		1	SM
Inflammation		1	SM
Cell and molecules involved in innate immunity		2	SM
Cell and molecules involved in Adaptive immunity (Cell mediated)		2	SM
Cell and molecules involved in Adaptive immunity (Humoral)		2	SM
Unit 3: Antigens		**4**	
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens		1	BM
Factors influencing immunogenicity		2	BM
Band T-Cell epitopes		1	BM
Unit 4:Immunoglobulins		**8**	
Structure and functions of different classes of immunoglobulins		2	BM
Antigen- antibody interactions		2	BM
Immunoassays (ELISA and RIA)		2	BM
Hybridoma technology, Monoclonal antibody production		2	BM
Unit 5: Major Histocompatibility Complex		**6**	
Structure and functions of MHC molecules		2	SC
Structure of T cell Receptor and its signalling		2	SC
T cell development &selection		2	SC
Unit 6: Cytokines		**2**	
Types, properties and functions of cytokines		2	SC
Unit 7: Complement System		**6**	
Components of complement system		3	AB
Pathways of complement activation		3	AB
Unit 8:Hypersensitivity		**4**	
Gell and Coombs' classification		1	AB
Brief description of various types of hypersensitivities		3	AB
Unit 9: Immunology of diseases		**6**	
Malaria		1	MM
Filariasis		1	MM
Dengue		2	MM
Tuberculosis		2	MM
Unit10:Vaccines		**4**	
Various types of vaccines		1	MM
Active immunization (Artificial and natural)		2	MM
Passive immunization (Artificial and natural)		1	MM

Suggested Readings:

1. Abbas, K.Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.
2. Abbas, K.Abul and Lechtman H. Andrew (2011.) Basic Immunology: Functions and Disorders of Immune System. Saunders Elsevier Publication.
3. Delves, Martin, Burton and Roitt (2006). Roitt's Essential Immunology. 11th Edn. Blackwell Pub.
4. Kindt, T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J (2006). Immunology, VI Edition. W.H.Freeman and Company.
5. Mohanty, SK and Leela, KS (2014). Text book of Immunology. 2nd Edn. Jaypee Pub. N. Delhi
6. Parija, SC (2012). Text book of Microbiology and Immunology. 2nd Edn. Elsevier.
7. Playfair, JHL and Chain, BM (2001) Immunology at a glance. 7 th Edn. Blackwell Pub.
8. Shetty, N. (2005). Immunology: Introductory Textbook. 2nd Edn. , New Age Internatl. Pub. N. Delhi
9. Virella, G (2007). Medical Immunology 6th Edn. Informa Healthcare.

3.20. Core P10–Immunology Lab

Immunology	**2 Credits**	**Class**	**TEACHER**
List of Practical			
1. Demonstration of lymphoid organs in human through model/ photograph.			AB
2. Histological study of spleen, thymus and lymph nodes through slides/photographs			BM
3. Preparation of stained blood film to study various types of blood cells.			BM
4. Total count (TC) & Differential count (DC) of WBC			BM
5. Demonstration of ELISA by available teaching kit			MM
Full Marks: 20 **Examination Pattern:** One Experiment from Item No. 3 or 4 ---------- (10X1) = 10 Identification of slides/ photographs(Two) (2 X4) = 08 Laboratory Note Book ---------- = 02			

SEC T2- Medical Diagnostic techniques

Time: hrs **Full Marks: (theory+ internal assessment) Lectures: 25**

Questions are to be set covering the entire syllabus; 5 questions (out of eight) of 2 marks each, tow questions (out of four) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

Medical Diagnostic Techniques	**2 Credits**	**Class**	**TEACHER**
Unit1:Introduction to Medical Diagnostics and its Importance		**2**	
Introduction to Medical Diagnostics		1	NR
Importance of Medical Diagnostics		1	NR
Unit2: Diagnostics Methods Used for Analysis of Blood		**7**	
Blood composition		2	NR
Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain		2	AB
Platelet count using haemocytometer		1	AB
Erythrocyte Sedimentary Rate (E.S.R)		1	SC
Packed Cell Volume (P.C.V.)		1	SC
Unit3: Diagnostic Methods Used for Urine Analysis		**4**	
Urine Analysis: Physical characteristics		2	SC
Urine Analysis: Abnormal constituents		2	SC
Unit4: Non-infectious Diseases		**5**	
Causes, types, symptoms, complications ,diagnosis and prevention of Diabetes (Type I and Type II)		2	SM
Hypertension (Primary and secondary)		2	SM
Testing of blood glucose using Glucometer/Kit		1	BM
Unit5:Infectious Diseases		**3**	
Causes, types, symptoms, diagnosis and prevention of Tuberculosis (Microscope based and ELISA based)		1	MM
Causes, types, symptoms, diagnosis and prevention of Hepatitis (Microscope based and ELISA based)		1	MM
Causes, types, symptoms, diagnosis and prevention of Malarial parasite (Microscope based and ELISA based)		1	MM
Unit6: Clinical Biochemistry		**1**	
LFT & Lipid profiling		1	BM
Unit7:Clinical Microbiology		**1**	
Antibiotic Sensitivity Test		1	BM
Unit8:Tumours		**2**	
Types (Benign/Malignant), Detection and metastasis		1	AB
Medical imaging: X-Ray of Bone fracture, PET, MRI and CT scan (using photographs)		1	BM
Unit9: Visit to Pathological Laboratory and Submission of Project			ALL

Suggested Readings:

1. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
2. Papadaki s, M.A., McPhee, S.J. and Rabow, M.W. ed. (2016). Current Medical Diagnosis and Treatment McGrw Hill.