UNIVERSITY OF KERALA

COURSE STRUCTURE AND SYLLABUS

For

CAREER RELATED FIRST DEGREE PROGRAMME IN
BIOCHEMISTRY (CORE) & INDUSTRIAL MICROBIOLOGY (VOCATIONAL)

Under

CHOICE BASED CREDIT & SEMESTER SYSTEM

Revised Syllabus 2019

w.e.f 2020 admission (1st Semester onwards)
Syllabus for Career related First Degree Programme in Biochemistry under CBCS System for B.Sc. Biochemistry and Industrial microbiology

### Distribution of hours and credits

<table>
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<tr>
<th>Semester</th>
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**Summary of courses and credits of various study components included in the programme**

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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 and Evaluation

- 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.
- Evaluation shall involve Continuous Evaluation (CE) and End Semester Evaluation (ESE).
- The CE and ESE ratio shall be 1:4 for both Courses with or without practical.
- There shall be a maximum of 80 marks for ESE and maximum of 20 marks for CE.

I. Attendance (Max. marks 5)

II. Assignments or Seminars: (Max. Marks 5): 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/Seminars shall be evaluated 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 shall be given for punctuality in submission. Seminar shall be similarly evaluated in terms of structure, content, presentation, interaction etc.

III Tests: (Max. marks 10: For each Course there shall be one class test during a semester. Valued answer scripts shall be made available to the students for perusal within 10 working days from the date of the test. The marks of CE shall be consolidated by adding the marks of Attendance, Assignment/ Seminar and Test paper respectively for a particular Course.

The marks for the components of Practical for Continuous Evaluation shall be as shown below.

a. Attendance 5 marks
b. Record 5 marks
c. Regularity/consistency 5 marks
d. Performance 5 marks
Scheme for the Evaluation of Practical Examination
Weightage may be assigned for various components as follows

A. For Qualitative Analysis
Step1.Result & Conclusion
Step2.Confirmatory test 1
Step3.Confirmatory test 2
Step4.Neatly written scheme of experiments used for arriving at the final conclusion

B. For Quantitative Experiments
Step1.Result of the reported value (minimum error)
Step2.Calculation, presentation of the result Graph
Step3.Procedure
Step4.Skill

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 upto latest reports & documentation
6. Conclusions
7. General presentation
   • Free of typographic errors
   • Free of redundant material
Semester I

IM1121: Foundation course I- Core related
Course title: Biomolecules

No. of Credits: 3
Hours/week: 3
No. of contact hours: 54

Objectives: This course emphasizes on various bio-molecules and its significance and enables the students to learn the basic functions, structures and biological importance of lifeless chemical compounds. On successful completion of the course the students should have understood the significance of the complex bio-molecules, polysaccharides, lipids, proteins, nucleic acids.

Course Outcome: Student will be able to
• List out the contributions of popular scientists in the field of biochemistry.
• Describe the classification, structure and chemical properties of biomolecules including carbohydrates, lipids, proteins, amino acids and nucleic acids.

Course Outline

Module I
History of biochemistry
(3 hrs)
Molecular logic of life. Contributions of several scientists to biochemistry: Francis Crick, James Watson, Frederick Sanger and Arthur Kornberg- their discoveries and the classical experiments associated with them (brief concept).

Module II
Carbohydrates
(13 hrs)
Occurrence, Classification of carbohydrates, ketoses and aldoses (C3 to C6 series) exemplified by one in each group (structure only), Monosaccharides: structure, configuration, isomerism (all 5 types), mutarotation. General reactions of carbohydrates-copper reduction, osazone formation, oxidation, reduction, sugar acids, sugar alcohols, amino sugars, deoxy sugars, esters, derived monosaccharides and glycosides. Disaccharides: maltose, lactose, sucrose, isomaltose, cellobiose (structure, occurrence and function), oligosaccharides. Haworth projection formula- ring formationPolysaccharides: classification as homo and heteropolysacharides. Homopolysaccharides: storage polysaccharides (starch, dextrin, glycogen- structure, reaction, properties), structural polysaccharides (cellulose and chitin-structure, properties), Mucopolysacharides (Outline study): Hyaluronic acid, chondroitin sulphates and heparin. Glycoproteins, proteoglycans, lipopolysaccharides.

Module III
Lipids
(8 hrs)
Outline study of - bile acids, ergosterol, sitosterol, prostaglandins, thromboxanes and leukotriens, Isoprenoids- carotenoids.

Module IV (8 hrs)
Amino acids
Amino acids-Ocurrence classification, abbreviated names (one letter, three letters) structure and important reactions - ninhydrin reaction, formol titration and van slyke method, colour reactions of aminoacids, properties: optical activity, UV absorption, ionisation property of aminoacids, Zwitter ion, isoelectric point and titration of aminoacids. Essential and non essential amino acids. Non protein aminoacids-outline study.

Module V (12 hrs)
Protein chemistry

Module VI (10hrs)
Nucleic acids
Structure of purines, pyrimidines, ribose, deoxyribose, nucleosides, nucleotides and polynucleotides. Structure of nucleic acids- Watson & Crick DNA double helix, chromosome organization and composition, introduction to circular DNA, helix to random coil transition - denaturation of nucleic acids, hyper chromic effect, Tm-values, cot curves and their significance. Types of RNA, unusual bases in nucleic acids. Action of DNAases and RNAases.

References
Semester I

Practicals for IM1121 P1 (Core)
Familiarization with biochemistry laboratory

Hours/week: 2
No. of Contact hours: 36

Course Outline

1. Introduction to Safety and Security at Workplace
   • Different types of occupational health hazards, knowledge of chemical substances, characteristics & safety measures, use of safety gears, masks, gloves & accessories, evacuation procedures for workers & visitors. Health, safety & security issues – types (illness, fire accidents), company policies and procedures, When and how to report, summon medical assistance & emergency services.

2. General reactions of Carbohydrates and Lipids
   • Test for Carbohydrates – Solubility test, Molisch’s test, Fehling’s test, Benedict’s test, Barfoed’s test, Bial’s test, Seliwanoff’s test, Phloroglucinol test, Iodine test, hydrolysis of sucrose and starch, ozazone test.
   • Test for Lipids- Solubility test, translucent spot tests, test for unsaturation, Salkowski reaction, Liebermann-Burchard reaction
   • Test for Amino acids- Solubility test, ninhydrin reaction, Xanthoproteic reaction, Millons test, glyoxylic acid test, Ehrlich’s test, nitroprusside test, lead acetate, test for Methionine, aldehyde test, isatin test.
   • Test for Proteins- Solubility test, ninhydrin reaction, Xanthoproteic reaction, Folin’s, Lowry, heat denaturation, TCA precipitation, metal precipitation, alcohol precipitation

Semester II

IM1241: Core Course-I
Course title: Environmental Studies

No. of Credits: 4
No. of contact hrs: 54
Hours/week: 3

Objectives: The need for sustainable development is a key to the future of mankind. This course is designed to give a clear understanding of environmental concerns and to follow sustainable development practices.

Course Outline

Module I (10 hrs)
Natural resources
The multidisciplinary nature of environmental studies. Definition, Scope and importance, Need for public awareness.
Natural Resources: Renewable resources and non renewable sources.
Natural resources and associated problems-

- Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam benefits and problems.
- Mineral resources: Use and exploitation environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Case studies.
- Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

**Module II (10 hrs)**

**Ecosystems**


Introduction types, characteristic features, structure and function of the following ecosystem- (a) Forest ecosystem, (b) grassland ecosystem, (c) desert ecosystem and (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

**Module III (10 hrs)**

**Biodiversity and its conservation**

- Introduction- Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, national and local levels.
- India is a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat less, poaching of wildlife, man wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity; In-situ and ex-situ conservation of biodiversity.

