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

Semester	Course Title	L	P	C	T
Semester I	English-I	5	-	3	16
	Additional language-I	5	-	3	
	IM1121: Foundation course-I Bomolecules (Core)	**3**	**-**	**3**	
	Practicals for IM1121 (Core) - P1	**-**	**2**	**-**	
	IM1171-Vocational Course-I- Fundamentals of Microbiology	3	2	4	
	CH 1131.7: Complementary course-I	3	2	3	
Semester II	English-II	5	-	3	20
	Additional language-I	5	-	3	
	IM1241: Environmental Studies (Core course I)	**3**		**4**	
	IM1242: Practicals-Qualitative analysis of Biomolecules (Core course II) - P2		**2**	**2**	
	IM1221-Foundation Course-II-(Microbial Taxonomy and Physiology (Vocational)	3	-	2	
	IM1271-Vocational Course-II (practicals)	-	2	3	
	CH1231.7 Complementary course-II	3	2	3	
Semester III	English-III	5	-	3	16
	IM1341: Analytical Biochemistry and Biophysical Chemistry (Core course-III)	**3**	**-**	**4**	
	Practicals for IM1341 (Core) - P3	**-**	**3**	**-**	
	IM1371: Cell Biology (Vocational course-III)	4	-	3	
	IM1372- Microbial genetics and biotechnology (Vocational Course-IV)	3	2	3	
	CH1331.7 Complementary course-III	3	2	3	
Semester IV	English-IV	5	-	3	24
	IM1441: Physiological aspects of Biochemistry and Enzymology (Core course-IV)	**3**	**-**	**3**	
	IM1442: Practicals-Quantitative analysis of Biomolecules (Core course-V) -P4	**-**	**3**	**3**	
	IM1471- Environmental Microbiology (Vocational Course-V)	3	-	3	
	IM1472 – Food Microbiology (Vocational course-VI)	3	-	2	
	IM1473 – Practicals (Vocational course-VII)	-	3	3	
	CH1431.7 Complementary course-IV	3	-	3	
	CH1432.7 Complementary course-V	-	2	4	

Semester V	**IM1541: Molecular Biology (Core course-VI)**	**2**	**-**	**3**	18
	IM1542: Food Science (Core course-VII)	**2**	**-**	**3**	
	IM1543: Practicals- Serum and Food analysis (Core course-VIII) - P5	**-**	**6**	**3**	
	IM1571- Fermentation Technology (Vocational Course-VIII)	4	-	3	
	IM1572: Microbiology practicals (Vocational course-IX)	-	6	4	
	IM1551/1552: Clinical approach to life/Lifestyle diseases -Open course (Core) #	**3**	**-**	**2**	
	IM1645 Project (Core/Vocational)		**2***	**-**	
Semester VI	**IM1641: Clinical Biochemistry (Core course-IX)**	**3**	**-**	**3**	26
	IM1642: Metabolism (Core course-X)	**3**	**-**	**4**	
	IM1643: Advanced Biochemistry (Core course-XI)	**3**	**-**	**3**	
	IM1643: Practicals-Urine analysis & Hematology (Core course-XII) – P6	**-**	**5**	**3**	
	IM1671: Medical Microbiology (Vocational course-X)	3	-	3	
	IM1672: Microbiology practicals (Vocational course-XI)	-	6	4	
	IM1661: Immunology –Elective course (Vocational)	2	-	2	
	IM1645: Project (Core/Vocational)		**-**	**4**	

Total credits: 120

*__1hr- Core Biochemistry, 1hr- Vocational microbiology__

L-Lecture, P- Practical, C- Credit, TC-Total Credit

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.

Summary of courses and credits of various study components included in the programme

Study components	Number of courses	Total credits	Total
1. English	4	12	120
2. Additional Language	2	6	
Foundation courses	2	5	
Core courses	12	38	
Vocational courses	11	35	
Complementary courses	5	16	
Open courses	1	2	
Elective courses	1	2	
Project	1	4	

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

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 **(3 hrs)**

History of biochemistry

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 **(13 hrs)**

Carbohydrates

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 **(8 hrs)**

Lipids

Classification and functions of lipids. Fatty acids - classification, nomenclature and structure of saturated and unsaturated fatty acids, Essential fatty acids. Classification of lipids- simple lipids, compound lipids and derived lipids. Simple lipids: nomenclature, physical properties and chemical properties. Purity of fats and oils: saponification number, acid number, iodine number, ReichertMeissel number. Rancidity of fat, reactions of glycerol, biological significance of fats. Complex lipids: glycerophospholipids, shingophospholipids and glycolipids (structure, properties and function), lipoproteins. Derived lipids: cholesterol- structure, functions and two colour reactions.

Outline study of - bile acids, ergosterol, sitosterol, prostaglandins, thromboxanes and leukotriens, Isoprenoids- carotenoids.

Module IV **(8 hrs)**

Amino acids

Amino acids-Occurrence 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

Peptide- properties, polypeptide, N & C terminal of polypeptide, polypeptide conformation- Ramachandran plot (brief ouline). Structure of proteins- primary, secondary, tertiary and quaternary- forces stabilizing each level of structure.

