

Sadguru Gadage Maharaj College, Karad

(Autonomous)

Under

Choice Based Credit System (CBCS)

MSc. Part II Zoology

Semester III

Paper-IX: Genetics

Paper-X: Enzymology

Paper –XI: Animal Physiology

Paper –XII Applied Physiology

Practical-V

Practical-VI

Semester IV

Paper –XIII: Animal Cells in Biotechnology

Paper-XIV: Toxicology & Immunology

Paper-XV: Physiology of Health

Paper XVI: Clinical Physiology

Practical-VII

Practical-VIII

Syllabus implemented from June 2019-2020

Course Structure Class M. Sc. II ZOOLOGY

M.Sc.II		Semester -III	
Sr. No.	Subject Title	Theory (TH)	
		No.Of Lecture	Credits
1	MZT 301 Paper- IX Genetics	04	04
2	MZT 302 Paper- X Enzymology	04	04
3	MZT 303 Paper-XI Animal Physiology	04	04
4	MZT 304 Paper-XII Applied Physiology	04	04
5	MZP 305 Practical - V Practical based on Paper- IX & Paper- X	04	04
6	MZP 306 Practical - VI Practical based on Paper-XI & Paper- XII	04	04
	Total Of	24	24

M.Sc.II		Semester -IV	
Sr. No.	Subject Title	Theory (TH)	
		No.Of Lecture	Credits
1.	MZT 401 Paper- XIII Animal Cell in Biotechnology	04	04
2.	MZT 402 Paper- XIV Toxicology & Immunology	04	04
3.	MZT 403 Paper- XV Physiology of Health	04	04
4.	MZT 404 Paper – XVI Clinical Physiology	04	04
5.	MZP 405 Practical - VII Practical Based on Paper- XIII & Paper- XIV	04	04
6.	MZP 406 Practical - VIII Practical Based on Paper- XV & Paper – XVI	04	04
	Total Of	24	24

**Sadguru Gadage Maharaj College, Karad
(Autonomous)**

Syllabus for Master of Science Part II

I) Title: Zoology

II) Year of Implementation: 2020-2021

III) Structure of Course:

1. Structure of Syllabus:

M.Sc. – II

Semester –III

Sr. No.	Course Title	Theory			Practical		
		Paper No.& Paper Code	No. of lectures Perweek	Credits	Course Title	No. of lectures per week	Credits
1	Zoology	Paper-IX: MZT 301	04	04	Practical V Paper – IX & X : MZP 305	04	04
		Paper-X: MZT 302	04	04			
		Paper-XI: MZT 303	04	04	Practical VI Paper – XI & XII :MZP 306	04	04
		Paper-XII: MZT 304	04	04			

M.Sc. – II

Semester –IV

Sr. No.	Course Title	Theory			Practical		
		Paper No.& Paper Code	No. of lectures Perweek	Credits	Course Title	No. of lectures per week	Credits
1	Zoology	Paper-XIII: MZT 401	04	04	Practical VII Paper – XIII & XIV MZP 405	04	04
		Paper-XIV: MZT 402	04	04			
		Paper-XV: MZT 403	04	04			
		Paper-XVI: MZT 404	04	04	Practical VIII Paper –XV & XVI MZP 406	04	04

Note: M: M. Sc. T=Theory and P= Practical

III Semester – Number of papers 4

M.Sc. II Zoology

Second Year – Number of papers IV

Paper-IX: Genetics

Paper-X: Enzymology

Paper –XI: Animal Physiology

Paper –XII Applied Physiology

Practical - V & VI

IV Semester – Number of papers 4

M.Sc. II Zoology

Second Year – Number of papers IV

Paper –XIII: Animal Cells in Biotechnology

Paper-XIV: Toxicology & Immunology

Paper-XV: Physiology of Health

Paper XVI: Clinical Physiology

Practical -VII & VIII

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-III
PAPER-IX
MZT 301 Genetics

Learning objectives:

- This will provide understanding of the inheritance and expression of various genes.
- An understanding of the clinical relevance of genetic concepts.
- To understand the chromosome structure, chromatin organization and variation
- To analyse strategies of gene transfers
- To learn the concepts of Linkage concept of sex determination and sex linked inheritance
- This syllabus will provide the student with knowledge and understanding of the role and application of genetics with learning difficulties and the implications to other family members

Unit- I Chromosomal variations

1. Human Karyotypic analysis- normal and abnormal chromosomes, banding, nomenclature
2. Genetics basis of sex determination in human beings Y linked genes, X linked genes, Dosage compensation, and testicular feminization Syndrome.
3. Numerical abnormalities of human chromosomes and related syndrome Nondisjunction, Aneuploidy, Patau syndrome, Edward syndrome, Down syndrome, Turner syndrome and Klinefelter syndrome
4. Structural abnormalities of human chromosomes and related syndromes Robertsonian Translocation
5. Linkage groups, genetic maps, crossing over, genetic recombination.
6. Chromosome painting

