Scheme and syllabus of Biochemistry for career related First degree programme in Biochemistry (core) and Industrial Microbiology (vocational)-Choice Based Credit and Semester System
<table>
<thead>
<tr>
<th>Paper</th>
<th>Lecture hours</th>
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### Summary of courses and credits of various study components included in the Programme

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<tr>
<th>Study components</th>
<th>Number of courses</th>
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<td>Project</td>
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Accumulated Total Minimum Credits required for Programmes of study = 120 Credits.  
Minimum Credits for Social Services/Extension Activity = 1 Credit  
Minimum Duration = 6 Semesters
Scheme of Examination, Evaluation and Grading:

- Each theory examinations are of 3 hours (for core, elective and open).
- Practical examination is of six hours duration.
- Evaluation and grading are in accordance with the general guidelines given by the university.
- Evaluation of each course shall be done in percentage score and shall involve Continuous Evaluation (CE) with a weightage of 25 percent and End Semester Evaluation with a weightage of 75%.

**Continuous Evaluation (CE) -25%**

1. **Attendance**
   - The allotment of grade for attendance shall be as follows:
     - Attendance less than 75 % - E grade
     - 75 & less than 80% - D grade
     - 80% & less than 85% - C grade
     - 85% & less than 90% - B grade
     - 90% & above - A grade

2. **Assignment** –
   - Assignments or Seminars: (WEIGHT 1)
     - Each student shall be required to do one assignment or one seminar for each Course.
     - Valued assignments shall be returned to the students. The seminars shall be organized by the teacher/teachers in charge of CE and the same shall be assessed by a group of teachers including the teacher/teachers in charge of that Course. Assignments/Seminar shall be graded on the basis of their quality. The teacher shall define the expected quality of an assignment in terms of structure, content, presentation etc. and inform the same to the students. Due weight may be given for punctuality in submission.

3. **Tests:** (WEIGHT 2)
   - For each Course there shall be at least two class tests during a Semester. Grades for the test component in CE shall be awarded on the basis of calculating average of the grades secured for the two class tests.

**Scheme for practical examination**

**For CE**

- Attendance:
  - Upto 75% - E grade
  - 75% - 80% - D grade
  - 81% - 85% - C grade
  - 86% upto 90% - B grade
  - Above 90% - A grade

- Laboratory record:
- Test - Better of the two can be taken for grading.
- Viva voce.

**Scheme for the Evaluation of Practical Examination**

Weightage may be assigned for various components as follows

**A. For Qualitative Analysis**

- Step 1. Result & Conclusion
- Step 2. Confirmatory test 1
- Step 3. Confirmatory test 2
- Step 4. Neatly written scheme of experiments used for arriving at the final conclusion
Grading scheme
For step 1 only - Grade D
For step 1 & 2 - Grade C
For step 2 & 3 - Grade C
For step 1, 2 & 3 - Grade B
For step 2, 3 & 4 - Grade B
For all steps - Grade A

B. For Quantitative Experiments
Step 1. Result of the reported value (minimum error)
Step 2. Calculation, presentation of the result (Graph)
Step 3. Procedure
Step 4. Skill
Grading scheme
For step 1 only - Grade D
For step 1 & 2 - Grade C
For step 2 & 3 - Grade C
For step 1, 2 & 3 - Grade B
For step 2, 3 & 4 - Grade B
For all steps - Grade A

PROJECT
Components required: - (a) Institutional visit (compulsory) + report
(b) Project work (lab work)
(c) Report of the project work done
(d) Viva voce of the work

Scheme for the Evaluation of Project
Weightage may be assigned for various components as follows
1. Rationale of the study
   General background of the study
   Relevance of the study
2. Objective & scope of the study
3. Methodology- Appropriateness & Accuracy
4. Results & Discussion
   Presentation (figures, graphs, legends etc)
   Analysis
Relevance/ importance
5. References/literature up to latest reports & documentation
6. Conclusions
7. General presentation
   • Free of typographic errors
   • Free of redundant material
First Semester

Code: IM 1121
Foundation course I –Core related
Fundamentals of Biochemistry
Credtis:3

Objective: To provide comprehensive information on fundamentals of Biochemistry and to provide an in-depth understanding on the origin and history of biochemistry. It also provides a perspective of research methodology and familiarizes the student with the varied branches of biochemistry, bioinformatics and biostatistics.

Module I (6 hours)

History of biochemistry, Contributions of several scientists to biochemistry: Edward Buchner, Francis Crick, James Watson, Emil Fischer, Otto Meyerhoff, Franz Knoop, Hans Kreb, Francis Jacob & Jacques Monod – their discoveries and the classical experiments associated with them.

Core Text:
• A history of the Life Sciences: Magner L N 2nd edition, Marcel Dekker, Inc

Module II (10 hours)


Core Text:

Module III (8 hours)


Module IV (8 hours)
Informatics
Overview of information technology: Features of modern personal computer and peripherals - computer networks and Internet - Overview of operating system and major applications of software. Academic search techniques –, plagiarism - Introduction to use of IT in teaching and learning. Power point features and slide preparation.

Core Text:

Module V (10 hours)
Bioinformatics

Familiarisation with the following terms for studying bioinformatics-Aminoacids, proteins, nucleic acids, gene. Introduction, importance and scope of bioinformatics, internet concepts (PubMed). Introduction to data mining and data analysis methods. Applications of sequence searching tools- BLAST, Clustal X, RASMOL-Elementary study of databanks- Genbank, EMBL, PDB.

Core Text:
• Bioinformatics: A Practical approach. K.Mani and N.Vijayaraj, Aparnaa Publication, 2004

Module VI (12 hours)
Statistics

Significance of statistical methods in biological investigations, Introduction to statistical software SPSS- Probability theory, random variables. Basic idea about regression and correlation analysis. student’s t-test, Chi-square($X^2$). Correlation coefficient Data presentation - tables, histograms and pi diagrams.

(Study of the statistical terms and methods expected only in the biological perspective)

Core Text:
Core Practicals

No. of contact hours: 36 hrs. (2 hrs/wk)

Familiarisation with biochemistry laboratory

Reactions of Aminoacids- Tyrosine, Tryptophan, Methionine, Proline, Arginine, Cysteine, Cystine, Histidine.

Second Semester

Code: IM 1241
Core Course-I
Biomolecules

Credits: 3          Total teaching hours: 54
3 hrs/wk

Scope of the Course
Biochemistry is the study of molecules and chemical reactions of life. It is the discipline that uses the principles and language of Chemistry to explain Biology at the molecular level. Chemical structures are the vocabulary of Biochemistry. Here we deal with an overview study of biomolecules to make the students geared up to absorb the finer principles of biochemistry.