**Module IV (8 hrs)**

**Environmental pollution**

Definition

- Causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards.
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: floods earthquake, cyclone and landslides.
Module V  
Social issues and the environment  
• From unsustainable to sustainable development.
• Urban problems related to energy.
• Water conservation, rain water harvesting, watershed management.
• Resettlement and rehabilitation of people, its problems and concerns. Case studies
• Environmental ethics issues and possible solutions.
• Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
• Waste land reclamation.
• Consumerism and waste products.
• Environment protection act.
• Air (Prevention and control of pollution) Act
• Water (Prevention and control of pollution) Act
• Wildlife Protection Act.
• Forest Conservation Act
• Issues involved in enforcement of environmental legislation.
• Public awareness.

Module VI  
Human population and environment (3 hrs)  
• Population growth variation among nations.
• Population explosion –Family welfare Programme.
• Environment and human health.
• Human Rights.
• Value education.
• HIV/AIDS.
• Women and child welfare.
• Role of Information Technology on Environment and human health.
• Case Studies.

Field work (5 hrs)  
• Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain.
• Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
• Study of common plants, insects, birds.
• Study of simple ecosystems-pond, river, hill slopes etc.(Field work equal to 5 lecture hours)

References  
• BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
• Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
• De A.K., Environmental Chemistry, Wiley Eastern Ltd.
• Down to Earth, Centre for Science and Environment (R)
• Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
• Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
• Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
• Survey of the Environment, The Hindu (M)
• Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
• Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
• Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)

Semester II

IM1242: Core course II (Practicals) P2
Course title: Qualitative Analysis of biomolecules

No. of credits: 2
No. of contact hrs: 36
Hours/week: 2

Course Outline

1. Qualitative analysis of Carbohydrates.
   • Carbohydrates- Glucose, fructose, xylose, sucrose, maltose, lactose, starch
   • Tests- Molisch’s test, Fehling’s test, Benedict’s test, Barfoed’s test, Bial’s test, Seliwanoff’s test, phloroglucinol test, Iodine test, hydrolysis of Sucrose and starch, osazone test.

2. Qualitative analysis of Lipids
   • Fatty acids: Stearic acid, oleic acid.
   • Tests- Solubility, translucent spot tests, test for unsaturation
   • Glycerol
   • Tests- Acrolein, solubility.
   • Triglycerides
   • Tests- Solubility, saponification, translucent spot test
   • Cholesterol
   • Tests- Solubility, Salkowski reaction, Liebermann-Burchard reaction.

3. Qualitative analysis of Amino acids and Proteins
   • Amino acids: Tyrosine, Tryptophan, Cysteine, Cystine, Proline, Methionine (single components only need be given)
• Tests- Solubility, Ninhydrin reaction, Xanthoproteic reaction, Millons test, Morners test, Glyoxylic acid test, Ehrlich’s test, Nitroprusside test, Lead acetate, Test for Methionine, Aldehyde test, Isatin test
• Proteins: Ovalbumin and Casein
• Tests- Solubility, Ninhydrin reaction, Xanthoproteic reaction, Folin’s test, Lowry’s test, Biuret test, Heat denaturation, TCA precipitation, Metal precipitation, Alcohol precipitation.

References:

• Analytical Techniques in Biochemistry and Molecular Biology- By Rajan Katoch. Springer Publishers

Semester III

IM1341: Core Course-III
Course Title: Analytical Biochemistry and Biophysical Chemistry

No. of Credits: 4 No. of contact hours: 54
Hours/week: 3

Objectives: 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.

Course outcome: Student will be able to
• Discuss about various concepts in research methodology
• Explain the principle, working and application of different separation techniques like chromatography, electrophoresis and centrifugation.
• Describe the principle, working and application of colorimeter and spectrophotometer
• List out the application of information technology and statistical methods in biology

Course Outline

Module I (8 hrs)
Methods in Science
Types of knowledge: Practical, Theoretical and Scientific Knowledge. What is Science; laws of science, basis of scientific laws and factual truths. Hypotheses: Formulation of hypothesis; hypothetico-deductive model, inductive model.
Academic search techniques, plagiarism - Overview of information technology: Overview of operating system and major applications of software. Introduction to use of IT in teaching and learning. Power point features and slide preparation.

**Module II**

**Chromatographic and Electrophoretic techniques**

*Chromatography*-Principle, procedure (only elementary details) and applications of Paper chromatography, TLC, ion exchange chromatography, gel filtration, affinity chromatography. *Electrophoresis*-PAGE, SDS-PAGE, agarose gel electrophoresis-separation of proteins and nucleic acids, staining and molecular weight determination. Blotting techniques-Southern, Western and Northern.

**Module III**

**Centrifugation and photometry**

*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.

*Photometry*: Colorimetre-Principles and applications. Spectrophotometry-Beer Lamberts law-limitations- calculation of molar extinction co-efficient.

**Module IV**

**Bioinformatics**

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.

**Module V**

**Statistics**

Significance of statistical methods in biological investigations, probability theory, random variables, Data presentation- tables, graphs, histograms and pi diagrams. Testing of significance: Student’s t-test, Chi-square test, basic idea about regression and correlation analysis, correlation coefficient, introduction to statistical software SPSS. *(Study of the statistical terms and methods expected only in the biological perspective.)*

**Module VI**

**Biophysical chemistry**


*Colloids*: True solution, colloids, coarse suspension, distinction between lyophilic and lyophobic colloids, fundamentals of Donnan-membrane equilibrium-biological applications, properties of colloids, applications, emulsions and emulsifying agents
References

- Instrumental Methods of analysis- Chatwal, Anand.
- Manuals of biochemistry-Satyanarayana.
- Principles and techniques of practical biochemistry- Bryan L. Williams and Keith Wilson.
- Basic Techniques In Biochemistry And Molecular Biology By R.K.Sharma, S.P.S. Sangha.

Semester III

Practicals for IM1341 (Core) P3

Hours/week: 3                                              No. of contact hours: 54

Course Outline

1. Introduction to laboratory and lab equipments
   - Use of balances-common, analytical and electronic balances.
   - Preparation of solutions:
     - Percentage, molar, normal, dilution of stock solutions, standard solution
     - Standardization of pH meter.
     - Determination of pH of unknown solution using pH meter.
     - Preparation of Buffer. (application of Henderson-Hasselbalch equation)
   - Preparation of colloidal solutions
     - Preparation of colloidal ferric hydroxide by hydrolysis
     - Preparation of emulsion
     - Precipitation of colloids by salts

2. Chromatographic Techniques
   - Demonstration of different types of paper chromatography.
   - Separation and identification of aminoacid mixture by paper chromatography
• Thin layer chromatography
• Extraction and quantification of total lipids.
• Separation of lipids by TLC

References:


Semester IV

IM1441: Core course IV
Course Title: Physiological aspects of Biochemistry and Enzymology

No. of Credits: 3
Hours/week: 3

No. of contact hours: 54

Objectives: 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 to understand themselves more, and to build up their own living standards.