Proteins: classification, physical properties, solubility, isoelectric point, protein denaturation, isoelectric precipitation, salt effect, heavy metal precipitation. Colour reactions of proteins. Determination of primary structure- N-terminal and C-terminal residues (one method each). Sequencing of amino acids in polypeptide, digestion by enzyme (chymotrypsin &trypsin), oligopeptide separation and overlapping of amino acid. Peptides: Peptide nomenclature, properties of the peptide bond, hydrolysis of proteins and separation of amino acids.

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

- A history of the Life Sciences: Magner LN 2nd edition, Marcel Dekker, Inc.
- Principles of Biochemistry, by Albert Lehninger, David L Nelson, Michael M Cox, CBS Publishers & Distributors Delhi ISBN81-239-0295-6.
- Lehninger Principles of Biochemistry, Fourth Edition by David L. Nelson Michael MCox Publisher: W. H. Freeman; Fourth Edition edition (April 23, 2004) ISBN-10:0716743396 ISBN-13: 978-0716743392
- Biochemistry- Sixth edition by Mary K. Campbell, Shawn O. Farrell. Thomson Brooks/Cole
- Principles Of Biochemistry (1995) by Geoffrey L Zubay, William W Parson, Dennis E Vance Publisher: Mcgraw-hill Book Company – Koga ISBN:0697142752 ISBN-13: 9780697142757, 978-0697142757
- Biochemistry (2008) by Rastogi Publisher: Mcgraw Hill ISBN:0070527954 ISBN-13:9780070527959, 978-0070527959
- Fundamentals of Biochemistry by J.L.Jain, Sanju Jain & Nitin Jain (2008) Publishers Chand and Co Ltd ISBN81-219-2453-7P 73,91,100,114

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

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposes. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.

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 **(8 hrs)**

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 **(8 hrs)**

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

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
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- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
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- Down to Earth, Centre for Science and Environment (R)
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- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
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- Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- 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 Stadards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
- Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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:

- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.
- Analytical Techniques in Biochemistry and Molecular Biology- By Rajan Katoch. Springer Publishers
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN81-7663-067-5.
- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Despande (ed). I.K International Pvt. LTD, New Delhi. ISBN 81-88237-41-8.

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 **(12 hrs)**

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 **(6 hrs)**

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 **(8 hrs)**

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 **(10 hrs)**

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 **(10 hrs)**

Biophysical chemistry

Physical aspects of biochemistry: Dissociation of water, ionic product of water, concepts of pH, pOH, determination of pH using indicators, pH meter and theoretical calculations. Dissociation of weak acids and electrolytes. Bronsted theory of acids and bases, titration curves, Ka and pKa values, Buffers: buffer action, buffers in biological system, Henderson-Hasselbach equation – derivation

Solutions: Normality, molarity, molality, percentage solutions, mole fractions (simple numerical problems relating to them). Fundamentals of diffusion, osmosis, osmotic pressure, types of solutions (isotonic, hypotonic and hypertonic). Biological significance of osmosis. Relationship of osmotic pressure to gas laws. General equations for dilute solutions, influence of ionization and molecular size on osmotic pressure

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

- Alexis and Mathews Leon, Fundamentals and Information and Technology. LeonVikasISBN0812590780.
- An Introduction to Biostatistics: A Manual for Students in Health Sciences by P. Sundar Rao, J. Richard publishers: Prentice-Hall Pvt. Ltd. ISBN 81-203-1008-X.
- Introduction to Biophysics by Pranab Kumar Banerjee (2008) Publishers: S. Chand & Company ltd ISBN:81-219-3016-2 p197.
- Bioinformatics: A Beginner's Guide. By Jean-Michel Claverie and Cedric Notredame; Wiley Publishing, Inc.2003.
- Bioinformatics: A Practical approach. K. Mani and N. Vijayaraj, Aparna Publication, 2004.
- Fundamentals of Biochemistry by J.L. Jain, Sanju Jain & Nitin Jain (2008) Publishers Chand and Co Ltd ISBN81- 219-2453-7 P132,204,214.
- Principles and techniques of biochemistry and molecular biology-Keith Wilson and JohnWalker.6thedition, Cambridge University Press.
- Analytical Techniques in Biochemistry and Molecular Biology-By Rajan Katoch. Springer Publishers.
- Instrumental Methods of analysis- Chatwal, Anand.
- Manuals of biochemistry-Satyanarayana.
- Principles and techniques of practical biochemistry- Bryan L.Williams and Keith Wilson.
- A biochemical guide to principles and techniques of practical biochemistry- Keith Wilson and Kenneth H.Gouldin.
- 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:

- Basic Techniques In Biochemistry And Molecular Biology By R. K. Sharma, S. P. S. Sangha-I.K. International Publishers Pvt. Ltd.
- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.
- Principles and techniques of biochemistry and molecular biology- Keith Wilson and John Walker. 6th edition, Cambridge University Press.

Semester IV

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

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

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 **(9 hrs)**

Digestion and absorption

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 **(9 hrs)**

Biochemistry of Blood

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, thalasemias. Hemopoiesis: blood forming organs, erythropoeisis, leukopoiesis. Blood group classification (ABO).