Unit- II- Population and Evolutionary Genetics

1. Genetic variation in natural population, phenotypic variation
2. Hardy- Weinberg principle, Genetic drift, Genetic pool
3. Models of Speciation Measurement of Genetic variations
4. Use of Molecular techniques to study genetic evolution.
5. Human Behavioral genetics

Unit- III- Mutations

1. Introduction to the mutation, mutation and environment, Spontaneous versus induced mutation.
2. Phenotypic effects of mutations.
3. Somatic and germinal mutation.
4. Pleiotropy,
5. Back mutation and suppressor mutation
6. Molecular basis of genetic mutation
7. Chemical induced mutation
8. Mutation and DNA repair mechanism
9. Mutation frequency
10. Practical application of genetic mutations
11. Mutagenicity and carcinogenicity.
12. Mutations and human welfare

Unit- IV- Basis of genetic counseling and developmental genetics

1. Ethical and psychological approach of genetic counseling
2. Avoidance of risk factor with genetic diseases, Prenatal genetic counseling and diagnosis.
3. Family pedigree, Genetic inheritance and investigations
4. Developmental genetics – Developmental anomalies in case of human – Inborn errors of metabolism
5. Socio-economic importance of developmental genetics

Learning outcomes –

1. Students will be able to define genetic terms and explain their clinical relevance
2. They will be able to Describe the inheritance and expression of human blood groups
3. The significance of a knowledge of genetics in medical field related to anomalies of inborn errors
4. They will know the importance of inheritance of genetic characters in any individual and will be able to interpret the factors responsible for that
5. They will understand the role of genetic counselor in life.
6. They will explore the changes in genes caused due to different types of mutations taking place in body due to environmental and evolutionary changes.

Reference Books:

1. Genetics of population by Philip Hedrick (Unit I & IV)
2. Principles of Population Genetics By Hartl and Clark (Unit II)
3. Gene Clones by Ernst Winnacker (Unit I)
4. Fundamentals of genetics by B. D. Singh. (Unit I)
5. Principles of genetics 8th edition by Gardner, Simmons and Snustad. (Unit III)
6. Molecular Biology by David Clark (Unit I & IV)
7. Concepts of Genetics By Klug and Cummings (Unit I, II, III & IV)
8. Principles of Genetics By Tamarin (Unit I, II & III)
9. Genetics By Strickberger (Unit I & IV)
10. Facts of Genetics By Robert Edger (Unit I & IV)
11. Introduction to biochemical genetics By Mather and Jinks (Unit I & II)
12. Molecular Genetics By Gunther Stint (Unit I, II, III & IV)

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-III
PAPER-X
MZT 302 - Enzymology

Learning objectives -

- To provide knowledge of different enzymatic reactions occurring in the body which is beneficial.
- To classify the enzymes and investigate the structure and role of enzymes in body.
- To know the importance of various enzymes in fundamental life processes and its kinetics.
- To deal with current applications and future potential of **enzymes** process.

Unit- I: Classification and Nomenclature of Enzymes, Isoenzymes, Multienzyme Complexes.

1 Cofactors.

2 Inorganic.

3 Organic: Pyridoxyl Phosphate, Biotin, Lipoic acid, Thiamine diphosphate, Flavin nucleotides, Nicotinamide.

Unit- II: Extraction and Purification of Enzymes.

1. The extraction of soluble enzymes.
2. Extraction of membrane bound enzymes.
3. The nature of the extraction medium.
4. Preliminary purification procedures
5. Further purification procedures.
6. Criteria of purity.
7. Determination of molecular weight of enzymes.

Unit- III: Enzyme Kinetics.

1. Relationship between initial velocity and substrate concentration.
 2. Michaelis-Menten equation
 3. Briggs-Haldane Hypothesis.
 4. The Line-Weaver-Burk Plot.
 5. The Halden relationship for reversible reaction
 6. Effect of Modifiers on enzyme Kinetics.
 7. Effect of temperature.
 8. Thermal denaturation.
 9. Effect of pH.
 10. Enzyme Actions of-Chymotrypsin.
 11. Fructose biphosphate aldolase

Unit- IV: The control of Enzyme Activities by Non Genetic Mechanism.

1. Enzymes in Organised System.
2. RNA nucleotidyl transferase.
3. The Pyruvate dehydrogenase.
4. Enzyme Technology.
5. Use of isolated enzymes in industrial processes.
6. Immobilized enzyme.

Learning outcomes –

1. Student will be able to classify the enzymes according to nomenclature
2. They will be able to explain the function of various enzymes and their factors related to it
3. They will learn and understand the enzyme kinetics and effect of different factors on enzyme action,
4. They will know the different processes of extraction and purification of enzymes.
5. They will explore the recent advances in the enzyme technology in the industrial process.