Course Outcome: Student will be able to
• Describe the mechanism of food digestion, hemopoeisis, hemostasis, kidney functions and respiration.
• Detail on the physiological events in nephron, muscle, nerve and bone.
• Explain the classification, functions and regulation of hormones and hormonal control of reproduction.
• Depict mechanism of enzyme action, enzyme kinetics and inhibition.

Course Outline

Module I
Digestion and absorption
(9 hrs)
Digestion and absorption of carbohydrates, proteins and lipids. Salivary, Gastric and Biliary Secretions- composition and functions. Role of bile in lipid digestion and absorption. Intestinal hormones, movements in gastro intestinal tract, secretion, digestion and absorption in the small intestine. Absorption in the large intestine. Peptic ulcer, Sprue, celiac disease, regurgitation, diarrhoea and constipation.

Module II
Biochemistry of Blood
(9 hrs)
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-

Module III
Biochemistry of respiration and renal function

Module IV
Biochemistry of specialized tissue
Muscle proteins, organization of contractile proteins and mechanism of muscle contraction in striated and non-striated muscle- sliding filament theory. Sources of energy for muscle contraction.
Nerve: Structure of neuron, neurotransmitters, mechanism of nerve impulse transmission, synaptic transmission, reflex action and neurotransmitters.
Bone: Structure and composition, role of Ca, P and Vitamin D in bone formation

Module V
Endocrinology and Reproductive physiology
Classification of hormones, important functions of the following hormones: thyroxin, GH, TSH, LH, FSH, ADH and oxytocin, cortisol, cortisone, corticosterone (mineralocorticoids), aldosterone (glucocorticoid), epinephrine and nor-epinephrine (structures of hormones not expected). Salient features and the endocrine defects associated with the following disorders- Addisons disease, Cushings syndrome, diabetes mellitus, goitre, hypothyroidism and hyperthyroidism, Hashimotos thyroiditis, diabetes insipidus, acromegaly. Male and female sex hormones: testosterone, estrone and estrasdiol. Interplay of hormones during reproductive cycle, pregnancy, parturition and lactation. Hormone based contraception.

Module VI
Enzymes
Introduction to enzymes, apoenzyme, holoenzyme, prosthetic group, classification of enzymes, lock and key model, induced fit model, features of active site, enzyme specificity and types. Enzyme kinetics, factors affecting the velocity of enzyme action- enzyme concentration, temperature, pH, substrate concentration- derivation of Michaelis Menten equation and Km value determination, its significance. Lineweaver Burk plot. Enzyme inhibition- irreversible and reversible (competitive, non-competitive and uncompetitive inhibition), allosteric enzymes. Isoenzymes, zymogen form of enzyme and its activation.

References:

• Mammalian Biochemistry – White A, Handler P and Smith P.L (McGraw Hill)
• Principles of Anatomy and Physiology – Gerald J Tortora, Bryan Derrickson. John villey and sons, INC

Semester IV

IM1442: Core course V (Practicals) P4
Course title: Quantitative analysis of Biomolecules

No. of Credits: 3
Hours/week: 3
No. of contact hours: 54

Course Outline

1. Quantitative analysis of carbohydrates
   • Estimation of glucose by Nelson-Somogyi method
   • Estimation of reducing sugar by anthrone method.
   • Estimation of reducing sugar phenol-sulphuric acid.
   • Estimation of pentose by Orcinol method.
   • Estimation of ketose by Roe-Papadopoulos method.

2. Quantitative Analysis of Lipids
   • Estimation of Cholesterol by Zak’s method.
   • Determination of Acid Value.
   • Determination of Saponification value.

3. Quantitative Analysis of Aminoacids and Proteins
   • Estimation of Tyrosine by Folin-Lowry method.
   • Estimation of Protein by Biuret method.
   • Estimation of Protein by Folin-Lowry method.

4. Quantitative Analysis of Nucleic Acids
   • Estimation of DNA by diphenylamine method.
   • Estimation of RNA by Orcinol method

References:


(Students should be trained to perform estimation of at least two carbohydrates, one lipid, two amino acids and protein and one nucleic acid. Minimum of 7 experiments should be recorded)

Semester V

IM1541: Core course VI
Course Title: Molecular Biology

No. of Credits: 3
No. of contact hours: 36
Hours/week: 2

Objectives: To generate understanding about the molecular details of the biological system and to describe the events including the central dogma of molecular biology

Course Outcome: The student will be able to
• Explain about the genome organization.
• Detail on gene expression and regulation of gene expression in prokaryotes.
• Describe the various mutations and repair pathways in prokaryotes.

Course Outline

Module I  (6 hrs)
Introduction to Molecular Biology

Module II  (8 hrs)
Replication

Module III  (8 hrs)
Transcription
Different forms of RNA- mRNA, tRNA, rRNA. Prokaryotic transcription- initiation, elongation and termination. Prokaryotic RNA polymerase- promoters and enhancers. Post transcriptional modification in eukaryotes.
Module IV
Genetic code and translation

Module V
Regulation of gene expression in prokaryotes

References:


Semester V

IM1542: Core course VII
Course Title: Food Science

No. of Credits: 3
No. of contact hours: 36
Hours/week: 2

Objectives: This course aims at offering an idea of nutrition, food composition, food preservation, adulteration, food safety and management.

Course outcome: The student will be able to

- Explain about the basic aspects of human nutrition and chemical composition of food consumed by human.
• List out the techniques of preservation of food and the common methods of adulteration.
• Enumerate food safety and management processes.

Course Outline

Module I
Nutrition (8 hrs)
Calorific value of food, determination of calorific value – Bomb calorimeter, Basal metabolic rate, factors affecting BMR, Specific Dynamic Action of food (SDA).

Module II
Foods (7 hrs)
Outline of chemical composition of: cereals, pulses, tubers, milk, egg, fish, meat, fruits, alcoholic beverages, soft drinks, coffee, tea, coconut, molasses, jaggery, honey, spices, edible oils and fats. Brief mention about the different antinutritional factors in food—phytic acid, lectins, tannins, saponins, amylase inhibitors and protease inhibitors. Food borne diseases: Lathyrisom, Favism, Ergotism and Epidemic dropsy. Analysis of moisture content—evaporation method, distillation method (Dean and Stark method), chemical reaction method (Karl-Fischer titration and gas production method), physical method (basics of Hydrometry and Refractometry) and spectroscopic method (basics principal of microwave and IR). Determination of total solid ash, total carbohydrates, crude fibre, crude protein and fat.

Module III
Food preservation and adulteration (7 hrs)
Preservation of foods: Low temperature (chilling and freezing), high temperature (boiling, pasteurization, autoclaving, canning-steps involved in canning), dehydration, high osmotic pressure, chemical preservatives, cold sterilization and anaerobic conditions. Food additives: Permitted colors, permitted food preservatives, emulsifying agents, flavoring agents, artificial sweeteners (saccharine). Food adulteration: FSSA definition of an adulterant. Common adulterants in milk, coffee powder, mustard seeds, curry powders, butter, honey, rice, wheat, black pepper and vegetable oils. Health hazards due to adulteration. Elementary study on qualitative detection of adulteration in milk, edible oils and detection of saccharine.

