

**MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI**

UG COURSES – AFFILIATED COLLEGES

B.Sc., Biochemistry

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

Eligibility for admission to B.Sc., Biochemistry

Candidates shall be admitted to the course provided he / she has passed plus two examinations of the state or central board with biology / biochemistry as one of the subject.

| Sem | Pt III/ IV/V/ VI | Su b N o. | Subject status | Subject Title | Hrs/ week | Cre dits | Marks | | | | |
|-----|---------------------------|--------------------|------------------------|---|--------------|-------------|---------|------|------|--------------------|------|
| | | | | | | | Maximum | | | Passing minimum | |
| | | | | | | | Int. | Ext. | Tot. | Ext. | Tot. |
| V | I | 36 | Core - 1 | Plant Biochemistry | 5 | 5 | 25 | 75 | 100 | 30 | 40 |
| | II | 37 | Core - 2 | Clinical Biochemistry | 5 | 5 | 25 | 75 | 100 | 30 | 40 |
| | III | 38 | Elective - 1 | Diagnostic Biochemistry | 4 | 4 | 25 | 75 | 100 | 30 | 40 |
| | | 39 | Elective - 2 | Nutritional Biochemistry | 4 | 4 | 25 | 75 | 100 | 30 | 40 |
| | | 40 | Practical –V | Clinical Enzymology | 4 | 2 | 50 | 50 | 100 | 30 | 40 |
| | | 41 | Practical – VI | Clinical Biochemistry-I | 4 | 2 | 50 | 50 | 100 | 30 | 40 |
| | | 42 | Practical – VII | Haematology | 2+ | 2 | 50 | 50 | 100 | 30 | 40 |
| | IV | 43 | Skill Based subject | Personality Development | 2 | 2 | 25 | 75 | 100 | 30 | 40 |
| | | | Total | | 30 | | | | | | |
| VI | I | 44 | Core - 1 | Molecular Biology | 4 | 4 | 25 | 75 | 100 | 30 | 40 |
| | II | 45 | Core - 2 | Endocrine Biochemistry | 4 | 4 | 25 | 75 | 100 | 30 | 40 |
| | III | 46 | Core - 3 | Immunochemistry | 4 | 4 | 25 | 75 | 100 | 30 | 40 |
| | | 47 | Elective - 3 | Biotechnology | 4 | 4 | 25 | 75 | 100 | 30 | 40 |
| | | 48 | Practical -VIII | Clinical Biochemistry-II | 2+ | 2 | 50 | 50 | 100 | 30 | 40 |
| | | 49 | Practical - IX | Immunology and Molecular biology techniques | 3+ | 2 | 50 | 50 | 100 | 30 | 40 |
| | | 50 | Practical - X | Microbial techniques | 2+ | 2 | 50 | 50 | 100 | 30 | 40 |
| | | 51 | Project | Group project | 7 | 7 | - | - | - | - | - |
| | | | Total | | 30 | | | | | | |

SEMESTER- V

Course-7: BC151 – PLANT BIOCHEMISTRY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

Objective: To introduce the students to the biochemistry of plant development.

Total Hours:60

Unit-1

12

Hours

Photosynthesis

Ultra structure of chloroplast- photosynthetic pigments, Light reaction, photo system I & II.
Electron transport- photo phosphorylation.

Unit-2

12

Hours

Metabolism

CO₂ fixation and reduction- C₃ plants (calvin cycle), C₄ plants (Hatch-Slack pathway), CAM plants (crassulacean acid metabolism), photo respiration.

Unit-3

12

Hours

Nitrogen fixation

Nitrogen and Sulphur metabolism- Biochemistry of nitrogen fixation- nitrogenase, nitroreductase, nitrate reductase. NIF genes, nitrate assimilation. Sulphate activation- reduction and sulphite reduction.

Unit-4

12

Hours

Plant growth regulators

Plant growth regulators- chemistry, synthesis, physiological role of auxin, Gibberlin, Cytokinin, Ethylene and Abcissic acid.