Reference book–

1. Methods in Enzymology all volumes.(Unit I, II, III &IV)
2. Scopes, R.K. Protein Purification, Principles and Practice. (UnitII)
3. Ferdinand, W. (1976) fundamentals of enzyme kinetics, Butterworths, London.
Enzyme by Palmer.(Unit III)
4. Fundamentals of Enzymology: Price N.C. and L. Stevens e.. Oxford, New York. Dixon, M., Webb, E.C; et al. (3rd Ed.) Longman, London.(UnitI)
5. Niggins, I.J. Best D.J. and Jones, J. Biotechnology – Principles and applications, Blackwell, scientific oxford (1985).(UnitIV)
6. Bullock, J. and Kristiansen, B- (1987) Basic biotechnology.(UnitIV)
7. Palmer and Bonner- Enzyme biochemistry, biotechnology and clinical chemistry 2nd edition.(Unit I, II, III &IV)

M.Sc.Zoology
Academic Flexibility, Credit System

M.Sc.-II Sem.-III

MZP 305 Practical No. V

(based on Paper IX & X)

- 1 .Human lymphocyte culture.
- 2 .Preparation of metaphasic chromosomes from human lymphocyte culture.
- 3 .Study of human chromosomes explain in gaspects of chromosome structure.
- 4 .Study of human normal karyotype.
- 5 .Manual preparation of human karyotype from metaphasic chromosomes.
- 6 .Assessing quality and quantity of metaphases.
- 7 .Harvesting of mitotic chromosomes from rat bone marrow.
- 8 .Study of X chromosome heterochromatinization by Barr body staining.
- 9 .G banding of rat chromosomes/Human chromosomes.
- 10.Preparation of chromosome ideogram.
- 11.Karyotype identification with reference to Patau syndrome, Edward Syndrome,Down syndrome, Klinefelter syndrome and Turner syndrome(from photographs).
- 12.Identification of cases of Patau syndrome, Edward Syndrome, Down syndrome Klinefelter syndrome and Turner syndrome fromphotographs bymorphological/symptomatic features
- 13.Principle of Fluorescence In Situ Hybridization, Interpretation of results FISH for Patau syndrome, Edward Syndrome, Downsyndrome,Klinefelter syndrome and Turner syndrome(from photographs).
- 14.Drosophila culture
- 15.Sexual dimorphism in Drosophila
- 16Study of heritable characters in Drosophila
- 17.Examples based on Hardy-Weinberg Equilibrium
- 18.Symbols used in Pedigree analysis
- 19.Studies of Human pedigrees concerned with autosomal recessive disorders, autosomal dominant disorders, X linked dominant disorders and X linked recessive disorders.
- 20Clinical test for Phenyl keto uria by Guthrie test /Ferric chloride test
- 21.Estimation of proteins.
- 22.Estimation of Amylase/any other suitable enzyme.
- 23.Effect of pH on Amylase activity/any other Suitable enzyme.
- 24.Effect of temperature on Amylase activity/any other suitable enzyme.
- 25.Michaelis– Menten constant determination for Amylase/ any other suitable enzyme.
- 26.Effect of modifiers on enzyme activity/Thermolability of enzyme.
- 27.Isolation of Amylase or any enzyme.
- 28.Catalase estimation using H_2O_2 as substrate
- 29.SDS-PAGE Electrophoresis
- 30.At Least 12 Experiments to be conducted

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-III
PAPER-XI
MZT 303 – Animal Physiology

Learning objectives:

- 1) To improve knowledge of basic concept in physiology along with advanced techniques in reproductive physiology.
- 2) To impart basic understanding of fundamental physiological processes.
- 3) To understand the basic concepts related to sense organs.
- 4) To provide the knowledge of the structure and functions of different organs in the body.

Unit 1: Membrane physiology and Muscle

- 1.1 Transport of ions and molecules through cell membrane
- 1.2 Membrane potential and action potential
- 1.3 Physiologic anatomy of skeletal and smooth muscle
- 1.4 Excitation of skeletal muscle
 - 1.4.1 Neuromuscular transmission
 - 1.4.2 Excitation –contraction coupling
- 1.5 Contraction and Excitation of smooth muscle

Unit 2: Physiology of sense organs

- 2.1 Anatomy and physiology of eye
 - 2.1.1 Optics of eye
 - 2.1.2 Receptor and neuronal functions of retina.
- 2.2 Sense of hearing
- 2.3 Chemical sense –Taste and smell
- 2.4 Aging and sense organs

Unit 3: Physiology of Reproduction:

- 3.1 Male Reproductive system
- 3.2 Female Reproductive system
- 3.3 Contraceptives and birth control
- 3.4 IVF and Embryo Transfer
- 3.5 Aging and the reproductive system

Unit 4: Mammalian developmental Physiology

- 4.1 Maturation of germ cells and fertilization
- 4.2 Physiology of Cell and Tissue culture
- 4.3 Embryonic development
- 4.4 Prenatal diagnostic tests
- 4.5 Physiological regulation in embryogenesis.