Module III **(9 hrs)**

Biochemistry of respiration and renal function

Transport of oxygen and carbon dioxide in blood, oxygen dissociation curve and Bohr effect, Hill plot, carbonic anhydrase, chloride shift. Structure of nephron, mechanism of formation of urine. Basic principles of acidosis and alkalosis- metabolic and respiratory. Role of lungs and kidney in acid-base balance.

Module IV **(9 hrs)**

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 **(9 hrs)**

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 insipidius, 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 **(9 hrs)**

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:

- Textbook of Medical Physiology,11/e WithStudent Consult Access (2005) by Arthur C Guyton, John E Hall Publisher**:** Else ISBN: 8181479203ISBN-13:9788181479204.
- Principles of Biochemistry, 6e (1959) byAbraham White, Philip Handler Publisher: Tata McGraw- hill Publishing Company Limited ISBN: 0070590494ISBN-13:9780070590496, 978-0070590496.
- Biochemistry by U. Satyanarayana, U. Chakrapani , third edition, ISBN 81-87134-80-1Enzymes-M.DixonandECWebb.LongmanPublication.

- Textbook of Medical Biochemistry for Medical Students by DM Vasudevan and Sreekumari S. 5th edition, Japee Brothers, Medical Publishers, ISBN 81-8448-124-1:9788184481242.
- Mammalian Biochemistry – White A, Handler P and Smith P.L (McGraw Hill)
- Review of Medical physiology – G. William, McGraw Hill Karan Books.
- 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 **No. of contact hours: 54**
Hours/week: 3

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:

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41-8.
- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (Ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.
- Hawks Physiological Chemistry, Bernard L.Oser (ed).TATA McGRAW Hill Publishing Company LTD, New Delhi.

- ES West, WR Todd, HS Mason and JT van Bruggen. A text Book of Biochemistry, Oxford and IBH Publishing Co., New Delhi, 1974.

(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

Identification of genetic material, chemical nature of gene, chromatin organization. Definition of gene, cistron, recon and muton. Concept of split genes-introns and exons. One gene-one enzyme hypothesis and one gene-one polypeptide hypothesis. Central dogma of molecular biology. C-value paradox. Classical experiments for the search of genetic material-transformation experiments by Griffith and Avery, Hershey and Chase's bacteriophage experiment.

Brief study about variations in chromosome structure and number-duplications, inversions, translocations, aneuploidy and polyploidy (details not expected).

Module II **(8 hrs)**

Replication

Replication- semi conservative replication, Messelson-Stahl experiment. DNA polymerase and other proteins required for replication, replication fork- continuous and discontinuous replication- Okazaki fragments. Mutation- point and frame shift mutations. Mutagens- physical and chemical and their mode of action. Fundamental study about DNA repair- photo reactivation, excision repair and mismatch repair mechanisms (detailed pathways not needed).

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 **(8 hrs)**

Genetic code and translation

Genetic code-deciphering the code (elementary study only). Major features of genetic code. Codon-anticodon interaction, wobble in pairing. Translation in prokaryotes-adaptor role of t-RNA, activation of amino acids and enzyme involved in activation. Initiation process-role of ribosomes and different r-RNAs, Shine-Dalgarno sequence. Elongation-roles of EF-Tu, EF-Ts and EF-G. Termination process and role of release factors. Inhibitors of protein synthesis. Eukaryotic protein synthesis (elementary study only). Major post translational modifications. Protein folding and chaperones.

Module V **(6 hrs)**

Regulation of gene expression in prokaryotes

Constitutive and inducible enzymes, concept of operon by Jacob and Monod-regulator gene, operator site, structural gene. Inducible operon- lac operon, role of lac repressor, regulation by CAP protein, catabolite repression. Repressible operon-tryptophan operon, control by repressor protein and attenuation. Protein-DNA interaction in transcriptional regulation-role of specific factors and regulatory proteins.

References:

- Cell and molecular biology- concepts and experiments by Gerald Karp, Wiley1807-2007, ISBN 978-0-470-16961-2
- Cell biology, Genetics, Molecular Biology, Evolution and Ecology by P.S.Verma and V. K. Agarwal (2008) Publisher: S. Chand & Company Ltd ISBN: 81-219-2442-.
- Molecular Biology of The Gene 5/e(s) by James D Watson, Tania A Baker, Stephen P Bell (2008) Publisher: Dorling Kindersley (India) Pvt Ltd ISBN: 8177581813, ISBN-13:9788177581812, 978-8177581812.
- Cell and Molecular Biology, 3e (2003) by Karp Publisher: Jw ISBN: 0471268909ISBN-13:9780471268901, 978-0471268901.
- Molecular Cell Biology (2002) by H.S. Bhamrah Publisher: Anmol Publications ISBN: 8126111429ISBN-13: 9788126111428, 978-8126111428.
- Cell and Molecular Biology by S. Sundara Rajan (2003) Publisher: Anmol Publications ISBN: 8126113553ISBN-13: 9788126113552, 978-8126113552.