Unit-5

12

hours

Seed germination and dormancy

Physiological and, biochemical changes, factors affecting seed germination and dormancy (water, light, temperature, salinity, stress). Photoperiodism- phytochrome- vernalization.

References

1. Plant biochemistry- Goodwin and mercer
2. Plant physiology- Devlin
3. Biochemistry for agricultural sciences, B. Thayumanavan et al., 2004
4. Plant physiology- F.B. Salisbury and C.W. Ross (4th ed)
5. Plant biochemistry- Geza Doby.

Course -8-CLINICAL BIOCHEMISTRY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

Objective: To give all students regardless of their professional laboratory background, a comprehensive understanding of the principles of clinical biochemistry.

Total hours : 60

Unit-1 12
hours

Disorders of carbohydrates metabolism

Regulation of blood glucose level, hypoglycemia, hyperglycemia, diabetes mellitus-types, Clinical features, diagnostic tests- blood and urine tests, Benedict's method, glucose tolerance test, renal threshold for glucose, glycogen storage diseases, lactosuria, ketonemia and ketonuria.

Unit-2 12
hours

Disorders of lipid metabolism.

Plasma lipids and lipoproteins- Hyper lipoproteinemia – types, LCAT deficiency, Hyper and hypo Cholesterolemia, lipidosis, Xanthomatosis, atherosclerosis and fatty liver.

Unit-3 12
Hours

Disorders of amino acid metabolism and protein abnormalities

Inborn errors of aminoacid metabolism- cystinuria, phenylketonuria, maple syrup urine disease, albinism, Hartnup's disease, Willson's disease, Gout, hypouricemia

Disorders of protein metabolism- proteinuria, fibrinogen, albumin, globulin and A/G ratio.

Unit-4

12 Hours

Function tests

Liver and kidney function tests. Jaundice- types, clinical features, diagnostic tests- Vandenberg, fouchet's, Hay's test, test for urobilinogen. Renal clearance – urea, uric acid and creatinine. Renal blood flow . Pancreatic function test.

Unit-5

12

Hours

Enzymes in clinical diagnosis,

Isoenzymes- LDH, CPK, AST, ALT, Alkaline phosphatase, acid phosphatase, choline esterase, amylase, lipase. Electrophoretic pattern of isoenzymes in myocardial infarction, liver and muscular diseases.

References

1. Text book of Medical Biochemistry- M.N.Chaterjee and Rane Shinde
2. Biochemistry with clinical correlation – Devlin
3. Clinical Biochemistry – William Hoffman
4. Practical Clinical Biochemistry – Harold Varley
5. Textbook of Medical Biochemistry – S.Ramakrishnan, K.G. Prassanan and R.Rajan
6. Harper's Biochemistry 24th edition
7. Clinical chemistry – Teity and Co.

ELECTIVES (MAJOR)

ELECTIVE – I (Semester- V)

DIAGNOSTIC BIOCHEMISTRY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |
| 4 | 0 | 0 | 4 |

Objective: To enable students to acquire specialized knowledge and understanding of selected aspects by means of a research project.

Total Hours : 60

Unit-1 12
Hours

Clinical chemistry tests

Blood group, glycosylated haemoglobin, fructosamine, GTT, uric acid, Ca, P, Fe, Cu, CSF analysis.

Unit-2 12
Hours

Enzymes

Acid phosphatases, LDH, CPK, CPK_MB, Alpha amylase, Hormones- T3, TSH, LH. Immunoglobulins- IgA, IgM, IgE.

Unit-3 12
Hours

Serodiagnostic procedures

Precipitation tests, VDRL test, Vidal test, (Slide and tube method) Brucella agglutination test, ASO test, RA test, CRP test.

Complement fixation test, skin test- Montaux test, Lepramin test.

Unit-4 12
Hours

Urine Analysis

Complete haemogram, complete urine analysis, complete motion analysis, seman analysis.

Blood Analysis

Blood bank, blood group and Rh factor, Coomb's test, Coagulation studies, Prothrombin test (PT), Partial PT, Plasma fibrinogen.