Module I Carbohydrates (10 hours)
Classification of carbohydrates, ketoses and aldoses C3 to C6 series exemplified by one in each group (structure only), reactions and structure of glucose, fructose, sucrose, maltose and lactose. Mutarotation-Inversion of cane sugar. glycosides, polysaccharides- starch, cellulose, and glycogen – important structural features. General reactions of carbohydrates- oxidation, reduction, osazone formation. Mucopolysacharides chondroitin sulphates, Heparin, Hyaluronic acid.


Module II Lipids (12 hours)
Classification of lipids, classification of fatty acids, Emulsification- Saponification- Glycerides. Phospholipids- lecithin, cephalins, plasmalogens, phosphatidyl inositides (indicate structure and function), cerebrosides, gangliosides, saponification number and acid number, iodine value, sterols-cholesterol- structure and two color reactions. Bile acids.


Module III Amino acids and Peptides (12 hours)


Module IV Proteins Structure, Classification and Properties (10 hours)

Classification, physical properties, solubility, isoelectric Point, protein denaturation, isoelectric precipitation, salt effect, heavy metal precipitation. -Structure of proteins-primary, secondary, tertiary and quaternary- forces stabilizing each level of structure.


Module Protein Sequencing (4 hours)

Determination of primary structure, N-terminal and C-terminal residues (one method each). Sequence of amino acid in polypeptide, digestion by enzyme (chymotrypsin & trypsin) oligopeptide separation and overlapping of amino acid.


Module VI Nucleic acids (6 hours)

Purines, pyrimidines, ribose, deoxyribose, nucleoside structure, nucleotide structure, different types of RNA-mRNA, tRNA and rRNA- basic structural features, Action of DNAase, RNAase, secondary and tertiary structure of DNA-Watson and crick double helix model of DNA.


Suggested reading:-

Qualitative Analysis of any one of the given unknown aminoacid

Tyrosine, Tryptophan, Methionine, Proline, Arginine, Cysteine, Cystine, Histidine.

The student should have done and recorded at least seven amino acids from the above list. The practical exam of 3 hrs duration consists of identification of any one of the given unknown amino acid from the above list.

References
- Analytical Techniques in Biochemistry and Molecular Biology- By Rajan Katoch. Springer Publishers
Third Semester

**Code:** IM 1341

**Core Course-II**

**METHODS IN BIOCHEMISTRY**

Credits: 4  
No. of contact hours : 54 hrs.  
3hrs/wk

**Scope of the course**

Advances in biochemistry are based on the careful design execution and data analysis of experiments designed to address specific questions or hypotheses. Biochemical experiments usually have much experimental detail in common. The aim of this course is to address many of these common experimental techniques. A thorough learning of this course will enable one to independently understand, design and carry out scientific experiments.

**MODULE I (16 hours)**

**Centrifugation**

- Centrifugation-principle of sedimentation technique. Principle, procedure (only elementary details) and application of differential centrifugation, density gradient centrifugation, ultra centrifugation. Cell disruption techniques. Subcellular fractionation.


**MODULE II (10 hours)**

**Electrophoretic techniques**

- PAGE, SDS-PAGE, agarose gel electrophoresis-separation of proteins and nucleic acids, staining and molecular weight determination.


**MODULE III (12 hours)**

**Chromatographic techniques**

- Principle, procedure (only elementary details) and applications of Paper chromatography, TLC, ion exchange chromatography, gel filtration, affinity chromatography.


**MODULE IV (6 hours)**

**Colorimetry and spectrophotometry**
Principles and applications of colorimetry, spectrophotometry - Beer Lamberts law - Limitations - calculation of molar extinction co-efficient.


**MODULE V (10 hours)**

**Principles of radioactivity and blotting techniques**

Principles of radioactivity - types and properties of $\alpha$, $\beta$ and $\gamma$-rays. Technique of autoradiography. Basic principle and applications of blotting techniques - western, northern and southern blotting.


**References**

7. Basic Techniques In Biochemistry And Molecular Biology - By R. K. Sharma, S. P. S. Sangha

**Core Practicals**

No. of contact hours: 54 hrs

(3 hrs/wk)

**Study of the general reactions of Carbohydrates**

Glucose, Fructose, Galactose, Xylose, Sucrose, Lactose, maltose, Starch.

*Molisch’s test, Benedict’s test, Fehling’s test, Barfoed’s test, Bial’s test, Phloroglucinol test, Hydrolysis test, Iodine test, Seliwanoff’s test, Foulger’s test, Osazone test.*

**Reference:**

Fourth Semester

Code: IM 1441
CORE COURSE III
Physiological aspects of Biochemistry
Credits: 4
No. of contact hours: 54 hrs
3 hrs/wk

Scope and Objective
Science of Physiology is the study of functions in living organisms. More recently, this field has proceeded apace, and biochemists have been really successful in learning the impeccable working of the body systems at a finer level. A thorough learning of Physiological Biochemistry will help the students understand themselves more, and to build up their own living standards.

Module I: Digestion, Absorption and nutrition (9 hours)
Digestion and absorption of carbohydrates, proteins and lipids. role of bile in lipid digestion and absorption. Defects in digestion and absorption.

Fundamentals of nutritional biochemistry
Nutrition: Calorific value. BMR Fat and water soluble vitamins. Functions and deficiency Diseases(Structure of vitamins not needed). Co-enzyme form of the vitamins and their functions.


Module II: Biochemistry of Blood. (9 hours)
Constituents of Blood, types of blood cells, components of plasma, types of plasma proteins and functions. Mechanism of blood clotting (Extrinsic and Intrinsic pathway). Structure of hemoglobin. -Types of hemoglobin, sickle cell anemia.


Module III: Biochemistry of Respiration and Renal function (9 hours)
Transport of oxygen and carbon dioxide in blood, oxygen dissociation curve and Bohr Effect, Carbonic anhydrase, Chloride shift. Structure of nephron, Mechanism of formation of Urine. Basic principles of acidosis and alkalosis-metabolic and respiratory.


Module IV: Biochemistry of specialized tissue (9 hours)
Muscle proteins, Organization of Contractile proteins and mechanism of muscle contraction.- Sliding filament theory. Sources of energy for muscle contraction.
Nerve: Structure of Neuron, Mechanism of nerve impulse transmission.


Module V: Endocrinology (9 hours)

Important functions of the following hormones.: -Thyroxin. GH, TSH, LH and FSH hormones. ADH and oxytocin. Cortisol, cortisone, corticosterone (mineralocorticoids), aldosterone (glucocorticoid). epinephrine and nor-epinephrine. Sex hormones- Testosterone, estrone and estradiol. (Structures of hormones in the above-mentioned list are not expected.) Salient features and the endocrine defect associated with the following disorders- Addisons disease, Cushings syndrome, Diabetes Mellitus, Goitre, Hypothyroidism and Hyperthyroidism, Hashimotos thyroiditis, Diabetes Insipidius, Acromegaly.