Module IV
Fortified Foods and neutraceuticals (7 hrs)
Types of food fortification (Biofortification, microbial biofortification, industrial/commercial, home fortification). Common vehicles for food fortification (common salt, whole wheat flour, rice, vegetable oils, milk and dairy products). Criteria, advantages and disadvantages of food fortification. Basic concepts of neutraceuticals—sources of neutraceuticals (probiotics, dietary fibers, antioxidants, phytochemicals, curcuminoids, flax seed, spirulina, soy protein, garlic, lycopene and fenugreek).
Module V

Food safety and quality management

References:


Semester V

IM1551: Open Course (Core)
Course Title: Clinical Approach to Life

No. of Credits: 2
No. of Contact Hours: 54
Hours/week: 3

Note: Open courses are offered to students of various other disciplines like arts, humanities and languages. Hence the approach to open course should be made only at a peripheral level. In depth approach is not expected in this course.

Objectives: 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.

Course outcome: The student will be able to

- Give the normal values of biochemical parameters of clinical significance.
- Explain the significance of the parameters in diagnosis of diseases.
- Interpret the results and relate it with various disorders.

Course Outline

Module I

Blood
Components of blood and their function- difference between plasma and serum. Blood groups, Rh factor, hemolytic disease of the newborn, basic idea about blood transfusion.

Module II

Routine Blood Analysis
Clinical significance and normal values of glucose- (fasting blood sugar, random blood sugar, postprandial blood sugar, Hb1Ac, total protein, albumin, urea, bilirubin, cholesterol- HDL and LDL (determination methods of these parameters not needed).
Module III
Hematology
(9hrs)
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
Urine analysis
(9hrs)
Routine examination of urine- names 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
Organ function tests
(18hrs)
Liver function tests- functions of liver. Serum bilirubin, jaundice- enzymes used for diagnosis of liver diseases- AST/ALT.
Renal function test- 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 hyperthyroidism.

References:

- Medical Laboratory Technology Volume I, Kanai.L.Mukharjee,
- Medical Laboratory Technology- Ramnik Sood.

Suggested Readings:

- Fundamentals of Biochemistry for Medical students Dr. Mrs. Ambika Shanmugam, Published by12, III-Cross street, West C.I.T.Nagar, Madras; IIIEdition,1977)
- Bauer J.D. Clinical LaboratoryMethods, C.V.Mosby,St.Louis1982.
Semester V

IM1552: Open Course (Core)
Course Title: Lifestyle Diseases

No. of Credits: 2
No. of Contact Hours: 54
Hours/week: 3

Note: Open courses are offered to students of various other disciplines like arts, humanities and languages. Hence the approach to open course should be made only at a peripheral level. In depth approach is not expected in this course.

Objectives: To create awareness among students about the various life style diseases and methods of prevention and management.

Course outcome: The student will be able to
• List out the common diseases caused by improper lifestyle.
• Describe the methods of diagnosis of the diseases.
• Explain the ways of treatment and management of these diseases.

Course Outline

Module I (8 hrs)
Concept of lifestyle diseases
Definition of lifestyle diseases/non communicable diseases - four major types of diseases-CVD, Diabetes, Cancer and Respiratory diseases. Other types of lifestyle diseases/non communicable diseases- Obesity. Sedentary life style. Importance of life style factors in preventing disease development diet, exercise, smoking, alcohol etc.

Module II (10 hrs)
Cardiovascular diseases
Definition of the terms- Coronary heart disease, angina, myocardial infarction, congestive heart failure, ischemic diseases, stroke. Cardiovascular diseases/atherosclerosis –symptoms, causes, diagnosis and management. Arterial plaque, hypertension (elementary knowledge). Normal value of cholesterol, life style changes to reduce cholesterol and risk of heart attack, drugs to lower cholesterol level (names only).

Module III (9 hrs)
Diabetes
Four types of diabetes: Type 1, Type 2, Gestational, and Pre-Diabetes. Modifiable and non-modifiable risk factors. Definition of fasting blood sugar, post prandial blood sugar, random blood sugar and their normal values. Significance of glucose tolerance test, characteristics, symptoms and causes. Diagnosis of Type 1 and Type 2 diabetes, importance of lifestyle factors in preventing its development and management. Drugs lowering blood glucose level (names only).

Module IV (10 hrs)
Cancer

Module V  
Chronic respiratory disease  

Module VI  
Importance of diet and exercise in health  
Definition- Balanced diet, Basal Metabolic Rate and Calorific value. Obesity (definition), symptoms and signs associated with obesity-Body mass index, determination and significance of obesity. Risk factors, prevention and management.  
Role of fibre containing food- PUFA- impact of junk foods.  
Role of exercise for control and prevention of life style diseases. Importance of regular walking in managing lifestyle disorders. Use of lifestyle medicine to treat disorders.

References:  

Semester V  
IM1543: Core course VIII (Practicals) P5  
Course Title: Serum and Food analysis  

No. of Credits: 3  
No. of contact hours: 108  
Hours/week: 6

Course Outline

1. Estimations in Serum  
   • Estimation of blood glucose by Nelson–Somogyi Method  
   • Estimation of serum Cholesterol by Zak’s Method  
   • Estimation of blood Urea by Diacetylmonoxime Method  
   • Estimation of total Protein in serum by Biuret Method  
   • Estimation of total protein in serum by Folin-Lowry method

2. Clinical Enzymology (only demonstration)  
   • Assay of Serum alanineamino transferases (ALT/SGPT)  
   • Assay of serum aspartate amino transferases (AST/SGOT)

3. Food Analysis  
   • Isolation of protein from milk.
• Estimation of cholesterol in egg.
• Estimation of reducing sugar in honey.
• Estimation of Sucrose in jaggery.
• Estimation of starch from potato

References:

• Practical Clinical Chemistry, Harold Varley, CBS Publishers and Distributors, New Delhi.

Semester VI

IM1641: Core course IX
Course Title: Clinical Biochemistry

No. of Credits: 3
No. of contact hours: 54
Hours/week: 3

Objectives: This course aims at providing an understanding of clinical significance of biochemical parameters and to introduce the students to basics of pharmacology.

Course outcome: The student will be able to

• Clinically assess the laboratory indicators of physiological conditions and diseases.
• Describe the basic concepts of pharmacology and mechanism of action of drugs.

Course Outline

Module I

Specimen collection and preservation methods

Module II

Blood & Urine analysis

Analysis of blood: Principles of estimation, normal values and clinical significance of Hb and uric acid, lipid profile: total cholesterol, triglycerides, LDL, HDL, serum electrolytes: Na⁺, K⁺ and Cl⁻, cardiac markers: creatine kinase- MB, acid phosphatase glucose levels : random, fasting and post prandial, GTT- Significance, preparation of patient, interpretation of results with special reference to normal, impaired glucose tolerance

Urine analysis: Urine physical characteristics: colour, volume, pH, specific gravity names of normal constituents. Abnormal constituents: ketone bodies, protein, glucose, blood, bile pigments (procedures of qualitative analysis and their clinical significance).
Module III

Hematology
Principle of determination and 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

Organ function test
Liver function tests: Principle of estimation, normal value and clinical significance of serum Bilirubin -Total and conjugated (test for excretory function), AST, ALT, alkaline phosphatase (marker enzymes of liver injury), Total protein, albumin, globulin, albumin/globulin ratio (test for synthetic function).
Thyroid function test-Assay of T3, T4, TSH normal value and clinical significance (hypo- and hyperthyroidism- primary and secondary).
Renal function tests- Principle of estimation of urea and clearance tests (urea & creatinine) normal value and clinical significance.