Test for amino acidurias- Test for phenyl ketonuria, DNPH, Test for keto acids, sodium nitroprusside test for Cystinuria and homocysteine.

References

1. Varley.H (1985), Practical Clinical Biochemistry, IV Edition
2. Tietz. N (1982), Fundamentals of Clinical Chemistry, W.B. Saunders Company
3. Jacques Wallach (1982), Interpretation of Diagnostic test – A Synopsis, V Edition, Little Brown and Company.
4. Jone Zilva & Pannall.P.R. , Clinical Chemistry, Diagnosis and treatment, PG Publishing Pvt. Ltd.

ELECTIVE – II

NUTRITIONAL BIOCHEMISTRY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

Objective: To acquire knowledge regarding the biological basis of nutrition and the mechanisms by which diet can influence health.

Total Hours :60

Unit-1 12
Hours

Introduction and definition of food

Introduction and definition of food and nutrition, Function of foods, essential nutrients, analysis of food composition, food groups, food habits.

Unit-2 12
Hours

Food sources

Sources of carbohydrates, fats, proteins, minerals (calcium, phosphorus, sodium and potassium) and trace elements (copper, cobalt, zinc, iodine and iron)

Protein mal nutrition (Kwashiorkor) and under nutrition (marasmus)

Unit-3 12
Hours

Vitamins

Vitamins- definition, classification, sources, daily requirements, metabolism, nutritional significance and deficiency.

Composition of balanced diet and RDA for infants, children, adolescents (male and female), pregnant and lactating women and old age.

Unit-4

12 Hours

Measurement of food stuff

Measurement of food stuff by Bomb calorimeter. Calorific values of proteins, carbohydrates and fats. Energy – basal metabolism, measurement of BMR, factors affecting BMR, regulation of body temperature, energy needs, total energy requirements.

Unit-5

12

Hours

Nutritional challenges

Nutritional challenges in future: food production, food storages, functional foods, new protein foods, new fat foods and changing food habits. Food adulteration and hygiene.

References

1. Principles of nutrition and dietetics – M. Swaminathan
2. Normal and therapeutic nutrition – Corine Robinson
3. Human nutrition and dietetics – Davidson and passmore
4. Food nutrition and diet therapy – Krause and Hunscher
5. Advanced text book on food and nutrition – M. Swaminathan (vol 1& 2)

PRACTICAL- 5: BC 1P5 – CLINICAL ENZYMOLOGY

| | | | |
|----------|----------|----------|----------|
| L | T | P | C |
| 0 | 0 | 4 | 2 |

Assay of the serum enzyme activity of

- a. Alkaline phosphatase
- b. Acid phosphatase
- c. Aspartate transaminase
- d. Alanine transaminase
- e. Lactate dehydrogenase
- f. Amylase
- g. Arginase
- h. Trypsin

References

1. Methods in Enzymology, Dixon & Web
2. Modern Experimental Biochemistry
3. Biochemical Methods – S. Sadasivam and A. Manikam

PRACTICAL-6: BC1P6 - CLINICAL BIOCHEMISTRY –I

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

Blood analysis

1. Estimation of blood sugar by King and Astoor method
2. Estimation of blood urea by DAM method
3. Estimation of serum uric acid by Caraway method
4. Estimation of serum calcium by titrimetric method
5. Estimation of serum iron by Ramsay method
6. Estimation of serum phosphorus by Fiske and Subbarow method
7. Estimation of serum protein and A/G ratio by Biuret method
8. Estimation of serum cholesterol by Zak's method
9. Estimation of serum Creatinine by Jaffey's Alkaline Picrate method.
10. Estimation of phospholipids
11. Estimation of triglycerides

References

1. Laboratory Manual in Biochemistry – T.N. Pattambiraman- 3rd edition
2. Laboratory Manual in Biochemistry – J. Jayaraman, New Age International Publishers
3. Practical clinical Biochemistry – Harold Varley, 4th edition.