Module VI: Enzymes (9 hours)

Introduction to enzymes, apoenzyme, holoenzyme, prosthetic group, classification of enzymes, lock and key model, induced fit model, active site, enzyme specificity and types. Enzyme kinetics, factors affecting the velocity of enzyme action. Enzyme concentration, temperature, pH, substrate concentration. Derivation of MM equation and Km Value determination, its significance. LB plot, Enzyme inhibition, reversible and irreversible, competitive, non-competitive and uncompetitive inhibition, allosteric enzymes. Isoenzymes, Zymogen form of enzyme and its activation.

Ref:- Enzymes-M.Dixon and E C Webb. Longman publication.

References:
1. Medical Biochemistry – Vasudevan and Sreekumari
3. Human Physiology – Chatterjee, Medical allied agency
Code: IM 1442
Core course IV
Qualitative Analysis of carbohydrates
(Practicals)

Credits: 3  No. of contact hours: 54 hrs.
(3 hrs/wk)

Qualitative analysis of any one of the given carbohydrate
Glucose, Fructose, sucrose, galactose, xylose, maltose, lactose, starch

The student should have done all the above experiments.

The practical exam will be of three hours duration and involves identification of the given carbohydrate from the above list.

References

Fifth Semester
Code: IM 1541
Core course VI
Metabolism-I
Credits: 3  No. of contact hours: 36 hrs.
2 hrs/wk.

Scope of the course
Life is a biochemical process involving thousands of reactions occurring in an organized manner. These reactions are collectively called metabolism. The major objective of learning this course is the complete understanding of all the metabolic reactions at a molecular level. This course is related to almost all the life sciences and without a background knowledge of this course, a thorough understanding of health and well-being is not possible.
Module I (10 hrs)
Glucose metabolism

Reactions and energetics of glycolysis (aerobic and anaerobic), galactose & fructose metabolism, oxidative decarboxylation- TCA cycle, anaplerotic reaction, gluconeogenesis, HMP shunt. galactosemia, fructosuria, essential pentosuria

Core Text:

Module II (4 hrs)
Glycogen Metabolism

Glycogen Metabolism: Glycogenesis, glycogenolysis, Regulation of glycogen metabolism. Cori cycle, Brief study of the Glycogen storage diseases(Von Gierke, Pompes, Cori’s or Forbe’s, Anderson, Her’s, Mc Ardle, Tarui’s).

Core Text:

Module III (8 hrs)
Fatty acid metabolism

Transport of fatty acid into mitochondria, Carnitine shuttle: \( \alpha, \beta, \omega \) oxidation of saturated, monounsaturated and polyunsaturated fatty acid, Refsum’s disease, sources of acetyl Co A, Biosynthesis of saturated fatty acid.

Core Text:

Module IV (8 hrs)
Lipid Metabolism

Biosynthesis of triglycerides and important phospholipids(cephalin, lecithin). Ketone bodies- formation, utilization and significance. Ketoacidosis and ketonuria. Action of lipases and phospholipases. Gaucher’s disease, Tay-Sach’s disease

Core Text:

Module V (6 hrs)
Steroid metabolism
Biosynthesis of cholesterol. Formation of sex hormones and bile acids from cholesterol. Regulation of cholesterol biosynthesis. Brief idea about prostaglandins.

**Core Text:**

**Code:** IM 1542  
**Core course VII**  
**Metabolism II**  
No. of credits: 3  
No. of contact hours: 36 hrs.  
2 hrs/wk.

**Module I (6 hrs)**

Nitrogen assimilation: conversion of nitrate to ammonia by plants, biological nitrogen fixation (symbiotic, non – symbiotic) Nitrogen balance (positive, negative).

**Core Text:**

**Module II (6 hrs)**

General reactions of amino acid metabolism: transamination, transdeamination, oxidative deamination and decarboxylation, Urea cycle and regulation, glucogenic and ketogenic amino acids, biosynthesis and degradation of glycine, phenyl alanine. Alkaptonuria, phenylketonuria,

**Core Text:**

**Module III (6 hrs)**

Nucleic acid metabolism: Sources of atoms of purines and pyrimidines, Biosynthesis and degradation of purines and pyrimidines- de novo and salvage pathways with regulation, Biosynthesis of adenylic acid, ATP and Uridylic acid (Outline pathway). gout, Lesch Nyhan syndrome

**Core Text:**
- Biochemistry by Lubert Stryer, W.H Freeman and Company, New York ISBN 0-7167-

Module IV (6 hrs)

Electron Transport Chain: Structure of mitochondria, sequence of electron carriers: NADH dehydrogenase, Succinate dehydrogenase, cytochrome reductase and cytochrome oxidase (outline of electron transport chain), sites of ATP synthesis, inhibitors of electron transport chain.

Core Text:

Module V (6 hrs)

Oxidative phosphorylation: Sites of ATP production, hypothesis of mitochondrial oxidative phosphorylation-Chemosmotic theory, P/O ratio, inhibitors and uncouplers, transport of reducing potentials into mitochondria-Malate aspartate and glycerol-3-phosphate shuttle.

Core Text:

Module VI (6 hrs)
Photosynthesis

Structure of chloroplast, light reaction, cyclic and noncyclic photophosphorylation, chlorophyll (structure only), dark reaction, fixation of CO₂ and formation of carbohydrate (brief treatment only), C3 and C4 plants, photorespiration, CAM pathway.

Core Text:
Code: IM 1543
Core course VIII
Quantitative Analysis of Biomolecules (practicals)

credits: 3        No. of contact hours: 108 hrs.
               6 hrs/wk.

I  Quantitative Analysis
   A. Estimation of Carbohydrates
      1. Estimation of glucose by Nelson-Somogyi method
      2. Estimation of glucose by anthrone method.
      3. Estimation of pentose by Orcinol method.
      4. Estimation of ketose by Roe-Papedopaulose method.
   B. Estimation of Lipids
      Estimation of Cholesterol Zak’s method
   C. Estimation of Aminoacids and Proteins
      1. Estimation of aminoacid by Ninhydrin method.
      2. Estimation of Protein by Biuret method.
      3. Estimation of Protein by Folin-Lowry method.
   D. Estimation of Nucleic Acids
      1. Estimation of DNA by diphenylamine method.
      2. Estimation of RNA by Orcinol method

II  Food analysis
   1. Estimation of cholesterol in egg-Zak’s method
   2. Estimation of reducing sugar in honey-Roe & Pappadopoulos method

The student should have done and recorded a minimum of eight experiments from the quantitative analysis section and two experiments from the food analysis section.