Module V

Life style disorders

Module VI

Pharmacology
Introduction to pharmacology, drugs, dosage forms (definitions only), sources of drugs, routes of administration, absorption, distribution. Mechanism of action: mention the target site, types of receptors and their mode of action. General mode of action of Antibiotics- penicillin, streptomycin, tetracycline, chloramphenicol (outline only).

References:

- Tietz Text book of Clinical chemistry and Molecular Diagnostics. Carl A. Burtis, Edward
- Clinical Biochemistry: Metabolic And Clinical Aspects by William J. Marshall, Stephen
- Clinical Chemistry, 6/e Ie by William J Marshall, Stephen K Bangert (2008) Publisher:
Semester VI

IM1642: Core course X
Course Title: Metabolism

No. of Credits: 4  No. of contact hours: 54
Hours/week: 3

Objectives: 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.

Course outcomes: Student will be able to

- Write the reactions involved in metabolism of carbohydrates, lipids, amino acids & nucleic acids.
- List out the inborn errors of metabolism and the defective enzymes associated with it.
- Describe the regulatory mechanisms and bioenergetics of the metabolic pathways.
- Explain the process involved in photosynthesis.

Course Outline

Module I (10 hrs)
Carbohydrate metabolism
Reactions and energetics of glycolysis (aerobic and anaerobic), Oxidative decarboxylation- TCA cycle, Anaplerotic reaction, Gluconeogenesis, HMP shunt. Metabolism of fructose and galactose. Galactosemia, Fructosuria, Essential pentosuria. 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, McArdle, Tarui’s).

Module II (9 hrs)
Lipid Metabolism
Fatty acid biosynthesis- saturated. Biosynthesis of triacylglycerol, phospholipid and cholesterol. Fatty acid oxidation- beta oxidation, alpha and omega oxidation. Ketone bodies: formation, utilization and excretion.

Module III (8 hrs)
Aminoacid metabolism
Module IV  (8 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, Gout, Lesch Nyhan syndrome.

Module V  (10 hrs)
Bioenergetics
Laws of thermodynamics-Role of high energy phosphates in energy transfer, concept of free energy. Biological oxidation, redox potential, coupled reactions. Enzymes involved in oxidation and reduction-oxidases, dehydrogenases, hydroperoxides, oxygenases.

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.


Module VI  (9 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- Calvin cycle, Hatch-Slack pathway
Secondary metabolites- Flavanoids, alkaloids, terpenoids, functions and applications.

References:


Semester VI

IM1643: Core course XI
Advanced Biochemistry

No. of Credits: 3
Hours/week: 3
No. of contact hours: 54

Objectives: This course will give a professional approach to the field of new techniques in life science. After the delivery of the course, student will have an idea of the concepts and applications of gene cloning, analysis of genes and genome by DNA sequence analysis, critical description of Nano science and Nano biotechnology and basic idea about Omics.
Course outcomes: Student will be able to
• Write the principle of rDNA technology, PCR, cloning, RFLP, RAPD, AFLP and STR.
• List out techniques for characterization of nanomaterials and its functionalization.
• Explain nanotechnology and its applications in medicine and developing nano-biosensors.
• Describe applications of virtual techniques in life science.

Course Outline

Module I
Principles of Gene Cloning
Introduction, history, the advent and importance of gene cloning PCR, real time PCR. Outline study of recombinant DNA technology. DNA manipulating enzymes, palindromes. Cloning vectors in prokaryotes and eukaryotes (pBR 322, pUC18, M13, Cosmids, Phagemids, yeast vectors, animal viral vectors, plant viral vectors, Ti plasmids). Construction of genomic library and c-DNA library.

Module II
DNA technology
Isolation and purification of total cell DNA. DNA sequencing methods (Maxam Gilbert sequencing, Sanger’s method). Principle and applications of In situ hybridization, DNA fingerprinting, DNA footprinting, RFLP, RAPD, AFLP, and STR analysis-. Outline study of Site- directed mutagenesis, DNA–protein interaction Assays.

Module III
Elements of Nanoscience

Module IV
Nanobiotechnology
Nanobiomaterials, Structural & functional principles of bionanotechnology: Size, zeta potential, bioavailability and excretion. Protein and DNA based nanostructures (Definition and examples only), nano bio-analytics, nanotechnology in food, medicine and health science application.

Module V
Oomics
Basic concepts and tools of proteomics, quantitative and targeted proteomics, proteogenomics, metabolomics, metabolomic data analysis, genomics, next generation sequencing (NGS) technology, gene expression and gene regulation networks, basic idea of molecular diagnostics.

References:
• Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.

Semester VI

IM1643: Core course XII (Practicals) P6
Course Title: Urine Analysis and Hematology

No. of Credits: 3
Hours/week: 5

No. of contact hours: 90

Course outline

I. Urine analysis and Hematology

Qualitative tests of urine: Abnormal constituents

• Proteins (Coagulation test, sulfo salicylic acid test,)
• Sugars (Benedicts test)
• Hemoglobin (Benzidine test)
• Ketonebodies (Rothera’s test, Gerhardt’s test)
• Bile pigments (Fouchet’s test, Gmelin’s test)
• Bile salts (Hay’test)

II. 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:


IM1645: Project

No. of Credits: 4
No. of Contact hours: 36
Hours/week: 2
1hr/wk for core and 1hr/wk for vocational

Total number of students will be divided into two batches with equal number. One of the batches will carry out the project work in core subject and the other batch in the vocational subject. Supervising faculty for the each batch will 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. (Project work will be carried out in fifth semester and report will be evaluated in 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

Total weightage: 30
Project: 20
Industrial Visit: 10 (6 for visit and 4 for visit report)
SECTION- A
Answer all questions. Answer in a word to a maximum of two sentences.
Each question carries one mark

1. Define carbohydrates.
2. Explain inversion of sugars.
3. Give the structure of tyrosine.
4. Name the mucopoly saccharide which has anticoagulant activity.
5. Give the significance of iodine value.
6. Name the most abundant class of RNA in a cell.
7. Forces that contribute to the stability of protein structure.
8. Name aminoacids having sulphur in it.
9. Name the oxidation product of galactose.
10. Explain protein denaturation.

(10x1=10 Marks)

SECTION- B
Answer any 8 questions. Answer not to exceed 1 paragraph. Each question carries two marks:

11. Explain formol titration.
12. Explain understand by chirality.
13. Give the deamination product of alanine.
14. Describe an alpha and beta glycosidic linkage.
15. Give the features of a peptide bond.
16. Define mean, median and mode.
17. Give the structures of the nucleotide in RNA.
18. Give the structures of basic aminoacids.
19. Differentiate between starch and glycogen.
20. Enumerate the contributions of Arthur Kornberg.
22. Brief on isoelectric precipitation.

(8x2=16marks)

SECTION-C
Answer any 6 questions. Each question carries 4 marks

23. Write a short note on salting in and salting out precipitation.
24. Differentiate essential and non- essential aminoacids.
25. Enumerate the differences between DNA and RNA.
26. Describe the significance of chymotrypsin in sequencing aminoacids.
27. Short note on hydrolysis of protein.
28. Describe with structural features of cellulose, why it cannot be digested in human gut.
29. Describe the structure and colour reactions of cholesterol.
30. Describe the structure of tRNA.
31. Write briefly on isomerism in sugars.