| | | | |
|----------|----------|----------|----------|
| L | T | P | C |
| 0 | 0 | 4 | 2 |

PRACTICAL- 7: B C 1P7- HAEMATOLOGY

1. Identification of blood group
2. Differential count of leukocytes
3. Enumeration of RBC
4. Enumeration of WBC
5. Enumeration of blood platelets
6. Determination of Erythrocyte sedimentation rate
7. Estimation of haemoglobin by Drabkin's method
8. Compatibility test (Major and Minor Cross matching)
9. Determination of Packed Cell Volume (PCV)
10. Determination of bleeding time and clotting time

References

1. Basic Medical Laboratory Techniques – Estridge, Reynold and Walter- 4th edition
2. Medical Lab Technology- Kanai L Mukherjee
3. Medical Lab Technology – Ramnik Sood
4. Laboratory manual in Biochemistry – T.N. Pattabiraman 3rd edition

SEMESTER- VI

Course-9: MOLECULAR BIOLOGY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

Objective: To provide depth knowledge of biological and medicinal processes through the investigation of the underlying molecular mechanisms.

Total hours : 60

Unit-1
12Hours

Eukaryotic genome organization

Structure of Chromatin, coding and non coding sequences, satellite DNA), DNA- The genetic material- Experimental evidences of DNA as the genetic material. Bacterial conjugation, transduction, lytic and lysogenic cycle.

Unit-2 12
Hours

DNA replication

DNA replication in prokaryotes- semi conservative replication, enzymology of DNA replication. Discontinuous replication, replication in circular DNA, replication in eukaryotic chromosome. DNA repair- alternation in the DNA molecule and its repair, methylation and mismatch repair, excision, recombination and SOS repair.

Unit-3 12
Hours

Transcription

RNA types and functions, initiation, elongation and termination of RNA synthesis. RNA Polymerases (eukaryotic and prokaryotic), inhibitions of transcription.

Unit-4

12

Hours

Translation

Genetic code- major features. Wobble hypothesis. Translation- activation of aminoacid, initiation, elongation and termination, inhibitors of translation

Unit-5

12

Hours

Regulation of gene expression

Translocation, post translational modifications, glycosylation. Bacterial signal sequences, mitochondria, chloroplast and nuclear protein transport. Gene expression and regulation in prokaryotes. Operon concept- lac, trp, arabinose operons.

References

1. Daenell J. et al in 1986. Mlecular Cellbiolgy, Scientifi American book, USA
2. Lewin. B, 1993, GENES V and VI, Oxford University press, New York.
3. Weaver. R.F and Philip.P.W., 1989, Genetics, WMC Brown Publishing.

Course-10: ENDOCRINE BIOCHEMISTRY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

Objective: To provide the basis for understanding endocrine diseases and their management.

Total hours : 60

Unit-1 12
Hours

Introduction to endocrine system

Hormones- definition, classification, biosynthesis, circulation in blood, modification and degradation.

Mechanism of hormone action, class I and Class II hormone receptors- structural features and regulation. Role of second messengers in hormone action. Feed back regulation of hormones.

Unit-2 12
Hours

Hypothalamus and pituitary hormones

Hypothalamic releasing factors, vasopressin and oxytocin. Biosynthesis, secretion, transport, regulation and biological effects of growth hormone, FSH,LH, TSH, ACTH and prolactin. Hyper and hypo activity of pituitary and hypothalamus- acromegaly, dwarfism diabetes insipidus and hypopituitarism

Unit-3 12
Hours

Thyroid hormones

Biosynthesis, secretion, transport, regulation and biological effects of thyroid hormones. Hypo and hyperthyroidism. Anti thyroid agents.

Role of parathyroid hormones, calcitonin and calcitriol in maintaining calcium and phosphorus homeostasis. Hypo and hyper para thyroidism.

Unit-4

12

Hours

Hormones of pancreas

Hormones of the pancreas, islets of Langerhans- cell types, biosynthesis, mechanism of action and biological effects of insulin and glucagon. Gastro intestinal hormones.