The core practical exam will be of three hours duration and involves colorimetric estimation of a biomolecule by the graphical method (from the above list of experiments)

References
OPEN COURSE

The open course is to be studied by students from other departments of the college and will be handled by core (biochemistry) faculty. The department can choose any one of the open course available in the scheme—Either Clinical approach to life or Life style diseases.

Code: IM 1551
Open Course(Core): Clinical Approach to Life

Credits: 2  No. of Contact Hours: 54
3 hrs/wk

Objective: To provide layman knowledge to the students of common stream about the various biochemical tests done to determine disease conditions, and a general interpretation of lab results.

Note: This course is studied by students from other departments like music, Malayalam, Hindi etc. who may not even have studied biology at their higher secondary level. Hence only an introduction to the terms and their significance in everyday life is aimed at in the present course.

Course Outline
Module I (8 hrs)
Blood

Components of blood and their function,— difference between plasma and serum. Blood groups, Rh factor, hemolytic disease of the new born, Basic idea about blood transfusion

Module II (10 hrs)
Routine Blood Analysis

Clinical significance and normal values of glucose— (fasting blood sugar, random blood sugar, post prandial blood sugar,Hb1Ac), total Protein, albumin, Urea, bilirubin, Cholesterol— HDL and LDL.(determination methods of these parameters not needed).

Module III (9 hrs)
Hematology

Normal values and clinical significance of the routine hematological tests — RBC count, WBC count, ESR, PCV, hemoglobin concentration, platelet count, bleeding time, clotting time.(Detailed procedures not needed).
Module IV (9 hrs)

Urine analysis

Routine examination of urine- Name of the normal constituents- Names and clinical significance of the abnormal constituents-Glucose, ketone bodies, blood, protein, bile pigments-. microbiological examination-casts, crystals, detection of infection.

Module V (18 hrs)

Function tests

Liver function tests-List the functions of liver. Serum bilirubin. Jaundice-Features Names of enzymes used for diagnosis of liver diseases-AST/ALT.
Renal function test-List the functions of kidney. Renal threshold. Clearance tests-urea and creatinine clearance., Dilution and concentration test.
Thyroid function test.-Significance of T3,T4 and TSH values. Definition of hypo-and hyper thyroidism.

Core Text:
Medical Laboratory Technology Volume I, Kanai. L. Mukharjee,
Medical Laboratory Technology-Ramnik Sood.
Textbook of Biochemistry for Medical Students, 6th Edition- By D. M. Vasudevan,
Sreekumari S, Kannan Vaidyanathan.

Suggested Readings:
• Medical Laboratory Technology (Volume, II& III) By Kanai. L. Mukharjee.
• A procedure for routine diagnostic tests, Tata Mc. Graw- Hill Publishing Company Ltd.,
  New Delhi, 12th reprint, 1988)
• Fundamentals of Biochemistry for Medical students Dr. Mrs. Ambika Shanmugam,
  Published by 12, III- Cross street, West C.I.T. Nagar, Madras; III Edition, 1977)
• Bauer J.D. Clinical Laboratory Methods, C.V. Mosby, St. Louis 1982.
• Mollison P.L. Blood Transfusion in Clinical Medicine, 6th Ed, Blackwell Scientific
• Bowley C. C., K.L.G. Goldsmith & Wd’A Maycock, Blood Transfusion: A guide to the
• Bishop M.L.-J.L. Dlaufer & E.P. Fody, Clinical Chemistry, Lippincott Company,
• Lamberg S.L., Laboratory Manual of Haematology and Analysis, AV I publishing Co.
Code: IM 1552
Open Course: Lifestyle Diseases (Core)
No. of Credits: 2

No. of Contact Hours: 54
3 hrs/wk.

Objective: To create awareness among students about the various diseases which originate and which could be prevented by controlling the life style. The course also covers the general aspects of diagnosis, methods of prevention and pharmaceutical intervention.

Course Outline
Module I (9hrs)
Concept of lifestyle diseases- importance of lifestyle factors in preventing disease development diet, exercise, smoking, alcohol etc.

Module II (9 hrs)
Diabetes- Type 1 and type2, characteristics, causes, diagnosis, prevention and management

Module III (9 hrs)
Cancer: Characteristics, Causes, Diagnosis, Prevention, Management, familiarization with treatment modalities

Module IV (9 hrs)
Body mass index, determination and significance Obesity- factors leading to development, prevention, management

Module V (6 hrs)
Atherosclerosis and cardiovascular diseases- Myocardial infarction, congestive heart failure, ischemic diseases-Causes, diagnosis and management.

Module VI (6 hrs)
Importance of diet and exercise in health- balanced diet, BMR, calorific value, How to reduce cholesterol and risk of heart attack through life style changes, use of life style medicine to treat disorders.

Reference:
Sixth semester

Code: IM 1641
Core course IX
CLINICAL BIOCHEMISTRY

Credits: 3
No. of contact hours: 54 hrs.
3 hrs/wk.

Scope
Clinical Biochemistry mainly deals with the biochemical aspects that are involved in several clinical conditions. The results of qualitative and quantitative analysis of body fluids assist the clinicians in the diagnosis, treatment, prevention of disease, drug monitoring, forensic investigation, tissue and organ transplantation.

Module I (6 hrs)

Sample collection and preservation methods of body fluids.
Collection and preservation procedures of blood, plasma, serum, and urine. Preparation of swabs.

Module II (12 hrs)
Blood analysis

Principle of estimation, normal values and clinical significance of the following parameters of blood-Glucose- fasting, random, post prandial, Hb1Ac- Glucose tolerance test, Hb, Uric acid, Lipid profile,- triglycerides, total cholesterol, HDL cholesterol and LDL cholesterol, Urea, Acid phosphatase, Creatine phosphokinase. (Detailed determination procedures not needed).

Module III (10 hrs)
Haematology

Principle of determination, clinical significance of the following parameters-Total count, differential count, erythrocyte sedimentation rate, packed cell volume, prothrombin time, bleeding time and clotting time. Brief study of blood groups-anticoagulants, storage and transfusion of blood, hemolytic disease of the newborn.

Module IV (12 hrs)
Organ function test

Principles of the following tests of liver function and the interpretation of the results- total protein, total and conjugated bilirubin, jaundice-features-hemolytic and obstructive- AST, ALT, ALP, Thyroid function test- T3, T4, TSH-determination of hypo-and hyperthyroidism. primary and secondary. Renal function test- Urea, creatinine, urea clearance test.
Module V (6 hrs)

Urine analysis

Urine – Names of normal constituents. Abnormal constituents-ketone bodies, protein, glucose, blood, bile pigments- procedures of qualitative analysis and their clinical significance.