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 **(8 hrs)**

Nutrition

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

Nutritional significance of carbohydrates, proteins and fat. Essential fatty acids, essential amino acids, limiting amino acids and significance of dietary fibre. Balanced diet and Recommended Daily Allowance (RDA). Terms related to protein evaluation-protein efficiency ratio (PER), digestibility coefficient, biological value, net protein utilization, net protein ratio and chemical score (definitions only). Nitrogen balance-positive and negative nitrogen balance. Protein-calorie malnutrition-kwashiorkor and marasmus. Functions of minerals- Ca, P, Mg, Na, K, Cl, Iodine, Cu, Zn, Mn and Fe. Vitamins-Fat and water soluble vitamins- Functions and deficiency diseases.

Module II **(7 hrs)**

Foods

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: Lathyrism, 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 **(7 hrs)**

Food preservation and adulteration

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 **(7 hrs)**

Fortified Foods and neutraceuticals

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 **(7 hrs)**

Food safety and quality management

Food safety: definition and basic concepts of food toxicity and food hazards (physical, chemical and biological). Food safety management systems: Good Manufacturing Practices (GMP), Good Handling Practices (GHP), Hazard Analysis Critical Control Points (HACCP). Product certification/grading – BIS and AGMARK (basic approach only). Food standards: Codex Alimentarius, ISO and Codex India. Brief study of the following: FSSAI, PFA 1954, FSSA 2006, FPO and essential commodities act.

References:

- Advanced Text Book on Food and Nutrition, Vol I and II, Dr. M Swaminathan.2nd edition. The Bangalore Printing and Publishing Co Ltd.
- Foods-Facts and Principles-N Shakuntala Manay and M Shadaksharaswamy. New Age International Publishers, ISBN-81-224-1325-0.

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 **(8hrs)**

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 **(10hrs)**

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 **(9hrs)**

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 **(9hrs)**

Urine analysis

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 **(18hrs)**

Organ function tests

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 hyper-thyroidism.

References:

- 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:

- 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 by12, III-Cross street, West C.I.T.Nagar, Madras; IIIEdition,1977)
- Bauer J.D. Clinical LaboratoryMethods,C.V.Mosby,St.Louis1982.
- MollisonP.L. Blood Transfusionin Clinical Medicine, 6th Ed, Blackwell Scientific Publications, Oxford; 1979.
- Bowley C.C., K.L.G. Goldsmith & Wd'A Maycock, Blood Transfusion: A guide to the formation & operation of a transfusion service, World Health Organisation, 1971.
- Bishop M.L. J.L. Dlaufer & E.P.Fody, Clinical Chemistry, Lippincott Company, Philadelphia, 1985.
- LambergS.L., Laboratory Manual of Haematology and Analysis, A VI publishing Co. Inc.,Westport, Connecticut, 1978.

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

Definition of the terms- Cancer, metastasis, sarcoma. Different types of cancer. Risk factors for cancer (carcinogens). Difference between primary and secondary tumor. Difference between benign

and malignant tumor. Characteristics of cancer cell, causes, diagnostic methods (name of methods only). Treatment modalities (surgery, chemotherapy, immunotherapy, hormonal therapy- basic concepts alone). Biochemical markers for detecting cancer, prevention and management of cancer- role of antioxidants in preventing carcinogenesis.

Module V **(8 hrs)**

Chronic respiratory disease

Effect of smoking to lungs. Modifiable and Non modifiable risk factors. Prevention and management of the disease.

Module VI **(9 hrs)**

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:

Guide to prevention of lifestyle diseases- M.N. Kumar, R.Kumar, Deep & Deep Publications, ISBN: 817629518.

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-Lowrymethod

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:

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41-8.
- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.
- 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 **(6 hrs)**

Specimen collection and preservation methods

Collection and preservation procedures of blood, plasma, serum, and urine, preparation of swabs. Automation in clinical biochemistry: precision, reliability, reproducibility and other factors in quality control.

Module II **(12 hrs)**

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 **(6 hrs)**

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 **(12 hrs)**

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 **(9 hrs)**

Life style disorders

Introduction to life style disorders- definition, lifestyle factors in the development and management of diseases. Diabetes: classification and etiology, glycosylated hemoglobin. Atherosclerosis: ischemia, myocardial infarction, hypertension and stroke. Obesity: classification according to BMI (brief description). Cancer: causes, types, metastasis, management- surgery, chemotherapy and radiation.

Module VI **(9 hrs)**

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:

- R. Ashwood, David E. Bruns (6TH Eds), Elsevier (Saunders) 2006 ISBN: 8131213749, ISBN-13: 9788131212742, 978-8131213742.
- Tietz Text book of Clinical chemistry and Molecular Diagnostics. Carl A. Burtis, Edward
- Basic & Clinical Pharmacology by Bertram G. Katzung (2006) Publisher: Mcgraw-hill Medical Publishing ISBN: 0071451536 ISBN-13: 9780071451536, 978-0071451536
- Notes on Clinical Biochemistry by John K. Candlish (1992) Publisher: World Scientific
- Publishing Company ISBN: 9810210663 ISBN-13: 9789810210663, 978-9810210663
- Clinical Biochemistry: Metabolic And Clinical Aspects by William J. Marshall, Stephen
- K. Bangert, Elizabeth S.m. Ed. S.m. Ed. Marshall (2008) Publisher: \Elsevier Science
- Health Science Div ISBN: 0443101868 ISBN-13: 9780443101861, 978-0443101861
- Basic Medical Biochemistry: A Clinical Approach by Dawn B., PH.D. Marks, Allan D.
- Marks Colleen M. Smith (1996) Publisher: Lippincott Williams & Wilkins; illustrated
- edition ISBN-10: 068305595X ISBN-13: 978-0683055955
- Clinical Chemistry, 6/e Ie by William J Marshall, Stephen K Bangert (2008) Publisher:
- Else ISBN: 0723434603, ISBN-13: 9780723434603, 978-0723434603