Unit-5

12

Hours

Adrenal hormones

Biosynthesis, secretion, transport, biological effects, mechanism of action and excretion of adrenal cortical and medullary hormones. Pathophysiology of adrenal gland secretions.

Biological effects of androgens and estrogens, ovarian cycle.

References

1. William textbook of endocrinology- Wilson and Foster 8th edition
2. Harper's biochemistry- Murray et al, 25th edition.
3. Principles of Biochemistry- Mammalian Biochemistry- Smith-et al.
4. Mechanism of Hormone action- Austin and Short.

Course-11 – IMMUNOCHEMISTRY

| | | | |
|----------|----------|----------|----------|
| L | T | P | C |
| 4 | 0 | 0 | 4 |

Objective: To learn about the structural features of the components of the immune system as well as their functions.

Total Hours : 60

Unit-1 12
Hours

Infection

Types, factors influencing infection- pathogenicity. Sources and carriers of infectious agents, Immune system- definition and properties, cells of immune system, Lymphoid organs- structure and function. Types of immunity- Innate and Acquired immunity.

Unit-2 12
Hours

Antigens

Definition, properties, antigenicity, immunogenic determinants and haptens. Types of antigens, Immunoglobulins- basic structure classes and distribution of antibodies.

Unit-3 12
Hours

Antigen antibody interactions

Molecular mechanism of binding, affinity, avidity, valency, cross reactivity and multivalent binding, complement system. Complement components, classical and alternative pathway. Antigen recognition – T & B cell activation. Immunological memory. Lymphokines and cytokines.

Unit-4

12

Hours

Transplantation immunology

Tissue types, graft rejection and role MHC and T cells. Prevention of graft rejection, Hypersensitivity- immediate and delayed types, mechanisms of reaction. Immunisation practice- Active and Passive immunization.

Tumor immunology- tumor antigens, immunosurveillance and NK cells. Primary and secondary immune deficiency disorders.

Unit-5

12

Hours

Immunological techniques

Production of monoclonal and polyclonal antibodies. Principles and applications of RIA, ELISA, complement fixation tests, precipitation, Immunodiffusion, immunoelectrophoresis, agglutination test- hemagglutination, latex agglutination (Widal, NDRL).

References

1. Immunology- 5th edition Ivan Roitt, Jonathan Brostoff and David Male
2. Immunology- 3rd and 4th edition, Janis Kuby
3. Immunology- D.N. Weir
4. Immunology- A short course Eli Benjamin and Sidnet Leshkowi
5. Immunology- Stewart

ELECTIVE – III

BIOTECHNOLOGY

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

Objective: To develop understanding of industrial processes for the production of antibiotics, enzymes etc.

Total Hours : 60

Unit-1 12
Hours

Tissue culture

Plant tissue culture- Micro propagation and Somatic variation, Protoplast culture. Animal cell & Tissue culture- Primary culture, cell lines, In vitro fertilization & embryo transfer in humans.

Unit-2 12
Hours

rDNA technology

General principles, Salient features of cloning vectors, restriction enzymes. Types of cloning vector, plasmids, cosmids, M-13 phage, Macro & microinjection, particle bombardment, electroporation (Vector less mode).

Unit-3 12
Hours

Plant Biotechnology

Vectors for gene transfer (Ti, Ri Plasmids, Co integrate, intermediate & helper plasmids), binary vectors, viruses as vectors: gene transfer techniques using Agrobacterium, Selectable marker, reporter genes & promoters. Transgenic plants, crop improvement, resistance to herbicide, insects, pests & viruses.

Unit-4

12

Hours

Animal Biotechnology

Genetic engineering in animals, animal viral vector & yeast vectors. Biotechnology of silkworm. Mapping of human genome, genetic engineering approaches for the correction of genetic disorder.

Unit-5

12

hours

Microbial Biotechnology

Bioprocess – Basic principles of microbial growth. Types, design and operation of fermentors, Antifoaming devices & agents. Downstream processing, Oil spill clean up by microbes, Biodegradable plastics, Bioleaching.