Learning outcome –

- 1) The students will be able to understand the concepts of mammalian development.
- 2) Student will be able to learn structure and function of different organs in the body.
- 3) They can explain the physiology of various processes in systems of body.
- 4) They can understand the techniques like IVF in reproductive system.
- 5) They can learn the process of aging and its impact on various systems

References:

- 1) Human Physiology – by A.C. Guyton. Saunders Company London, Toronto.
- 2) Shepherd G.M. Neuro Biology, New York Oxford University Press 1987.
- 3) Hurst J.W et al (eds) The Heart 7th ed. New York McGraw- Hill Book Co. 1990.
- 4) Hand Book of Physiology Vols. Circulation. Renkin, E.M. & Michel, C.C. (eds) American Physiological Society, 1984.
- 5) Guyton A.C. et al. Circulation Overall regulation Annu Re. Physiol. 34: 13 1972.
- 6) Guyton A.C. 1980 Arterial pressure & Hypertension Philadelphia, W.B. Saunders Co- Cardiac output & its regulation 1973.
- 7) Kaplan N.M. et al 1989- The Kidney in Hypertension (Perspectives in hypertension vol.2) New York. Raven Press.
- 8) Guyton A.C. et al 1975 Dynamics & Control of the Body fluids Philadelphia, W.B. Saunders, Co., 1975.
- 9) Brenner B.M. & Rector, F.C. (Jr) 1986. The kidney 3rd ed. Philadelphia, W.B. Saunders Co., 1986.
- 10) Brooks V.B. 1986. The neural Basis of motor control New York, Oxford University Press.
- 11) Johnson L.R. et al Physiology of the gastrointestinal tract 1987 New York Raven press.
- 12) Thompson J.C. et al (eds) Gastrointestinal Endocrinology. New York McGraw Hill book co., 1987.
- 13) Setchell K.D.R. et al eds 1988. The Bile Acids New York Plenum Pub.Corp.
- 14) Guthrie H.A. 1988. Introductory Nutrition 7th ed. St.Louis C.V. Mosby Co.
- 15) Felig P et al (eds) 1987. Endocrinology & Metabolism New York Mac Graw- Hill Book Co.
- 16) De Groot L.J. et al 1989. Endocrinology 2nd ed. Philadelphia, W.B. saunders Co. 1989.
- 17) Kannan, C.R. 1988. The adrenal gland New York Plenum Pub.Corp.

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-III
PAPER-XII
MZT 304 – Applied Physiology

Learning objectives:

- To understand the effect of environmental changes on various physiological systems.
- To study physiological changes take place at high altitude, deep sea and at space.
- To understand effect of exercise on various physiological systems.
- To study biochemical changes occur in physiological systems during exercise.
- To understand the ergonomics and industrial physiology.
- To study occupational physiology.

Unit I- Environmental physiology

- 1.1. Physiology of high altitude.
- 1.2. Physiology of deep sea diving.
- 1.3. Temperature, light and life.
- 1.4. Space Physiology- a) Physiological requirement of space travel b) Adaptations due to space travel

Unit II- Exercise physiology

- 2.1. Fundamental of physical exercise
- 2.2. Energy for exercise, Enhancement of energy- Aerobic and Anaerobic power
- 2.3. Exercise physiology- Muscles in exercise, Respiratory exercise, Cardiovascular system exercise, Nervous system exercise, Body heat in exercise
- 2.4. Biochemical changes in exercise
- 2.5. Recovery from exercise.

Unit III- Ergonomics and Industrial physiology

- 3.1. Man- machine and environment
- 3.2. Physiology of man and women at work
- 3.3. Physical fitness and efficiency
- 3.4. Aging and occupational disease/ hazards
- 3.5. Problems of Child labour in India.

Unit II- Occupational Physiology

- 4.1. Work place environment
- 4.2. Occupational health.
- 4.3. Occupational stresses
- 4.4. Occupational hazards and diseases
- 4.5. Management of Occupation hazards and diseases

Learning outcomes –

1. Students will be able to understand effect of different environmental factors on the physiology. They will be able to describe the histopathology at high altitudes, at deep seas and at space
2. They will learn the benefits of exercise for different physiological systems.
3. They will understand physiology of man and women at work, aging and occupational disease/ hazards.
4. They will get knowledge about problems of Child labour in India

5. They will understand the preventing measures of different physiological diseases.
6. They will explore knowledge of how the working place environment affects health and causes disease with respect to occupational health.
7. They will learn to manage management of occupational hazards and diseases.