Module VI (8 hrs)

Life style disorders

Introduction to life style disorders-definition, lifestyle factors in the development of diseases- Diabetes- Types, causes, diagnosis, prevention and management.
Cancer-a basic idea about the disease.

References

• Preventive and social medicine By K. Park
• Text book of medical Biochemistry by Sreekumari and Vasudevan
Code: IM 1642
Core course X
Molecular Biology
Credits: 4
No. of contact hours: 54 hrs.
3 hrs/wk.

Scope of the course
Molecular biology is a new research field that is a result of traditional industrial microbiology and recombinant DNA technology. It is a revolutionary scientific discipline based on the ability of researchers in gene transfer. This very interesting course will definitely equip the students to surf the world of genetic engineering and genetic manipulations.

Module I: Introduction to Molecular Biology (8 hrs)

Classical experiments proving DNA as the genetic material- transformation experiments, Hershey Chase experiment, Central dogma of molecular biology, Concept of gene- Split genes- introns and exons. C-value paradox.


Module II: Replication (10 hours)


Module III: Transcription (9 hours)

Prokaryotic Transcription – process- Initiation, elongation and termination, different forms of RNA- mRNA, tRNA, rRNA. Prokaryotic RNA polymerase-promoters and enhancers. Definition of splicing.


Module IV: Genetic code and translation (9 hours)

Salient features of genetic code, codons, anticodons, recognition, Prokaryotic translation- aminoacid activation, initiation, elongation and termination- inhibitors of protein synthesis.
Definition of protein folding and chaperones.


**MODULE V: Regulation and expression in prokaryotes (6 hours)**

Constitutive and inducible enzymes, operon concept Brief study about lactose operon and tryptophan operon- Positive and negative regulation of lactose operon.


**MODULE VI: Recombinant DNA technology (12 hours)**

Outline study of recombinant DNA technology- vectors, cosmid, plasmid, phage, restriction enzyme, palindromes, reverse transcriptase, construction of genome library, cloning, identification of clones, fingerprinting, DNA sequencing- Maxam Gilbert sequencing, Sanger’s method, an introduction to PCR and RFLP.


**REFERENCES:**


Code: IM 1643  
Core course XI  
(Practicals)

Credits: 3  
No. of contact hours: 72hrs  
4hrs/wk

Urine analysis and Hematology

**Qualitative tests of urine: Abnormal constituents**

- Proteins (Coagulation test, sulfosalicylic acid test,)
- Sugars (Benedicts test)
- Hemoglobin (Benzidine test)
- Ketone bodies (Rothera test, Gerhardt’s test)
- Bile pigments (Fouchet’s test, Gmelin’s test)
- Bile salts (Hay’s test)

**Hematology**

ESR, PCV, TC/DC count, Blood Grouping, Hemoglobin

The student should have done a minimum of five abnormal constituents in urine analysis and four hematology experiments. The core practical exam will be of three hours duration and involves identification of an abnormal constituent in the given urine sample and a hematology experiment from the above list.

**References**

**Code:** IM 1644  
**Core course XII**  
**(Practicals)**  
**Credits:** 3  
**No. of contact hours:** 72hrs  
**4hrs/wk**

**Serum estimation**

1. Estimation of blood glucose by Nelson – Somogyi Method
2. Estimation of serum Cholesterol by Zak’s Method
3. Estimation of blood Urea by Diacetylmonoixime Method
4. Estimation of Total Protein in serum by Biuret Method
5. Estimation of total protein in serum by Folin-Lowry method
6. Estimation of Uric acid in serum using Phosphotungstic acid reagent
7. Estimation of inorganic phosphate in serum by Fiske-Subbarao Method
8. Estimation of serum Bilirubin

**Clinical Enzymology:**

10. Assay of serum alkaline phosphatase
11. Assay of Serum alanine amino transferases (ALT/SGPT)
12. Assay of serum aspartate amino transferases (AST/SGOT)

The student should have done and recorded a minimum of seven experiments from the above list. The core practical exam will be of three hours duration and involves estimation of a biomolecule in the given serum/blood sample.

**References**

IM1645 Project
Credits: 4

Contact hours: 36 hours (2 hrs/wk)
1 hr/wk for core and 1 hr/wk for vocational

The students should do one project either in Biochemistry or Microbiology. The total number of students in the program should be equally divided into two batches and one batch should do a project in core subject and the other batch should do the project in the vocational subject. Which batch would come under which faculty can be decided by drawing lots.

The project report should be based on a mini-project work done by the students. This should include original laboratory work, analysis of results and should be presented along with relevant and current literature review. The evaluation of dissertation should be done on the basis of evaluation of the project report and a viva-voce examination of the student. The students will do the project in the fifth semester and have to submit their reports in the sixth semester.

A report of the industrial visit carried out to any industries/institutions relevant to the subject should accompany the project report.

Scheme for evaluation of project

<table>
<thead>
<tr>
<th>Total weightage: 30</th>
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<tr>
<td>Project: 20</td>
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<tr>
<td>Industrial Visit: 10(The visit carries a weightage of 6 and the visit report carries a weightage of 4)</td>
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Scheme and syllabus of Industrial Microbiology for
Career related First Degree programme in
“BIOCHEMISTRY AND INDUSTRIAL MICROBIOLOGY”
Under CBCSS

(Two Major, 2a Career Related Course)
<table>
<thead>
<tr>
<th>Semester</th>
<th>Course code</th>
<th>Paper</th>
<th>Duration</th>
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<tr>
<td>I</td>
<td>IM 1171</td>
<td>Vocational course- I Fundamental Microbiology</td>
<td>3 hours</td>
<td>30</td>
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<tr>
<td>II</td>
<td>IM1222</td>
<td>FOUNDATION COURSE II- Microbial Taxonomy and Physiology</td>
<td>3 hours</td>
<td>30</td>
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<td></td>
<td>IM 1271</td>
<td>Vocational course- II Microbiology Practicals</td>
<td>6 hoursX2 days</td>
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<td>IM1371</td>
<td>Vocational course- III Cell Biology</td>
<td>3 hours</td>
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<td>Vocational course- IV Microbial Genetics &amp; Biotechnology</td>
<td>3 hours</td>
<td>30</td>
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<td>IV</td>
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<td>3 hours</td>
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<td>Vocational course- VI Food Microbiology</td>
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<td>Vocational course-VII Microbiology Practicals</td>
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<td>IM 1571</td>
<td>Vocational course- VIII Fermentation Technology</td>
<td>3 hours</td>
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<td>IM 1572</td>
<td>Vocational course- IX Microbiology Practicals</td>
<td>6 hours X 2 days</td>
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<td>Vocational course- X Medical Microbiology</td>
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<td>Elective course- Immunology- Elective</td>
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<td>IM 1672</td>
<td>Vocational course-XI Microbiology Practicals</td>
<td>6 hours X 2 days</td>
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SEMESTER I

CODE: IM1171

VOCATIONAL COURSE I

Fundamentals of Microbiology

Total Hrs-54 CREDITS -4

(3Hrs /week)

MODULE I


MODULE II

Microscopy- Principles & uses of bright field, dark field, phase contrast, fluorescent, electron microscopy (TEM&SEM). Principles of staining of bacteria- simple staining, Negative staining, Gram’s staining, Acid fast staining (Ziehl Neelsen staining), spore staining & staining of metachromatic granules.