References

1. Biotechnology- P. K. Gupta
2. Biotechnology – H. D. Kumar
3. Text book of Biotechnology – Dubey
4. Recombinant DNA Technology – Watson
5. Molecular Biotechnology – Glick & Pasternack

PRACTICAL 8: CLINICAL BIOCHEMISTRY –II

| | | | |
|----------|----------|----------|----------|
| L | T | P | C |
| 0 | 0 | 4 | 2 |

1. Estimation of urea from urine
2. Estimation of uric acid from urine
3. Estimation of phosphorus from urine
4. Estimation of calcium from urine
5. Estimation of glucose from urine
6. Qualitative analysis of abnormal constituents of urine
7. Determination of the titrable acidity and ammonia in urine
8. Estimation of Chloride from urine
9. Qualitative analysis of pathological urine sample

Reference Books 1. Practical Clinical Biochemistry- Varley's by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition ,1988. 2. Laboratory manual in Biochemistry, T.N.Pattabiraman. All India publishers, 1998. 3. Practical Biochemistry for Students, Varunkumar Malhotra, Jaypee Bros, 1986. 4. Laboratory Manual in Bio Chemistry, Jayaraman, New Age International Pub, 2000. 5. Medical Lab Technology Vol I& II, Kanai L Mukerjee New Delhi: Tata Mcgraw Hill Publishing Company, 1996. 6. Practical Biochemistry – Plummer, New Delhi: Tata Mcgraw Hill Publishing Company, 2000. 7. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd

PRACTICAL 9: Immunology and Molecular Biology

Techniques

| | | | |
|----------|----------|----------|----------|
| L | T | P | C |
| 0 | 0 | 4 | 2 |

1. Immunodiffusion-Ouchterlony
2. Immunoelectrophoresis
3. dot ELISA
4. Separation of plant pigments by column chromatography
5. Separation of lipids by Thin Layer Chromatography
6. Separation of aminoacids by paper chromatography
7. Separation of proteins by SDS-PAGE
8. Western Blotting of protein
9. Separation of DNA by Agarose gel electrophoresis
10. WIDAL test
11. VDRL test

Reference Books:

1. Practical Clinical Biochemistry- Varley's by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition ,1988.
2. Laboratory manual in Biochemistry, T.N.Pattabiraman. All India publishers, 1998.
3. Practical Biochemistry for Students, Varunkumar Malhotra, Jaypee Bros, 1986.
4. Laboratory Manual in Bio Chemistry, Jayaraman, New Age International Pub, 2000.
5. Medical Lab Technology Vol I& II, Kanai L Mukerjee New Delhi: Tata Mcgraw Hill Publishing Company, 1996.
6. Practical Biochemistry – Plummer, New Delhi: Tata Mcgraw Hill Publishing Company, 2000.
7. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd

PRACTICAL 10: MICROBIAL TECHNIQUES

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

1. Gram staining
2. Negative staining
3. Acid fast staining
4. Determination of growth curve
5. Simple staining
6. Enumeration of microorganisms from soil
7. Enumeration of microorganisms from air
8. Enumeration of microorganisms from water
9. Microbial growth curve
10. Determination of microbial motility.
11. Biochemical Characterization of Bacteria 1. Indole test 2. Methyl Red test 3. Triple Sugar Iron Agar test 4. Voges Proskauer test 5. Citrate Utilization test 6. Catalase test 7. Urease test 8. Oxidase test 9. Nitrate test

Reference Books: 1. Manuals in Biochemistry – Dr. J. Jayaraman, New Age International Pub, 2000. 2. Instrumental Methods of Chemical Analysis Bk.Sharma, Goel publications, Meerut, 2000 3. Laboratory Manual in Bio Chemistry, Jayaraman, New Age International Pub, 2000. 4. Laboratory manual in Biochemistry T.N.Pattabiraman. All India publishers, 1998. 5. Lab Manual in General Microbiology - N Kannan, Palaniappa Brothers, 2000. 6. Lab Manual in Microbiology - Dr P Gunasekaran, New Age International Pub, 2000.