- Tietz Fundamentals of Clinical Chemistry, 6/e by Carl A Burtis, Edward R Ashwood
- (2008) Publisher: Else ISBN: 8131213749, ISBN-13: 9788131213742, 978-8131213742
- Preventive and social medicine By K. Park
- Text book of medical Biochemistry by Sreekumari and Vasudevan

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 triacylgycerol, phospholipid and cholesterol. Fatty acid oxidation- beta oxidation, alpha and omega oxidation. Ketone bodies: formation, utilization and excretion.

Module III **(8 hrs)**

Aminoacid metabolism

Aminoacid pool, glucogenic and ketogenic amino acids. Biosynthesis and degradation of tyrosine and lysine. Transamination, deamination and decarboxylation,.Urea cycle and regulation. Alkaptonuria, phenylketonuria.

Module IV **(8 hrs)**

Nucleic acid metabolism

ources of atoms of purines and pyrimidines, Biosynthesis and Degradation of purines and pyrimidines- de novo and salvage pathways with regulation, Gout, Lesch Nyhan syndrome.

ModuleV **(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.

Oxidative phosphorylation: Sites of ATP production, Hypothesis of mitochondrial oxidative Phosphorylation-Chemiosmotic theory, P/O ratio, Inhibitors and Uncouplers, Transport of reducing potentials into mitochondria-Malate aspartate and Glycerol-3-phosphate shuttle.

Module VI **(9 hrs)**

Photosynthesis

Structure of Chloroplast, light reaction - cyclic and noncyclic photophoshorylation. Chlorophyll (structure only), dark reaction, fixation of CO_2 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:

- Biochemistry by Lubert Stryer, W.H Freeman and Company, New York ISBN 0-7167-2009-4, 4th Edition.
- Principles of Biochemistry, by Albert Lehninger, David L Nelson, Michael M Cox, CBS Publishers & Distributors Delhi ISBN81-239-0295-6.

- Biochemistry by Lubert Stryer, W.H Freeman and Company, New York ISBN 0-7167-2009-4, 4th Edition.
- Principles of Biochemistry, by Albert Lehninger, David L Nelson, Michael M Cox, CBS Publishers & Distributors Delhi ISBN81-239-0295-6.

Semester VI

IM1643: Core course XI
Advanced Biochemistry

No. of Credits: 3 **No. of contact hours: 54**

Hours/week: 3

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 **(10 hrs)**

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 **(12 hrs)**

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 foot printing, RFLP, RAPD, AFLP, and STR analysis-. Outline study of Site- directed mutagenesis, DNA-protein interaction Assays.

Module III **(12 hrs)**

Elements of Nanoscience

Basics and scale of nanotechnology, different classes of nanomaterials: Liposomes, quantum dots shell structures, metal oxides and semiconductors (Definition &Physico-chemical properties and applicationonly). Synthesis of nanomaterials- Physical & Chemical Methods.Characterization of nanostructures: DLS, FTIR & X-ray diffraction (Basic idea). Types of nanostructure: one dimensional, two dimensional and three dimensional nano-structured materials.

Module IV **(10 hrs)**

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 **(10 hrs)**

Omics

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:

- Gene Cloning and DNA Analysis: An Introduction, 6th Edition, T. A. Brown, Wiley-Blackwel.
- Principles of Gene Manipulation & Genomics – 7th Edition – Sandy B. Primrose, Richard Twyman– Blackwell

- Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.
- Nanoparticles: From theory to applications – G. Schmidt, Wiley Weinheim 2004.
- Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005), 11: 830- 831, Cambridge University Press.
- Processing & properties of structural naonmaterials- Leon L. Shaw, Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK 2005.
- Bernhard O.Palsson,SangeetaN.Bhatia,"Tissue Engineering" Pearson Publishers 2009.
- Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P. Fundamentals of Tissue Engineering and Regenerative Medicine.2009.

Semester VI

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

No. of Credits: 3 **No. of contact hours: 90**
Hours/week: 5

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'stest)

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:

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41-8.
- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.

- Standard Methods of Biochemical Analysis, S. K.Thimmaiah (Ed), Kalyani Publishers, Ludhiana ISBN81-7663-067-5.
- Hawks Physiological Chemistry, Bernard L.Oser (ed).TATA Mc GRAW Hill Publishing Company LTD, New Delhi.