(6x4=24marks)

SECTION-D
Answer any 2 questions. Each question carries 15 marks

32. Describe classification of lipids.
33. Write in detail the various colour reactions of amino acids.
34. Describe the classical experiment and contributions of any two scientists in Biochemistry.
35. Describe in details, the structure and functions of glycosaminoglycans.

(2x15=30marks)

MODEL QUESTION PAPER FOR SECOND SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM1241 ENVIRONMENTAL STUDIES

Time: 3 Hours
Max marks: 80

SECTION- A
Answer all questions. Answer in a word to a maximum of two sentences.
Each question carries one mark

1. Explain Timber extraction.
2. Comment on genetic diversity.
3. Name any 2 endangered species in India.
4. Explain sustainable development.
5. Discuss on value education.
6. Mention any 2 environmental pollutant
7. Comment on wildlife protection act.
8. Name any 2 Hot spot diversity in India
10. Define renewable resources.

(10x1=10 Marks)

SECTION- B
Answer any 8 questions. Answer not to exceed 1 paragraph. Each question carries two marks

11. Explain deforestation and its impact on animals and plants?
12. Comment on soil erosion?
13. Explain producers?
14. Describe what are ecological pyramids
15. Enumerate the causes of thermal pollution
16. Comment on consumerism?
17. Explain *insitu* conservation of biodiversity?
18. Distinguish between ethical and aesthetic value of diversity
19. Write a short note on water logging
20. Explain causes of man induced land slides
21. Define poaching
22. Discuss about changes caused due to overgrazing? (8x2=16marks)

**SECTION-C**
Answer any 6 questions. Each question carries four marks

23. Write a short note on use and over exploitation of forest resources
24. Short note on role of individual in conservation of natural resources
25. Enumerate the differences between forest and aquatic ecosystem
26. Describe the use of alternative energy resources
27. Write a note on noise pollution
28. Describe waste land reclamation
29. Describe the public awareness on social issues and environment
30. Describe the resettlement and rehabilitation of people
31. Write briefly urban problem related to energy (6x4=24marks)

**SECTION-D**
Answer any 2 questions. Each question carries fifteen marks:

32. Describe the energy flow in ecosystem? Explain the characteristics, structure and function of different types of ecosystem
33. Write in detail on causes, effects and control measures of air and water pollution and nuclear hazards
34. Describe the disaster management of flood, earthquake cyclone and landslides
35. Describe in details on population explosion and family welfare programme. (2x15=30marks)

**MODEL QUESTION PAPER FOR THIRD SEMESTER EXAM**
**2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY**
**IM 1341 ANALYTICAL BIOCHEMISTRY AND BIOPHYSICAL CHEMISTRY**

Time: 3Hours Max marks: 80

**SECTION-A**
Answer all questions. Each question carries one mark

1. Write about SDS PAGE
2. Name any two anion exchanger
3. Write about TLC.
4. Explain Beer Lamberts law.
5. Write about Buffers.
6. Write about BLAST.
7. Write about SPSS.
8. Comment on centrifugal force.
9. Explain PUBMED.
10. Explain normality.

(1x10=10 marks)

SECTION-B
Answer any 8 questions. Each question carries two marks

11. Write about differential centrifugation.
12. Write down the principle of DNA separation by agarose gel electrophoresis.
13. Write down two cell disruption techniques.
14. List out the applications of ion exchange chromatography.
15. Define data mining.
16. Explain hypothesis.
17. Define knowledge.
18. Discuss about science.
20. Comment on pH.
21. Short note on Bronsted acid and bases.
22. Write a short note on TCA cycle.

(8x2=16 marks)

SECTION-C
Answer any 6 questions. Each question carries four marks

23. Explain dissociation of water.
24. Explain Henderson Hasselbalch equation.
25. Describe Biological significance of osmosis.
26. Write a short note on distinction between lyophilic and lyophobic.
27. Explain emulsions and emulsifying agents.
28. Explain the hypothetico-deductive model and inductive model.
29. Briefly explain plagiarism and publication.
30. Short note on affinity and gel chromatography.
31. Enumerate the different ways to present data.

(6x4=24 marks)

SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Give a detailed account on use of IT in teaching and learning
33. Describe the Significance of statistical methods in biological investigations? Differentiate students t test and chi square
34. Discuss donnan membrane equilibrium and is biological application
35. Explain what is centrifugation and discuss subcellular fractionation

(2x15=30 marks)
MODEL QUESTION PAPER FOR FOURTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM 1441 PHYSIOLOGICAL ASPECTS OF BIOCHEMISTRY AND ENZYMEOLOGY

Time: 3 Hours
Max. Marks: 80

SECTION- A
Answer all questions. Each question carries one mark

1. Define Calorific value.
2. Comment on neurotransmitters.
3. Explain erythropoiesis.
4. State Bohr effect.
5. List out the functions of adrenalin.
6. Mention any two functions of oxytocin.
7. How is apoenzyme different from enzyme.
8. Give two functions of vitamin K.
9. Give two examples for protein deficiency diseases.
10. List out constituents of blood.

(10x1=10 marks)

SECTION- B
Answer any 8 questions. Each question carries two marks

11. Draw the structure of nephron.
13. Explain oxygen dissociation curve.
15. Write a note on the composition of bile.
17. Explain the coenzyme form of vitamins.
18. Define regurgitation and give its significance.
20. Name two female sex hormones.
21. Mention the enzymes involved in carbohydrate digestion.
22. Significance of Km and Vmax.

(8x2=16 marks)

SECTION- C
Answer any 6 questions. Each question carries four marks

23. Write the physiological functions of thyroxine in the body.
24. Explain the ionic balance in the RBC during respiration.
25. Bring out the role of bile salts in lipid digestion and absorption.
26. Give an account on enzyme inhibition.
27. Explain the sliding filament theory.
28. Describe the process of hemopoiesis.
29. Write a short note on minerelocorticoids.
30. Detail the various processes involved in the contraction of muscles.
31. Give brief note on reflex action

(6x4=24marks)

SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Explain the mechanism of urine formation with structure of nephron.
33. Derive MM equation and give a note on LB plot.
34. Detail on the transport of gases in blood.
35. Discuss the lipid digestion and absorption process with schematic representation.

(2x15=30marks)

MODEL QUESTION PAPER FOR FIFTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM1541 MOLECULAR BIOLOGY

Time: 3Hours Max marks: 80

SECTION-A
Answer all questions. Each question carries one mark

1. Define C-value paradox
2. Outline the concept of split genes?
3. List out the enzymes required for DNA replication.
4. Mention the function of helicases?
5. How DNA alkylating agents can induce mutations?
6. Give the role of promoter sequences in transcription.
7. Why genetic code is said to be degenerate?
8. Distinguish between point mutation and frameshift mutation.
9. Mention the role of CAP in the regulation of lac operon.
10. Define attenuation.

(1x10=10 marks)

SECTION-B
Answer any 8 questions. Each question carries two marks

11. Describe rolling circle replication?
12. Discuss the central dogma of molecular biology.
15. Comment on reverse transcriptase.
16. Write a note on activation of amino acids for protein synthesis.
17. Distinguish between constitutive and inducible enzymes.
18. How is transcription regulated in prokaryotes?
19. How chaperones assist in protein folding?
20. Give the significance of attenuator structure in trp operon.
21. Comment on wobble hypothesis.
22. Give the role of different types of rRNAs in translation.