References:

- 1). Human Physiology – by A.C. Guyton. Saunders Company London, Toronto.
- 2) Shepherd G.M. Neuro Biology, New York Oxford University Press 1987.
- 3) Hurst J.W et al (eds) The Heart 7th ed. New York McGraw- Hill Book Co. 1990.
- 4) Hand Book of Physiology Vols. Circulation. Renkin, E.M. & Michel, C.C. (eds) American Physiological Society, 1984.
- 5) Guyton A.C. et al. Circulation Overall regulation Annu Re. Physiol. 34: 13 1972.
- 6) Guyton A.C. 1980 Arterial pressure & Hypertension Philadelphia, W.B. Saunders Co- Cardiac output & its regulation 1973.
- 7) Kaplan N.M. et al 1989- The Kidney in Hypertension (Perspectives in hypertension vol.2) New York.
- 8) Raven Press. Guyton A.C. et al 1975 Dynamics & Control of the Body fluids Philadelphia, W.B. Saunders, Co., 1975.
- 9) Brenner B.M. & Rector, F.C. (Jr) 1986. The kidney 3rd ed. Philadelphia, W.B. Saunders Co., 1986. Brooks V.B. 1986. The neural Basis of motor control New York, Oxford University Press.
- Johnson L.R. et al Physiology of the gastrointestinal tract 1987 New York Raven press.
- 10) Thompson J.C. et al (eds) Gastrointestinal Endocrinology. New York McGraw Hill book co., 1987.
- 11) Setchell K.D.R. et al eds 1988. The Bile Acids New York Plenum Pub. Corp.
- 12) Guthrie H.A. 1988. Introductory Nutrition 7th ed. St. Louis C.V. Mosby Co., Felig P et al (eds) 1987. Endocrinology & Metabolism New York MacGraw- Hill Book Co.,
- 13) DeGroot L.J. et al 1989. Endocrinology 2nd ed. Philadelphia, W.B. Saunders Co. 1989.
- Kannan, C.R. 1988. The adrenal gland New York Plenum Pub. Corp.

M.Sc.-II Sem.-III M.Sc.-Zoology
Academic Flexibility, Credit System
MZP 306 Practical VI
(based on Paper XI & XII)

- 1) Study of histology and histochemistry of reproductive organs.
- 2) Vaginal smear technique.
- 3) Study of Uterine muscles.
- 4) Study of sperm count.
- 5) Capacitation and motility of sperm.
- 6) Study of placental type.
- 7) Contraceptive devices.
- 8) Gonadectomy in white rat
- 9) Estimation of lactate content of rat blood.
- 10) Estimation of calcium content of rat blood.
- 11) Determination of PEFR.
- 12) Study of physical fitness by Step Test method
- 13) Determination of Grip strength.
- 14) To study effect of work load on finger muscle by Finger Ergometry.
- 15) Absorption spectra of blood pigments.
- 16) Estimation of Chloride content in rat blood.
- 17) Visit to the industrial area to study man- machine environment.
- 18) Demonstration of principal of dialysis.
- 19) Demonstration of IVF procedure (Lab. visit).
- 20) Project work/ Review articles.
 - Any other practical set by concern teacher.

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-IV
PAPER-XIII
MZT 401 Animal Cells in Biotechnology

Learning objectives :

- Student are introduced with the different animal cells used for tissue culture
- To Understand the use and limitations of in vitro cell analysis
- To Understand the basic requirements for a tissue culture laboratory
- To Understand the basic techniques of tissue culture, sterile technique, contamination analysis, bio-waste, cell storage

Unit I:

1. Laboratory design and introduction of cells: Design of Tissue Culture Laboratory
Equipments: Laminar Flow Hoods, CO₂ incubator, Microscopes, centrifuge, Refrigerators and Freezers, pipetting aids, Miscellaneous Equipments.
2. Glass wares/plastic wares and filters for tissue culture.
3. Basic Aseptic Techniques
4. Cryopreservation for Storage and shipment
5. Primary cell culture, Established cell line, transformed cell line

Unit II:

1. Growth media
2. Physical requirements and Nutritional Requirements of Cells
Natural media
Basal salt solution (BSS)- Various types
Minimum Essential Medium (MEM)
Antibiotics in media
Serum dependent defined media
Serum independent defined media – Cell specific media
3. Basic Techniques of mammalian cell culture
 1. Primary Cell culture – Isolation and separation of cells, viable cell count, maintenance of cell culture, maintenance of stock culture, Antibiotic free stock cultures
 2. Types of cell cultures – Monolayer, Suspension, Clonal culture, Mass culture- micro carrier culture (monolayer), Stem cell cultures (ESC)

Unit III:

1. Biology and Characterization of cultured cells
2. Karyotyping
3. Contamination Testing of Culture
4. Viability measurement and cytotoxicity, MTT assay
5. Measurement of growth parameters
6. Cell cycle analysis and Synchronization of cultures
7. Uses of Animal Cells in Culture
8. Evaluation of Chemical carcinogenicity, Cell malignancy Testing
Uses of Embryonic stem cells and Pluripotent stem cells

Unit IV:

1. Cell surgery and Cell Fusion Methods
2. Surgical manipulation of in vitro fertilization
3. Cell fusion by Sendai virus and Polyethylene glycol
Hybridoma cell preparations and their properties
Tissue Engineering
4. Capillary culture Units
5. Techniques for culturing differentiated cells: Use of Reconstituted basement membrane rafts and use of feeder layers.