MODULE III

Morphology and anatomy of bacterial cell- Cell size, shape, arrangement. Structure of Prokaryotic plasma membrane, cell wall, capsule, slime layer, S-layer, flagella, pili, nucleoid, inclusion bodies, endospore.

MODULE IV


MODULE V
Sterilization (physical and chemical methods)-Sterilization by heat (Moist heat, dry heat and incineration), radiation (ionizing radiations and Ultraviolet rays), aldehydes and disinfectants. Factors influencing sterilization.

**MODULE VI (9 Hrs)**


**REFERENCES**

3. Microbiology - Bernard D Davis
4. Foundations in Microbiology - Talaro and Talaro
5. Essentials of Microbiology (Sixth edition) - Purohit and Singh (ISBN 81-85031-67-3)

**SEMESTER I**

**VOCATIONAL PRACTICAL**

Total Hrs-36 CREDIT-0

(2Hrs /week)

**Part I (18 Hrs)**

1. Laboratory precautions- General rules and regulations.
2. Common instruments in Microbiology laboratory.
3. Cleaning and sterilization of glass wares.
4. Preparation of media.
5. Isolation of pure culture - Isolation of bacteria by pour plate, streak plate and spread plate methods.
6. Cultural characteristics of Microorganisms - Colony morphology on culture plate.

**Part II (18 Hrs)**

7. Study of the various components of the microscope, its handling and maintenance.
8. Preparation of bacterial smear

9. Staining of bacteria:
   (a) Simple staining of bacteria,
   (b) Gram staining,
   (c) Negative staining,
   (d) Spore staining,
   (e) Volutin granule staining

10. Motility of bacteria by hanging drop method.

11. Lactophenol cotton blue mounting of fungi and study of fungal microscopic characteristics.

REFERENCES

3. Experiments in Microbiology Plant Pathology and Biotechnology- K. R. Aneja

SEMESTER II

CODE: IM 1222

FOUNDATION COURSE II

Microbial Taxonomy and Physiology

Total Hrs-54 CREDITS-3 (3 Hrs /week)

MODULE I (12 Hrs)


MODULE II (10Hrs)

Classification of fungi-with examples (brief account only). Classification of algae-green algae, brown algae and diatoms with examples. Classification of protozoa- flagellates, Amoebas, sporozoa and ciliates- (brief account) with examples.
MODULE III

Bacterial growth- Binary fission, Bacterial growth curve, factors affecting bacterial growth. Significance of various phases of growth. Batch, continuous culture, Fed batch, Synchronous growth.

MODULE IV

Bacterial Photosynthesis - : oxygenic and anoxygenic types, Nitrogen fixation: Symbiotic and non-symbiotic types

MODULE V


REFERENCES

3. Essentials of Microbiology-Purohit and Singh
4. Brock’s Biology of Microorganisms-Mardigon Martinko And Parker
5. Microbial Genetics-Frifielder
6. Microbiology-Zins

SEMESTER II

CODE: IM1271

VOCATIONAL COURSE II Microbiology Practical

Total Hrs-36 CREDITS-3

(2Hrs /week)

Part I (18 Hrs)

1. Isolation and enumeration of bacteria from soil.
2. Isolation and enumeration of bacteria from Water.
3. Isolation and enumeration of bacteria from Air.
4. Biochemical tests-
   (a) IMViC
   (b) Sugar fermentation
   (c) Urease test
(d) TSI

(e) Catalase and Oxidase

**Part II (18 Hrs)**

5. Candle jar method for cultivation of anaerobic bacteria.

6. Slide culture technique for fungi


9. Effect of different disinfectants and antiseptics on bacteria.

**REFERENCES**


2. Microbiology A Laboratory Manual - James G Cappucino Natalie Sherman

3. Experiments In Microbiology Plant Pathology And Biotechnology- K.R Aneja

**SEMESTER III**

**CODE: IM1371**

**VOCATIONAL COURSE III**

**CELL BIOLOGY**

**Total Hrs-72 CREDITS -3**

**(4 Hrs /week)**

**MODULE I** (12 Hrs)


**MODULE II** (12 Hrs)

MODULE III  
(12 Hrs)
Cell-cell interactions, cell-matrix interactions, cell-cell adhesion, cell-cell signaling, Role of bacterial cell-cell signaling in virulence and pathogenesis.

MODULE IV  
(12 Hrs)

MODULE V  
(12 Hrs)

MODULE VI  
(12 Hrs)

REFERENCES

2. Principles of Genetics by D. Peter Snustad and Michael J Simmons, John Wiley & Son,
4. Cell and Molecular Biology by De Robertis & De Robertis.jr.
SEMESTER III  
CODE: IM1372  
VOCATIONAL COURSE IV  
Microbial Genetics and Biotechnology  
Total Hrs-54 CREDITS -3  
(3 Hrs /week)  

Module I  
Introduction to history of genetics, Mendel’s laws of genetics, alleles, multiple alleles, Test cross and back cross. Basic idea about linkage and crossing over, Mapping, Sex linked inheritance, (simple numerical problems to be worked out) A brief idea about population genetics-Hardy Weinberg law.

Module II  
Prokaryotic replication & its types: φ- Theta mode and σ-sigma mode or rolling circle model of replications. Different method used for introducing foreign DNA into the cell: DNA direct transformation, electroporation, Microinjection and biolistic methods.

Module III  

Module IV  
Animal cell tissue culture- Preparation of culture media, primary culture, cell lines & its types. Maintenance of cell lines. Genetically modified organisms. Transgenic animals – engineering embryos (brief account only).

Module V  
Plant cell tissue culture- Media composition. Plant tissue culture techniques- callus culture, cell suspension culture, protoplast culture and somatic hybridization. Applications of plant tissue culture, Transgenic plants- improving crops and foods (brief account only).