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)

MODEL QUESTION PAPER FOR FIRST SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM1121 FUNDAMENTALS OF BIOCHEMISTRY

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. Define carbohydrates.
2. Explain inversion of sugars.
3. Give the structure of tyrosine.
4. Name the mucoploysaccharide 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 contributes 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 glyosidic 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.
21. Give the structure of lecithin.
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 aminoacids.
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. Discus on value education.
6. Mention any 2 environmental pollutant
7. Comment on wildlife protection act.
8. Name any 2 Hot spot diversity in India
9. Define ecosystem.
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 deforestion 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. Discus 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 ennivorment
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.
19. Write a note on the principle of electrophoresis.
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 ENZYMOLOGY

Time: 3Hours Max. Marks: 80

SECTION- A

Answer **all** questions. Each question carries **one** mark

1. Define Calorific value.
2. Comment on neurotransmitters.
3. Explain erythropoeisis.
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=10marks)

SECTION- B

Answer any **8** questions. Each question carries **two** marks

11. Draw the structure of nephron.
12. Give a short note on carbonic anhydrase.
13. Explain oxygen dissociation curve.
14. Comment on the composition of ORS in connection with glucose absorption.
15. Write a note on the composition of bile.
16. State MM Equation.
17. Explain the coenzyme form of vitamins.
18. Define regurgitation and give its significance.
19. Differentiate Cushing syndrome and Addison's disease.
20. Name two female sex hormones.
21. Mention the enzymes involved in carbohydrate digestion.
22. Significance of Km and Vmax.

(8x2=16marks)

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 hemopoeisis.
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.
13. Define replication fork? Give the names of enzymes involved in its formation.
14. Give an account of prokaryotic RNA Polymerases.
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 prokarotes?
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.
28. The Watson and crick model of DNA suggested a possible copying mechanism for the replication of genetic materials. Justify the statement.
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

(1x10=10 marks)

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.
14. Give an account of digestibility coefficient.
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.
21. Short note on Biofortification.
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.
31. Briefly explain Product certification/grading.

(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.
6. Mention the symptoms of diabetes.
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.
13. Define balanced diet.
14. Describe gestational diabetes.
15. List out different types of non communicable diseases.
16. Define polyuria.
17. Give the details of arterial plaque.
18. Give a note on junk food.
19. Difference between primary tumor and secondary tumor.
20. Name any two heart-healthy foods.
21. Short note on modifiable risk factors of respiratory diseases.

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
9. Clinical relevance of glycosuria.

10. Distinguish AST and ALT.

(1x10=10 marks)

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.
16. Short note on obstructive jaundice.
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.
21. Give the clinical significance of albuminuria.
22. Define Icteric Index and state its significance.

(8x2=16 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.

(6x4=24 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)

MODEL QUESTION PAPER FOR SIXTH SEMESTER EXAM
2(A): BIOCHEMISTRY & INDUSTRIAL MICROBIOLOGY
IM1642 METABOLISM

Time: 3Hours Max marks: 80

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. Distingush 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. Distingush 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 metabolosm
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

6x4=24 marks)

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.
24. Explain cloning vectors for eukaryotes.
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

EXAMINATION FOR VOCATIONAL MICROBIOLOGY

Semester	Course code	Paper	Duration
I	IM 1171	Vocational course- I Fundamental Microbiology	3 Hours
II	IM1222	FOUNDATION COURSE II- Microbial Taxonomy and Physiology	3 Hours
	IM 1271	Vocational course- II Microbiology Practicals	6 Hours X 2 days
III	IM1371	Vocational course- III Cell Biology	3 Hours
	IM1372	Vocational course- IV Microbial Genetics & Biotechnology	3 Hours
IV	IM 1471	Vocational course- V Environmental Microbiology	3 Hours
	IM 1472	Vocational course- VI Food Microbiology	3 Hours
	IM 1473	Vocational course- VII Microbiology Practical	6 Hours X 2 days
V	IM 1571	Vocational course- VIII Fermentation Technology	3 Hours
	IM 1572	Vocational course- IX Microbiology Practical	6 Hours X 2 days
VI	IM 1671	Vocational course- X Medical Microbiology	3 Hours
	IM 1681	Elective course- Immunology- Elective	3 Hours
	IM 1672	Vocational course- XI Microbiology Practical	6 Hours X 2 days

SEMESTER I CODE: IM1171

VOCATIONAL COURSE I Fundamentals of Microbiology

Total Hrs-54 CREDITS-4 (3Hrs/week)

MODULE I (9Hrs)

Introduction and history of Microbiology-contribution of Louis Pasteur, Robert Koch, Alexander Fleming, Anton Van Leeuwenhoek, Joseph Lister, & Needham. Concepts of origin of life-abiogenesis and biogenesis, Spontaneous generation theory. Scope of Microbiology.

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)

Culture media- Nutritional requirements of bacteria, classification of media. Methods of isolation pure cultures - Serial dilution technique, streak plate method, pour plate method, spread plate method. Anaerobic culture methods. Preservation of cultures- refrigeration, deep-freezing, freeze drying (lyophilization).

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)

Distinguishing characters of bacteria, fungi, algae and protozoa. General structure of Fungi, Algae and Protozoa, General characters of viruses, structure, classification, multiplication and cultivation. Structure and replication of bacteriophages.