Learning outcomes -

- Student will be able to explain the differences between primary and cell line cultures
- Student will get Brief understanding of cell growth requirements
- Brief understanding of analytical techniques
- They will be able to know the cell fusion techniques and different methods of maintaining the contamination free culture.

Reference:

Freshney, R.I. Culture of Animal Cells: A Manual of Basic Technique, 1994, John Wiley & Sons Inc. Pub. USA. (Unit I)

Butler, M. Mammalian Cell Biotechnology.: A practical Approach 1991 IRL Press Oxford. (Unit I, II, III & IV)

Cell Culture: Methods in Enzymology, vol. 58 1979/recent volume. Academic Press.

Kuchler, R.J. Biochemical Methods in Cell Culture & Virology 1977. Dowden, Hutchinson & Ross, Inc. Strausberg, USA (Unit I, II, III & IV)

Morgan, S.I. Animal Cell Culture 1993 Bio. Scientific Publishers Ltd Oxford.

Butler, M. Mammalian Cell Biotechnology.: A practical Approach 1991 IRL Press Oxford. (Unit I, II, III & IV) Jenni P. Mather & David Barnes Eds: Animal Cell Culture Methods. Methods in

Cell Biology Vol. 57 Academic Press. (Unit I, II, III & IV)

Ranga M.M.- Animal biotechnology 2nd edition. (Unit I, II, III & IV) Dubey R.C.- Advanced biotechnology (Unit I, II, III & IV)

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-IV
PAPER-XIV
MZT 402 Toxicology & Immunology

Learning objectives –

- To provide knowledge of how chemicals spread, accumulate and impact on Nature and people
- Introduces you to the principles of toxicology, with particular emphasis on the principles governing toxic responses to chemical exposures, including the disposition of toxicants, and the nature and effect of toxicity.
- Student will gain knowledge about the immunological techniques for the detection of various diseases.
- I will impart knowledge of antigens and structures of antibodies within body

Unit I

Concept and Scope of Toxicology :Definition, History, Recent development, Disciplines of toxicology. Classification of toxicants, toxic effects, principle aspects and importance of toxicology.

Toxicity Tests: Types of toxicity tests, acute, subacute and chronic toxicity tests and their objectives, experimental design, route of administration, doses and number. Bioassays
i.e. determination LD₅₀ or LC₅₀ value using fish/mollusk/ insects graphical and statistical methods (**Probit analysis**).

Unit- II

Insecticides and metals toxicity- Synthetic organic insecticides, their classification, prospectus effects, symptoms mechanism of toxic action of Organochlorine, Organophosphate, Carbamate and synthetic Pyrethroid insecticides, toxic metals-Arsenic, Lead, Mercury and Cadmium, their toxic effects on animals and toxic kinetics.

Bio-accumulation and bio magnification toxicants- Organochlorine insecticides and heavy metal mercury.

Bio-transformation

Organochlorine and Organophosphate insecticides i.e. Metabolism of insecticides- DDT, BHC, Parathion and Malathion- Mechanism Phase I and Phase II reaction.

of toxicant-

Food Toxicants- Food additives, Contaminants, adulterants, food poisoning due to bacterial fungal and algal toxins.

Immunology

Unit –III:

Antigens: Antigenicity and immunogenicity, Factors influencing immunogenicity, Epitopes, Antibody: Basic structure of antibodies, obstacles to antibody sequencing, Immunoglobulin fine structure, Antibody classes and biological activities. MHC molecules: Genomic map of MHC genes, Regulation of MHC expression, MHC and immune responsiveness, T cell, B cell antigenic properties, cytokines and therapeutic use of cytokines.

Unit –IV:

Innate immunity: Anatomy, physiologic, phagocytic and inflammatory, Adaptive immunity: e played Antigenic specificity, diversity, immunologic memory, self and non-self-recognition, Hypersensitive reactions, IgE mediated (Type I) hypersensitivity, Antibody mediated cytotoxic (Type II) hypersensitivity, Immune complex mediated (Type III) hypersensitivity, Delayed type (Type IV) hypersensitivity. T cell mediated cytotoxicity, vaccine development (recombinant, combined, polyvalent vaccine), cancer immunology, immunological techniques- ELISA, RIA, Monoclonal antibodies, immunohistochemistry.