Module VI

Reference:


SEMESTER III

VOCATIONAL PRACTICAL

Total Hrs 36 CREDITS-0

(2 Hrs /week)

Part I (18 Hrs)

1. Isolation of antibiotic resistant bacterial population by gradient plate method.
2. Isolation of streptomycin resistant mutant by replica plate technique.
3. Isolation of plasmid DNA.
4. Preparation of genomic DNA from bacteria.
5. Principle and application of agarose gel electrophoresis

Part II (18 Hrs)

6. Plant regeneration from callus or plant tissue.
7. Mushroom cultivation
8. Bioassay for evaluating the mutagen or carcinogen by Ames test.
10. Demonstration of Bacterial transformation.

REFERENCES
3. Experiments in Microbiology plant pathology and Biotechnology- K.R.Aneja

SEMESTER IV
CODE: IM1471
VOCATIONAL COURSE V
Environmental Microbiology
Total Hrs 54 CREDITS-3
(3 Hrs /week)

MODULE I (9 Hrs)
Microbial ecology-interactions. Microorganisms as components of ecosystem-as producers and decomposers. Bacterial life in extreme environments & effect of temperature, pH, pressure, salt and heavy metals.

MODULE II (9 Hrs)

MODULE III (9 Hrs)
Bioremediation: Degradation of pesticides, detergents, degradation of lignin, xenobiotic compounds, petroleum and hydrocarbon compounds. Microbes in mining. Bacterial leaching.

**MODULE IV**

(9 Hrs)


**MODULE V**

(9 Hrs)


**MODULE VI**

(9 Hrs)

Plant pathology- Symptoms, etiology, epidemiology and management of the following plant diseases: mosaic disease of tobacco, bunchy top of banana, bacterial blight of paddy, damping off of tobacco, blight of maize/sorghum, leaf spot of paddy and citrus canker.

**REFERENCES**

2. Environmental Microbiology- K.Vijaya Ramesh (ISBN 81-8094-003-9)
5. Introduction to Soil Microbiology –Alexander
6. Soil Microbiology-Waksman
7. Soil Microorganisms And Its Growth-N.S. Subba Rao
8. Biofertilizers in Agriculture- Subha Rao
SEMESTER IV  
CODE: IM1472  
VOCATIONAL COURSE VI  
Food Microbiology  

Total Hrs 54 CREDITS-2

(3 Hrs /week)

Module I

Introduction: Importance of food and dairy Microbiology – Types of microorganisms in food – Source of contamination (primary sources) – Factors influencing microbial growth in foods (extrinsic and intrinsic)

Module II

Fermented food: Cheese, bread, wine, fermented vegetables – methods and organisms used. Food and enzymes from microorganisms – single cell protein, production of enzymes.

Module III


Module IV

Food Poisoning: food borne infections and intoxications: Source, symptoms and Management of the following- (a) Bacterial (Staphylococcal, Brucella, Clostridium, Escherichia, Salmonella) (b) Fungal : Mycotoxins,(c) Viral: Hepatitis, (d) Protozoa – Amoebiasis. Management

Module V

REFERENCES


SEMESTER IV

CODE: IM1473

VOCATIONAL COURSE VII Microbiology Practical

Total Hrs 54 CREDITS-3

(3 Hrs/week)

Part I (27 Hrs)

1. Determination of Biochemical oxygen Demand (BOD) of water.

2. Determination of Chemical oxygen Demand (COD) of water.


   (a. Presumptive coliform test, b. Confirmed coliform test, c. Completed coliform test)

4. Isolation & culturing of *Rhizobium* from root nodules of higher plants.

5. Study of the following disease

   (a) Tobacco mosaic disease, (b) Bacterial blight of paddy, (c) Leaf spot of mulberry, paddy

   (d) Bunchy top of banana, (e) Citrus canker
Part II (27 Hrs)


7. Determination of quality of a milk sample by MBRT, phosphatase test.

8. Determination of TDT and TDP


10. Effect of salt concentrations on bacterial growth.

11. Microbiological examination of foods-

(a) Isolation and enumeration of bacteria and fungi from spoiled vegetables,

(b) Isolation and enumeration of bacteria and fungi from spoiled fruits

(c) Isolation and enumeration of bacteria and fungi from spoiled fish or meat.

(d) Isolation and enumeration of bacteria and fungi from soft drinks.

REFERENCES

1. Experiments in Microbiology, Plant pathology and Biotechnology- K. R. Aneja
2. Practical Microbiology- R C Dubey and D K Maheswari.

SEMESTER V

CODE: IM1571

VOCATIONAL COURSE VIII

Fermentation Technology

Total Hrs 72 CREDITS-3

(4 Hrs /week)

MODULE I

Fermentation technology-isolation, screening and strain improvement of industrially important microorganisms. Introduction to fermentation processes- media for industrial fermentation, sterilization, inoculum preparation.
MODULE II

Design and parts of fermenter – agitation, aeration, pH, temperature, dissolved oxygen-control and monitoring, difference in fermentation process of biomass, chemicals and conversion products- comparative brief account. Cell and enzyme immobilization.

MODULE III

Recovery of fermentation product (Down-stream processing) - Methods for cell lysis, Physical separation, liquid liquid extraction, Precipitation, chromatography, drying.

MODULE IV

Microbial products- raw materials, organism and industrial process involved in the production of penicillin, streptomycin, ethanol, butanol, acetone, vitamin B12, riboflavin, alpha lysine, amylase, protease, pectinase, citric acid. Biopesticide production.

MODULE V

Microbes in food industry - bacteria (lactics, acetics, proteolytic and lipolytic bacteria, Thermophilic and thermoduric bacteria, pigmented bacteria and coliform bacteria), molds (Mucor, rhizopus, penicillium, Aspergillus and yeasts (Genus Saccharomyces, zygosaccharomyces, Genus candida & salt tolerant yeast). Production of SCP.

MODULE VI

Fermentation - Bacteria grouped according to major products of glucose, dissimilation-Lactic acid fermentation, Homolactic fermentation, Heterolactic fermentation, Ethanolic fermentation, and propionic acid fermentation, mixed acid, fermentation, Butanediol fermentation and butyric acid fermentation. Amino acid fermentation (stickland reaction). Pasteur effect.

REFERENCES

1. Industrial Microbiology - L.E. Casida, JR (ISBN 0 85226 1012)
5. Fermented foods Economic Microbiology Vol 7 rose A (ed)
6. Manual Of Industrial Microbiology And Biotechnology, Demin & Davis
7. Applied Microbiology-Musharaffudde
SEMESTER V

CODE: IM1572

VOCATIONAL COURSE IX Microbiology Practical

Total Hrs 108 CREDITS-4

(6 Hrs /week)

Part I (54 Hrs)

1. Yeast Cell immobilization
2. Isolation of amylase producers.
3. Demonstration of microbial antibiosis by crowded plate technique.
4. Production of wine from grapes.
5. Isolation of lipolytic microbes.
6. Isolation of protease producers.