REFERENCES

1. Microbiology - Pelczar, Chan and Kraig (ISBN 0-07-462320-6)
2. Microbiology -Prescott, Harley and Klein (ISBN 0-07-111217-0)
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

1. Dubey R C and Maheswari, D K (2002). Practical Microbiology. S. Chand & Co Ltd. (ISBN 81- 219 - 2153 - 8)
2. Micobiology A Laboratory Manual-James G Cappucino Natalie Sherman (ISBN 81-297-0265-7)
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 (3Hrs/week)

MODULE I (12 Hrs)

Classification of microorganisms- Objectives and practical value of taxonomy. Criteria for classification-morphological, Nutritional, ecological, molecular. Numerical taxonomy, matching coefficients, dendrogram, phylogenetic tree. Phylogenetic relationship. Major systems of classification. Three-kingdom and Five kingdom classification. Bergy's manual.

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 (10Hrs)

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 (12Hrs)

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

MODULE V (10 Hrs)

Uptake of nutrients by bacteria- Passive diffusion, facilitated diffusion, active transport, group translocation, Iron uptake. Biosynthesis of cell wall peptidoglycan. Utilization of energy by halo bacteria. Bioluminescence and its Applications.

REFERENCES

1. Microbiology - Pelczar, Chan and Kraig (ISBN 0-07-462320-6)
2. Microbiology - Prescott, Harley and Klein (ISBN 0-07-111217-0)
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
7. Measurement of fungal growth by colony diameter method.
8. Germicidal effect of ultra violet light on bacterial growth.
9. Effect of different disinfectants and antiseptics on bacteria.

REFERENCES

1. Dubey R C and Maheswari, D K (2002). Practical Microbiology. S. Chand & Co Ltd. (ISBN 81-219-2153-8)
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 (4Hrs/week)

MODULE I (12 Hrs)

Introduction to cell biology: Early conditions on earth, Origin of life on earth. Spontaneous generation theory, Damn's concept about the origin of life, Haldane and Oparin theory of the origin of life, Urey-Milk experiment, Fox's experiments. Preliminary idea about speciation, natural selection and genetic drift. Robert Hooke- Discovery of cells and the cell theory.

MODULE II

Fundamentals of cell biology: ultrastructure of cell- prokaryotic and eukaryotic cell, Structure and functions of subcellular organelles- nucleus, mitochondria, chloroplast, ribosomes, Endoplasmic reticulum, Golgi bodies, lysosomes, microfilaments, microtubules, glyoxysomes and peroxisomes.

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)

Apoptosis- definition, mechanism- difference between apoptosis and necrosis.Cell cycle- check points and arrest. Regulation of cell cycle. Analysis of cell cycle by flow cytometry. Cell division- mitosis and meiosis- different stages. Cell differentiation.

MODULE V (12 Hrs)

Chromosomal changes and cytogenetics: Euploidy, Aneuploidy, Chromosomal aberrations: structural alterations, gene mutations- complementation test, molecular changes, intra and interchromosomal aberrations, chromosome preparation, G-Banding, FISH. Disorders associated with chromosomal aberrations-Philadelphia chromosome.

MODULE VI (12 Hrs)

Genetic organization- chromatin and nucleoid structure, chromosomes-nucleosomes, plectonemic and solenoidal supercoiling, m'icrosatellites. DNA binding protein families- Helix-loop-Helix, Helix loop Turn and Leucine zipper. Oncogenes and tumor suppressor genes- role in malignant transformation.

REFERENCES

1. Cell and Molecular Biology by Gerald Karp, John Wiley & Son, Inc. New York
2. Principles of Genetics by D. Peter Snustad and Michael J Simmons, John Wiley & Son,
3. Biochemistry by Lubert Stryer, W.H Freeman and Company, New York
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 (9 Hrs)

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

Module IV (9 Hrs)

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 (9 Hrs)

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 (9 Hrs)

Ethical problems associated with the use of rDNA technology. Intellectual property: Intellectual property rights- patents, trade secrets, copyrights & trademarks). Patenting of transgenic organisms and isolated genes.

Reference:

1. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM.
2. Genes V by Tewin B, 1994. Oxford University press.
3. Molecular Cell Biology by Lodish, H, Baltimore D, Berk A, Zipursky ST, Matsudaira P, Darnell J.
4. Molecular Biology by FreifelderD., 1991 Narosa Publishing Home.
5. Principles of Gene Manipulation, 4th Ed., by R.S.Old and S.B.Primrose.
6. Principles of Genetics by Gardner EJ, Simmons MJ, Snustad DP.
7. Genes and Genomes by Singer M, Berg P, 1991 University Science Books.

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.
9. Demonstration of genetic recombination in bacteria by conjugation.
10. Demonstration of Bacterial transformation.

REFERENCES

1. Lab manual in Biochemistry, Immunology and Biotechnology-Arti Nigam, Archana Ayyagari (ISBN 13:978-0-07-061767-4)
2. Dubey R C and Maheswari, D K (2002). Practical Microbiology. S. Chand & Co Ltd. (ISBN 81-219-2153-8)
3. Experiments in Microbiology plant pathology and Biotechnology- K.R.Aneja
4. Molecular Cloning: A Laboratory Manual, Volume 1 & 2: Joseph Sambrook, David William Russell.

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)

Waste - types; Solid waste - treatment of solid waste - composting, incineration, land filling. Liquid waste - Conventional methods of treatment of liquid waste. House hold sewage treatment - septic tank, imhoff tank, cess pool. Municipal sewage treatment-primary, secondary and tertiary, disinfection.