(8x2=16 marks)

SECTION-C
Answer any 6 questions. Each question carries four marks

23. Write in detail on different types of mutation.
24. Why DNA replication is said to be semi-discontinuous?
25. Explain catabolite repression in lac operon.
26. Describe what are chemical mutagens? Give an account of their mode of action.
27. Write a note on the post transcriptional modifications in eukaryotes.
29. Explain the elongation cycle in translation.
30. Briefly describe Jacob and Monod operon concept.
31. Explain the different modes in which biosynthesis of tryptophan is regulated.

(6x4=24 marks)

SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Give a detailed account on structure and functions of mRNA, tRNA and rRNA.
33. Describe the process of DNA replication with suitable diagrams
34. Discuss the process of prokaryotic translation and its regulation with suitable diagrams
35. Write in detail about Classical experiments proving DNA as the genetic material.

(2x15=30 marks)

MODEL QUESTION PAPER FOR FIFTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM1542 FOOD SCIENCE

Time: 3Hours                                      Max marks: 80

SECTION-A
Answer all questions. Each question carries one mark

1. Define Calorific value of food
2. Discuss on AGMARK
3. Comment on BMR
4. Mention any two permitted colors in food
5. Explain neutraceuticals
6. Expand PER
7. Define food toxicity
8. Discuss on emulsifying agents
9. Explain Food adulteration
10. Comment on SDA

SECTION-B
Answer any 8 questions. Each question carries two marks

11. Describe the term obesity.
12. Differentiate between positive and negative nitrogen balance.
13. Explain crude proteins.
15. Comment on evaporation method.
16. Explain Ergotism.
17. Differentiate between pasteurization and autoclaving.
18. Name any two artificial sweeteners.
19. Comment on Common adulterants in milk.
20. Discuss on the health hazards due to adulteration.
22. Write short note on Fat soluble vitamins.

(8x2=16 marks)

SECTION-C
Answer any 6 questions. Each question carries four marks

23. Write in detail on flavoring agents.
24. Explain food borne diseases.
25. Explain the sources of neutraceuticals.
26. Describe some qualitative detection of food adulterants.
27. Write a short note on analysis of moisture content by spectroscopic method.
28. Explain how the functions of minerals.
29. Briefly describe bomb calorimeter.
30. Short note on anti-nutritional factors in food.

(6x4=24 marks)
SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Give a detailed account on vitamins and its function and deficiency diseases.
33. Describe the Food standards.
34. Discuss the Food safety management systems.
35. Write in detail about chemical composition of cereals and pulses, edible oils and fats and alcoholic beverages and soft drinks.

(2x15=30 marks)

MODEL QUESTION PAPER FOR FIFTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY OPEN COURSE
IM1552 LIFE STYLE DISEASES

Time: 3Hours
Max marks: 80

SECTION- A
Answer all questions. Answer in a word to a maximum of two sentences.
Each question carries one mark

1. Mention any two drugs that lower cholesterol in the blood.
2. Write the significance of BMI.
3. List out the diseases associated with CVD.
4. Name the chemical present in cigarette.
5. Comment on risk factors of cancer.
7. Give the normal value of cholesterol in blood.
8. Write the normal fasting blood sugar.
9. Differentiate random blood sugar and fasting blood sugar.
10. Define life style disease.

(10x1=10 Marks)

SECTION- B
Answer any 8 questions. Answer not to exceed 1 paragraph. Each question carries two marks

11. Explain obesity
12. Write note on characteristics of cancer cell.
15. List out different types of non communicable diseases.
17. Give the details of arterial plaque.
18. Give a note on junk food.
20. Name any two heart-healthy foods.
22. Detailed note on antioxidants in preventing life style diseases (8x2=16marks)

SECTION-C
Answer any 6 questions. Each question carries four marks

23. Write a short note on metastasis
24. Explain the role of insulin and glucagon in maintaining blood glucose levels.
25. Give an account of the diet to be followed by a person with hyperlipedemia
26. Describe the causes and symptoms of ischemic diseases
27. Short note on PUFA. Give any two examples
28. Give a note on importance of diet control in preventing the development of diabetes mellitus
29. Comment on the importance of dietary fibers in the management of lifestyle disorders
30. How BMI is determined? Explain the significance of BMI
31. Write briefly the risk factors of hypertension. (6x4=24marks)

SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Give an account of cancer with special emphasis to its management by changing life style.
33. Write in detail the causes, diagnosis and management of atherosclerosis
34. Discuss on the development, prevention and management of obesity
35. Describe the causes and major risk factors of non insulin dependent diabetes mellitus. Briefly explain the importance of lifestyle factors in preventing its development and management. (2x15=30marks)

MODEL QUESTION PAPER FOR SIXTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM 1641 CLINICAL BIOCHEMISTRY

Time: 3Hours Max marks: 80

SECTION-A
Answer all questions. Each question carries one mark

1. Define oncogenes.
2. Give the significance of creatine phosphokinase determination.
3. Name two anticoagulants with function.
4. Explain diabetes mellitus.
5. How liver function is assessed.
6. Give the functions of TSH.
7. How kidney function is monitored.
8. Give the clinical significance of ESR
10. Distinguish AST and ALT.  

SECTION-B  
Answer any 8 questions. Each question carries two marks

11. Write down the difference between bleeding time and clotting time.  
12. Name the enzymes which are elevated after acute MI.  
13. Explain random and post prandial blood sugar level.  
14. How will you determine the uric acid in serum.  
15. What is the significance of ESR determination.  
17. Comment on the etiological factors behind life style disorders.  
18. Differentiate between plasma and serum.  
19. How hypo and hyperthyroidism determined.  
20. Give the reason for polyuria in diabetes.  
22. Define Icteric Index and state its significance.

(1x10=10 marks)

SECTION-C  
Answer any 6 questions. Each question carries four marks

23. Write a note on plasma proteins.  
24. Describe the components and functions of blood.  
25. Elaborate the pathological states of liver and liver function test.  
26. Give an account of routine hematological tests.  
27. Write a short note on clinical significance of urea and its normal values.  
28. Write notes on i) SGPT ii) SGOT iii) LDH iv) CK (CPK).  
29. Write a short note on the analysis of Ketone bodies and Bile salts in urine?  
30. Write short note on the types of Jaundice.  
31. Short note on indications of glucose tolerance test.

(8x2=16 marks)

SECTION-D  
Answer any 2 questions. Each question carries fifteen marks

32. Give a detailed account on different treatment modalities of cancer.  
33. Enumerate the liver function test and describe any one of them with clinical significance.  
34. Explain GTT and its clinical relevance in detail.  
35. Discuss on the abnormal constituents of urine and the pathological conditions associated with them.