Learning outcomes –

- Student will be able to understand the concept and scope of toxicology
- They will be able to define various toxicological terms
- They will understand different toxicity test and their lethal concentration and doses affecting various bodies
- They will be able to describe types of immunity and role played by immunological cells
- Student will have clear concepts of vaccines and their development, and knowledge of various immunologic techniques for identification of diseases by Ag-Ab reaction.

References Book

1. Clark W.R.. Experimental functions of Modern Immunology. Immunobiology- Charles A. Janeway and others – 2001. (Unit III & IV)
2. Pandey Kamleshwar. Shuklar J.P. and Trivedi S.P. (2005): Fundamental of Toxicology. New Central book agency PVT. LTD. Kolkata. (Unit I & II)
3. Thomas J.H. and William O.B. (1987): Handbook of Toxicology. (Unit I & II)
4. Roiff, I Brosfott, J and Male D – Immunology. (Unit III & IV)
5. Sharma, J.M. : Avian Cellular Immunology. Karger and Basel: The year of Immunology 1988. (Unit III & IV)
6. Zapata A.G. and Cooper, E.L. The immune system. (Unit III & IV)
7. Smialowicz R.J. and Holsapple Michael. Experimental Immunology toxicology. (Unit III & IV)

8. Laurie Hoffman – Goetz : Exercise and immune function (Unit III & IV)
9. Chris Kent (2001) : Basics of Toxicology (Unit I & II)
9. David J.K. and Kit A.K. (2006): Toxicological testing handbook 2nd Ed. (Unit I & II)
10. Gupta P.K. and Salunkhe D.K. (1985): Modern toxicology (Vol. I, II & III) Pandey, Shukla and Trevedi (2004): Fundamentals of Toxicology. (Unit I & II)
11. Kuby Immunology, WH Freeman, USA. (Unit III & IV)
12. W Paul Fundamentals of Immunology. (Unit III & IV)
13. I.M. Roitt, Essential Immunology, ELBS edition. (Unit III & IV)

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-IV
MZP 405 Practical VII
(based on Paper XIII & XIV)

1. Measurements of growth parameters- DNA
2. Cell cycle analysis – mitotic cells.
3. Karyotype studies- Bonemarrowperitonealmacrophages.
4. Evaluation of acute toxicity by using staticrenewal bioassay test (In fish /Insect).
5. Determination of LC50 of toxicant in fish / stored grain pest by employingprobit analysis.
6. Effect of toxicant (sublethal dose) on fish gill and alimentarytract in fish and in insecton alimentary canal haemolymph (Mulberrysilkworm)
7. Detection of heavy metal fromanimalissue by AAS(Lead/cadmium/chbromium).
8. Detection of pesticideby TLC method fromwater sample(organochlorine/ organophosphate).
9. Paw edemates
10. Granulometa – Quantification byweightandddifferentialcellcount.
11. Splenectomy.
12. Study of spleen replica for germinalcenters.
13. Separation of immunoglobulin byElectrophoresis.
14. Immuno diffusion technique of agar geldiffusion.
15. RBC rosettetechnique.
16. Haremagglutination inhibitiontest.
17. Blood group analysis.
18. Histology of lymphoid organs spleen, thymus, lymph node& Bonemarrow.
19. Any other practical / experiments set by theDepartment.
20. Antigen antibody reaction one of each type : precipitation (VDRL setup in tubeor gels)
WID

M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-IV
PAPER-XV
MZT-403 Physiology of Health

Learning objectives:

- To understand the disorders and diseases of various physiological systems.
- To understand causes of different diseases and disorders.
- To understand the physiological basis of the disease and disorder.
- To study histopathology of the diseased organs.
- To study the biochemical changes occurred in various diseases and disorders.
- To study diagnostic methods and treatment methods on various diseases and disorders.

Unit I- Physiology of gastrointestinal disorders and Diseases (physiological basis, histopathology, biochemistry)

- 1.1 Digestive glands
- 1.2 Swallowing and esophagus
- 1.3. Stomach
- 1.4. Small intestine
- 1.5. Rectum
- 1.6. Large intestine- constipation, diarrhea, and defecations.
- 1.7. Aging and general disorders of digestive tract.
- 1.8. Appendix

Unit II- Disorders and Diseases of respiratory and circulatory systems (physiological basis, histopathology, biochemistry)

- 2.1. Respiratory insufficiency- Chronic pulmonary Emphysema, Pneumonia, Atelectasis, Aathama, Tuberculosis.
- 2.2. Hypoxia, Hypercapnia, Hypocapnia.
- 2.3. Haemolysis and clotting defects
- 2.4. Congenital and Ischemic heart diseases,
- 2.5. Hypertension, cardiac arrest and heart failure.
- 2.6. ECG-defect, Angiogram and Angioplasty.