Part II (54 Hrs)

8. Citric acid production by Aspergillus sp..
9. Amylase production by SSF.
10. Enrichment of coir pith degraders.
11. Analysis of Mycotoxin (Aflatoxin) in fungus- contaminated food materials.
12. Demonstration of fermentation by yeast.

REFERENCES

1. Experiments in Microbiology plant pathology and Biotechnology - K. R. Aneja
2. Practical Microbiology-R C Dubey and D K Maheswari.
IM1645 PROJECT (Core/Vocational)

Credit 4

(1 Hr /week)

The students should do one project either in Biochemistry or Microbiology. The total number of students in the program should be equally divided into two batches and one batch should do a project in core subject and the other batch should do the project in the vocational subject. Which batch would come under which faculty can be decided by drawing lots.

The project report should be based on a mini-project work done by the students. This should include original laboratory work, analysis of results and should be presented along with relevant and current literature review. The evaluation of dissertation should be done on the basis of evaluation of the project report and a viva-voce examination of the student. The students will do the project in the fifth semester and have to submit their reports in the sixth semester.

A report of the industrial visit carried out to any industries/institutions relevant to the subject should accompany the project report.

**Scheme for evaluation of project**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total weightage</td>
<td>30</td>
</tr>
<tr>
<td>Project</td>
<td>20</td>
</tr>
<tr>
<td>Industrial Visit</td>
<td>10</td>
</tr>
</tbody>
</table>

(The visit carries a weightage of 6 and the visit report carries a weightage of 4)
SEMESTER VI
CODE: IM1671
VOCATIONAL COURSE X
Medical Microbiology
Total Hrs 54 CREDITS-3
(3 Hrs /week)

MODULE I          (9 Hrs)

Normal Microbial flora- Resident flora and transient flora, Beneficial and harmful effects of normal flora. Brief account on normal flora of skin, conjunctiva, upper respiratory tract, mouth, teeth, stomach, upper and lower intestine, genitourinary tract. Nosocomial infection

MODULE II          (9 Hrs)

Bacteriology: Pathogenicity, laboratory diagnosis, prevention and control of the diseases caused by (brief account only): Staphylococcus aureus, Streptococcus pyogenes, Neisseria gonorrhoeae, Escherichia coli, Salmonella typhi, Vibrio cholerae, Corynebacterium diptheriae, Clostridium tetani, Mycobacterium tuberculosis, Treponema pallidum, Mycoplasma pneumoniae & Chlamydia trachomatis.

MODULE III          (9 Hrs)


MODULE IV          (9 Hrs)

Virology: Air borne viral disease (Influenza, measles, mumps, rubella, small pox). Insect borne (yellow fever, dengue fever) food and water borne disease (polio). Direct contact diseases – Hepatitis B. rabies, AIDS.

MODULE V          (9 Hrs)

Protozoology: Disease caused by Protozoa (Pathogenic mechanisms, Disease transmission and life cycle ) – Plasmodia, Toxoplasma, Entamoeba histolytica, Trypanosoma
MODULE VI  

(9 Hrs)

**Antimicrobial chemo therapy:** Antibiotics and their mode of action. Drug resistances– Mechanism of drug resistances. Antimicrobial sensitivity tests- diffusion and dilution techniques.

**REFERENCES**

1. Ananthanarayan and Panicker’s Textbook of Microbiology- ISBN 81 250 2808 0
2. Notes on Medical Bacteriology – J.Douglas SleighMorag C.Timbury
3. Parasitology – B.Dasgupta
4. Medical Mycology – Rippon
5. Principles of Bacteriology Virology and immunity Vol 4 Lopka and Wilson
6. Fundamentals of medical Virology by Kucera and Myrvik

**SEMESTER VI**

**CODE: IM1672**

**VOCATIONAL COURSE – XI Microbiology Practical**

**Total Hrs 108 CREDITS-4**

(6hrs/week)

**Part I (54 Hrs)**

1. Antibiotic sensitivity testing- Kirby-Bauer method

2. Determination of MIC and MBC of antibiotics

3. Identification of common bacterial pathogens by using morphological, cultural and biochemical characters.

   a) *Staphylococcus*,
   b) *Streptococcus*
   c) *Escherichia coli*,
   d) *Pseudomonas*
   e) *Klebsiella*


5. RPR card test for syphilis.
Part II (54 Hrs)

6. ASO latex agglutination test
7. RA latex agglutination test
8. HBs Ag detection by using immunochromatographic technique
10. Isolation of Enteric pathogens from stool by direct plating methods.

REFERENCES

2. Medical Laboratory technology—Methods and interpretation (ISBN 81-8448-449-6)

ELECTIVE COURSE

CODE: IM1661

ELECTIVE COURSE- IMMUNOLOGY

Total Hrs 36 CREDITS-2

(2 Hrs /week)

MODULE 1

(6 Hrs)


MODULE 1I

(6 Hrs)

Antigens, structure and types of antigens-endogenous and exogenous, & super antigens. Antigenicity and immunogenicity. Haptens, adjuvants and its types. Structure and functions of different classes of immunoglobulins (IgG, IgM, IgA, IgD & IgE )

MODULE III

(10 Hrs)
Cells of immune system (Lymphocytes, Mononuclear cells, granulocytes, dendritic cells), Phagocytosis, Organs of immune system (primary and secondary lymphoid organs), Complement system and activation pathways (classical, alternate and lectin pathways), Membrane attack complex. Structure, and function of Major Histocompatibility complex (MHC class 1 and Class II) –brief introduction only.

**MODULE IV**

Brief introduction to antigen and antibody reactions- complement fixation, neutralization, agglutination reactions, precipitation reactions and its types. Immunoassays of diagnostic importance-ELISA, RIA, VDRL and WIDAL test. Western Blotting, Production of monoclonal and polyclonal antibodies, and its applications.

**MODULE V**

Brief account on Immunodeficiency disorders, Hypersensitivity reactions, Immunohaematology (Blood groups and Rh incompatibilities), Autoimmunity, Vaccines, Immunology of organ and tissue transplantation and Immunology of malignancy

**REFERENCES**

1. Immunology: An Introduction by Ian R Tizard (2006) Publisher: Cengage Learning
2. Immunology and Immunotechnology by Chakravarty (2006)
4. Elements of Immunology (2009) by Khan Publisher: Dorling Kindersley (India) Pvt
5. Immunology by K.R. Joshi (2007) Publisher: Agrobios (India)
6. Basic Immunology, 3ed by: Abbas Publisher: Elsevier
8. Immunology by David A. Marcus, Richard A. Goldsby, Barbara A. Osborne (2003) Publisher: WH. Freeman & Company