(2x15=30 marks)
SECTION-A
Answer all questions. Each question carries one mark

1. List the sources of acetyl CoA for fatty acid synthesis
2. Name the enzyme absent in Pompe’s disease
3. Identify the ring structure present in cholesterol
4. Write about Essential pentosuria
5. State the significance of carnitine in fatty acid oxidation
6. State the names of any two ketone bodies
7. Mention the role of glycogenin in glycogenesis
8. Name the disease caused by deficiency of sphingomyelinase
9. Define gluconeogenesis
10. Name the activated form of glycogen phosphorylase

(1x10=10 marks)

SECTION-B
Answer any 8 questions. Each question carries two marks

11. Write a brief outline on α-oxidation of fatty acid
12. State the term ketoacidosis
13. Write down two irreversible reactions of glycolysis
14. Distinguish between glucogenic and ketogenic amino acids
15. Mention briefly the clinical condition fructosuria
16. Comment on Refsum disease
17. Describe cori cycle
18. Define anaplerotic reactions
19. Give a brief idea about glycogen storage diseases
20. Comment on the inherited disorder Lesch Nyhan syndrome
21. Write the significance of HMPshunt
22. Distinguish between Pastuer’s effect & Bohr’s effect

(8x2=16 marks)

SECTION-C
Answer any 6 questions. Each question carries four marks

23. Write the difference between inhibitors and uncouplers
24. Explain galactose metabolism
25. Explain the synthesis of purines
26. Describe TCA cycle and its regulation
27. Write a short note on biosynthesis of triglycerides
28. Compare & contrast Chloroplasts and Mitochondria
29. Explain the synthesis of cholesterol
30. Briefly describe action of lipases and phospholipases
31. Write notes on Alkaptonuria and phenylketonuria

SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Give a detailed account on secondary metabolites
33. Describe the reactions of glycolysis, energy stoichiometry and regulation
34. Discuss the beta oxidation of fatty acid and their regulations
35. Explain the Electron Transport Chain

(2x15=30 marks)

MODEL QUESTION PAPER FOR SIXTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM1643 ADVANCED BIOCHEMISTRY

Time: 3Hours
Max marks: 80

SECTION-A
Answer all questions. Each question carries one mark

1. Define cosmid.
2. C-DNA library.
3. Give the role of reverse transcriptase enzyme in molecular biology.
4. Define the term nanotechnology.
5. Define metabolomics
6. Mention any two 2-D nanostructure materials.
7. Elaborate RFLP.
8. Mention any two vectors for cloning.
9. State a function of quantum dots
10. What is qPCR?

(1x10=10 marks)

SECTION-B
Answer any 8 questions. Each question carries two marks

11. Comment on bacteriophages and their application in recombinant DNA technology.
12. Mention any one application of PCR in biotechnology.
13. Give the application of restriction endonucleases.
14. Give the role of plasmids in rDNA technology.
15. How is DNA libraries formed?
16. Describe snRNAs.
17. Mention the biological sources and application of taq polymerase.
18. How does crossing linking allow genetic recombination?
19. Give the significance of palindromes.
20. Mention any three methods for characterization of nanostructures.
21. Short note on principles of bio nanotechnology.
22. What is nano bio-analytics?

(8x2=16 marks)

SECTION-C
Answer any 6 questions. Each question carries four marks

23. Differentiate between one dimensional and three dimensional nano structured materials.
25. Explain DNA-protein interaction assays.
26. Describe the purification of DNA from living cells.
27. Write a short note on biocompatibility of nanomaterials.
28. Describe next generation sequencing
29. Applications of nanotechnology in medicine.
30. Briefly describe DNA foot printing.
31. Short note on construction of genomic library.

(6x4=24 marks)

SECTION-D
Answer any 2 questions. Each question carries fifteen marks

32. Give a detailed account on DNA sequencing.
33. Describe the applications and techniques of Gene Cloning.
34. Discuss different classes of nanomaterials and its biological applications.
35. Explain omics and its applications

(2x15=30 marks)
Scheme and syllabus of Industrial Microbiology for
Career related First Degree programme in
“BIOCHEMISTRY AND INDUSTRIAL MICROBIOLOGY”
Under CBCS
<table>
<thead>
<tr>
<th>Semester</th>
<th>Course code</th>
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<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>
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<tr>
<td>II</td>
<td>IM1222</td>
<td>FOUNDATION COURSE II- Microbial Taxonomy and Physiology</td>
<td>3 Hours</td>
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<td></td>
<td>IM 1271</td>
<td>Vocational course- II Microbiology Practicals</td>
<td>6 Hours X 2 days</td>
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<tr>
<td>III</td>
<td>IM1371</td>
<td>Vocational course- III Cell Biology</td>
<td>3 Hours</td>
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<td>IM1372</td>
<td>Vocational course- IV Microbial Genetics &amp; Biotechnology</td>
<td>3 Hours</td>
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<tr>
<td>IV</td>
<td>IM 1471</td>
<td>Vocational course- V Environmental Microbiology</td>
<td>3 Hours</td>
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<td>IM 1472</td>
<td>Vocational course- VI Food Microbiology</td>
<td>3 Hours</td>
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<td>6 Hours X 2 days</td>
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<td>IM 1571</td>
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<td>Elective course- Immunology- Elective</td>
<td>3 Hours</td>
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<td>IM 1672</td>
<td>Vocational course-XI Microbiology Practical</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 (9Hrs)


MODULE II (9 Hrs)

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 (9 Hrs)

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 (9 Hrs)


MODULE V (9Hrs)

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 (9Hrs)


REFERENCES
3. Microbiology-Bemard 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 (10 Hrs)
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 (10 Hrs)
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 (12 Hrs)
Bacterial Photosynthesis -: oxygenic and anoxygenic types, Nitrogen fixation: Symbiotic and non- symbiotic types.

MODULE V (10 Hrs)

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) TS1
   (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


Cell-cell interactions, cell-matrix interactions, cell-cell adhesion, cell-cell signaling, Role of bacterial cell-cell signaling in virulence and pathogenesis.


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

(9 Hrs)

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: o- Theta mode and o-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

Gene transfer mechanisms- Transformation, conjugation and transduction- generalized and specialized transduction. Ames test & its significance

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

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

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

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


MODULE III

Bioremediation: Degradation of pesticides, detergents, degradation of lignin, xenobiotic compounds, petroleum and hydrocarbon compounds. Microbes in mining. Bacterial leaching.

MODULE IV


MODULE V

MODULE VI

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 (10 Hrs)

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

General principles underlying spoilage, Spoilage of different kinds of foods, cereals and cereal products - sugar and sugar products - vegetables and fruits - meat and meat products - fish and other sea foods - eggs and poultry - dairy and fermentative products (ice cream/milk/bread/wine).

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

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 diseases
   (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  (12 Hrs)

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

MODULE II  (12 Hrs)

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  (12 Hrs)

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

MODULE IV  (12 Hrs)

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  (12 Hrs)

Microbes in food industry-bacteria (lactics, acetics, proteolytic and lipolytic bacteria, Thermophilic anc 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  (12 Hrs)

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)
3. Prescott & Dunn’s Industrial Microbiology Reed G (Ed) ISBN 81-239-1001-0) (Fourth Edition’
5. Fermented foods Economic Microbiology Vol 7 rose A (ed)
6. Manual Of Industrial Microbiology And Biotechnology, Demin & Davis
7. Applied Microbiology - Musharraffuddede

SEMESTER V

CODE: IM1572

VOCATIONAL COURSE IX Microbiology Practical

Total Hrs 108 CREDITS-4 (6Hrs/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.
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 cholera, Corynebacterium diptheriae, Clostridium tetani, Mycobacterium tuberculosis, Treponema pallidum, Mycoplasma pneumoniae & Chlamydia trachomatis.

MODULE III  (9 Hrs)

MODULE IV  (9 Hrs)
Virology: Airborne 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)
REFERENCES
1. Ananthanarayan and Panicker's Textbook of Microbiology- ISBN 81 250 2808 0
2. Notes on Medical Bacteriology - J.Douglas Sleigh Morag 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 II (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 & Ig E)

MODULE III

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, R1A, 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 Immuno technology 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