Unit III- Renal Disorders and Diseases (physiological basis, histopathology, biochemistry)

- 3.1. Acute renal failure- Peripheral internal and post renal failure.
- 3.2. Chronic renal failure – injury to glomeruli and interstitium
- 3.3. Hypertensions and kidney diseases.
- 3.4. Uremic toxicity, dialysis and artificial kidney.
- 3.5. Kidney transplantation

Unit IV- Disorders and Diseases of Nervous and muscular system (physiological basis, histopathology, biochemistry)

- 4.1. Disorders of Cerebrospinal fluid (CSF) a) Psychosis b) Epilepsy c) Alzimers diseases
- 4.2. Inherited neurological disorders.
- 4.3. Clinical physiology of muscular system.
- 4.4 Muscular atrophy and dystrophy

Learning outcomes –

1. Students will be able to understand different physiological diseases and disorders.
2. They will be able to describe the histopathology of diseased organs.
3. They will learn the causes of different diseases and disorders of physiological systems.
4. They will understand signs, symptoms and diagnostic methods for diseases and disorders of physiological systems
5. They will understand the preventing measures of different physiological diseases.
6. They will explore knowledge of histopathological changes, biochemical changes occurs in the diseased organs.

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M.Sc. Zoology
Academic Flexibility, Credit System
M.Sc.-II SEM-IV
Paper- XVI
MZT 404- Clinical Physiology

Learning objectives:

1. To understand the disorders and diseases of different organs and physiological systems of the human body.
2. To provide the knowledge of physiological base of a particular disorder or disease.
3. To understand the histopathology and biochemistry involved in different disorders and diseases of different organs and physiological systems of the human body.
4. To understand the physiological base of carcinoma in different parts of human body.
5. To understand the histopathology and biochemistry of carcinoma in different parts of human body

Unit I

Disorders and diseases of Endocrine glands (physiological basis, histopathology and biochemistry)

- 1.1. Pituitary glands
- 1.2. Thyroid glands
- 1.3. Parathyroid glands
- 1.4. Endocrine pancreases.
- 1.5. Adrenal gland and Kidney
- 1.6. Disorders of Testis, Ovaries

Unit II

Disorders and diseases of Special senses (physiological basis, histopathology and biochemistry)

- 2.1. Hearing defects
- 2.2. Occular defects
- 2.3. Hyperthermia and Hypothermia.
- 2.4. Defects in Chemoreception.
- 2.5. Aging and defects in special sense.
- 2.6. Disorders of Organs: Liver, Lungs and Brain.

Unit III

Disorders of Blood and immunity (physiological basis, histopathology and biochemistry)

- 3.1. Different causes of Anemia.
- 3.2. Genetic blood disorders
- 3.3. Polycythemia and Leukemia
- 3.4. Types of immunity and its mechanisms
- 3.5. Hypo and Hypersensitivity mechanism

Unit VI

Physiology of Carcinoma (physiological basis, histopathology and biochemistry)

- 4.1. Introduction and mechanism of different types of carcinoma
- 4.2. Carcinoma of digestive tract and associated glands
- 4.3. Brain tumor
- 4.4. Breast cancer
- 4.5. Malignancy of Gonadal cells
- 4.6. Altered biomechanics in cancer cells.
- 4.7. Skin cancer

Learning outcome –

1. The students will be able to understand the clinical physiology of disorders and diseases of different organs and physiological systems of the human body.
2. They can understand the histopathology and biochemistry involved in different disorders and diseases of different organs and physiological systems of the human body.
3. They can understand the physiological base of carcinoma in different parts of human body.
4. Students will learn the histopathology and biochemistry of carcinoma in different parts of human body.

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M.Sc.-Zoology
Academic Flexibility, Credit System
M.Sc.-II Sem.-IV
MZP 406 Practical VIII
(based on Paper XV& XVI)

1. Study of blood indices.
2. Effect of toxicant / drug to the digestive/ reproductive cell/ glands (Histology and Histochemistry).
3. Qualitative test of Carbohydrate, Protein and fatty acids.
4. Determination of Oxygen Consumption in fish.
5. Effect of pH on Amylase activity.
6. Study of Electrocardiogram (ECG).
7. Study of Arterial blood pressure (BP).
8. Effect of Insulin on blood sugar level.
9. Effect of Adrenalin on blood sugar level.
10. Study of colour index from blood sample by using haemocytometer.
11. To study effect of temperature on enzyme activity
12. Effect of temperature on heartbeat.
13. Demonstration of role of brain hormones in developmental stage.
14. Determination of Calcium in given sample of blood plasma.
15. Separation of serum proteins by Electrophoresis.
16. Estimation of blood Cholesterol.
17. Tracheotomy in rat
18. Pancreatomy in rat
19. To study pathophysiology of muscle fiber – smooth, skeletal and cardiac muscle (Histology and Histochemistry).
20. Detection of reducing substances in urine using Chromatography.
21. Histochemical detection of uric acid crystals by using AgNO₃ Formalin method.
22. Study of Endocrine disorders
23. Any other practical set by concern teacher.