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)

Microorganisms in soil processes-carbon cycle-organic matter decomposition, humus formation. Nitrogen cycle-nitrogen fixation -symbiotic, non-symbiotic, associative symbiotic nitrogen fixing organisms. Microbial transformation of phosphorous, iron, sulfur micronutrients in soil.

MODULE V (9 Hrs)

Rhizosphere concept. Rhizosphere microorganisms-their importance in plant growth. Mycorrhizae - brief account of ectomycorrihizae ,endo mycorrhizae and ecto-endo mycorrhizae. Applications of mycorrhizal fungi. Biofertilizers: microbial inoculants-definition and perspectives of agriculturally useful inoculants; brief account of production and application of *Rhizobium, Azotobacter, Azospirillum and cyanobacteria.*

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

1. Microbial Ecology Fundamentals and applications - Atlas and Bartha (ISBN 981 -405-344-9)
2. Environmental Microbiology- K. Vijaya Ramesh (ISBN 81 -8094-003-9)
3. Agricultural Microbiology- Rangaswamy G, D J. Bhagyaraj (ISBN-81 -203-0668-6)
4. Soil Microbiology an exploratory approach - Mark S.Coyne (ISBN 981 -240-203-9)
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 (10 Hrs)

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

Module III (10 Hrs)

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 (12 Hrs)

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 (12 Hrs)

Food preservation: Principles of food preservation - methods of preservation. Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere). Chemical preservation- (Sodium benzoate Class I & II). Food Sanitation: Good manufacturing practices - HACCP, Personal hygiene.

REFERENCES

1. Food Microbiology by Adams, M.R. and Moss, M.0.1995. The Royal Society of Chemistry, Cambridge.
2. Food Microbiology by Frazier, W.C. and WesthofF, D.C. 1988. TATAMcGraw Hill Publishing company ltd., New Delhi.
3. Modem Food Microbiology by Jay, J.M. 1987. CBS Publishers and distributors, New Delhi.
4. A Modem Introduction to Food Microbiology by Board, R.C. 1983. Blackwell Scientific Publications, Oxford.
5. Dairy Microbiology by Robinson, R.K. 1990. Elsevier Applied Science, London.
6. Food Poisoning and Food Hygiene, Hobbs, B.C. and Roberts, D. 1993. Edward Arnold. London.

SEMESTER IV

CODE: IM 1473

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.
3. Bacteriological examination of water by multiple tube fermentation test.
   (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)

6. Determination of number of bacteria in milk by standard plate count.
7. Determination of quality of a milk sample by MBRT, phosphatase test.
8. Determination of TDT and TDP
9. Effect of pH on bacterial growth.
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, Thermophillic 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)
2. Industrial Microbiology-A.H.Patel (ISBN 0333 90842 2)
3. Prescott & Dunn's Industrial Microbiology Reed G (Ed) ISBN 81-239-1001-0) (Fourth Edition'
4. Food Microbiology-William C.Frazier Dennis .C Westhoff (ISBN 0-07-46210147)
5. Fermented foods Economic Microbiology Vol 7 rose A (ed)
6. Manual Of Industrial Microbiology And Biotechnology, Demin & Davis
7. Applied Microbiology- Musharraffudde

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.
7. Bioassay of antibiotic.

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)

Mycology: Brief account on the following fungal diseases: **Superficial mycoses-** Pityriasis versicolor, Tinea nigra. **Cutanaceous mycoses-** Dermatophytes, Candidiasis. **Subcutanaceous mycoses-** Mycotic mycetoma, Rhinosporidiosis. **Systemic mycoses-** Cryptococcosis, Histoplasmosis and **Opportunistic mycoses-** Aspergillosis, Penicilliosis.

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)

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

4. Tube agglutination test: WIDAL test.
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
9. Urine culture and its microbiological analysis.
10. Isolation of Enteric pathogens from stool by direct plating methods

REFERENCES

1. Lab manual in Biochemistry, Immunology and biotechnology-Arti Nigam, Archana Ayyagari (ISBN 13:978-0-07-061767-4)
2. Medical Laboratory technology Methods and interpretation (ISBN 81-8448-449-6)
3. Mackie &McCartney Practical Medical Microbiology (ISBN 0443 04906 8)

ELECTIVE COURSE

CODE: IM1661

ELECTIVE COURSE - IMMUNOLOGY

Total Hrs 36 CREDITS-2 (2 Hrs /week)

MODULE 1 (6 Hrs)

Infections, Source of infection, Epidemic, Pandemic and Endemic diseases. Determinants of microbial pathogenicity. Immunity, types of immunity-Innate immunity and acquired immunity-(natural and artificial active, natural and artificial passive), immune response- primary and secondary immune response. Mechanism of immune response

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 Histocompatability 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)
3. Kuby Immunology by Thomas J. Kindt (2006) Publisher: W H Freeman & Co
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
7. Immunology by P.R. Yadav (2004) Publisher: Discovery Publishing House
8. Immunology by David A. Marcus, Richard A. Goldsby, Barbara A. Osborne (2003) Publisher: WH. Freeman & Company