INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
ACCREDITED BY NAAC WITH 'A' GRADE
Marching Beyond 25 Years Successfully

M.Sc

BIOCHEMISTRY

Curriculum and Syllabus

Regulations 2021

(Based on Choice Based Credit System (CBCS)

and

Learning Outcomes based Curriculum Framework (LOCF))

Effective from the Academic year

2021 - 2022

Department of Biochemistry

School of Life Sciences

VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES

SCHOOL OF LIFE SCIENCES

DEPARTMENT OF BIOCHEMISTRY

VISION AND MISSION OF THE DEPARTMENT

VISION

- To be recognized in the global scientific arena, with a marked specialization and excellence in Biochemistry.
- To provide an atmosphere for critical thinking to differentiate and interlink the various branches; cell biology, intermediary metabolism, clinical biochemistry, immunology, enzymology and endocrinology.

MISSION

- To excel in the basic concepts and principles of Biochemistry
- To identify the problem in protocols in the thrust areas of research where the intervention of biochemist is essential
- To expose the students to the grooming areas of research with advanced instrumentation technique
- To correlate the anthropogenic inputs in the environment with the biochemical changes in the biological species and its impact on human life
- To understand the concepts in scientific learning for the process of experimentation and hypothesis testing.
- To develop a sound knowledge in the practical biochemistry and its application for the benefit of the society

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1. Compare and contrast the scope and profundity of scientific knowledge in the broad range of fields, including Cell biology, Intermediary metabolism, Clinical Biochemistry, Hormonal Biochemistry, Genetics, Nutritional Biochemistry, Immunology and Enzymology.

PEO2. An ability to gain knowledge and know-how for successful career in academia, industry and research.

PEO3: Describe the biochemical basis of human diseases, protein structure and conformation, non-invasive diagnostics, biochemical pathway regulation and drug development and apply the same for a multitude of laboratory applications.

PEO4: Promoting lifelong learning to meet the ever-evolving professional demands by developing ethical, inter personal and team skills.

PROGRAM OUTCOME (PO)

The M.Sc. programme (Biochemistry/Biotechnology/Bioinformatics/microbiology) at VISTAS has documented measurable outcomes that are based on the needs of the programme's stakeholders. The programme outcomes that the department presently adapts to are as follows:

PO-1 Life Sciences knowledge: Successful candidates will acquire current/recent specific knowledge in the respective discipline with proficiency in practical skills and leadership skills for a successful career.

PO-2 Problem analysis: Successful candidates will be able to analyse, design standards, resolve and troubleshoot problems in implementation or standardization of Life sciences protocols.

PO-3 Design/development of solutions: Successful candidates will develop creative and cognitive thinking and cooperate with each other to solve problems in the field of Life sciences.

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO1: Demonstrate an understanding of structure and metabolism of macromolecules and understand the regulation and disorders of metabolic pathways.

PSO2: Gain proficiency in laboratory techniques in both biochemistry and molecular biology, and be able to apply the scientific method to the processes of experimentation and Hypothesis testing.

BOARD OF STUDIES

S. No	NAME	AFFILIATION	ROLE
1	Dr. R. Padmini	Assistant Professor & Head, Department of Biochemistry, School of Life Sciences, VISTAS	Chair Person
2	Dr. P. Kalaiselvi	Department of Medical Biochemistry, University of Madras	External Expert
3	Dr. Usha Ravi	Assessor at NABET, Quality council of India	External Expert
4	Dr. S. Perumal	Assistant Professor, Department of Biochemistry, School of Life Sciences, VISTAS	Internal Member
5	Ms. Sathya	Medical coder Omega Health Care, Chennai	Alumni member 2014-2016 batch

M.Sc., BIOCHEMISTRY

REGULATIONS 2021

(Applicable to all the candidates admitted from the academic year 2021-22 onwards)

1. DURATION OF THE PROGRAMME

1.1. Two years (four semesters)

1.2. Each academic year shall be divided into two semesters. The odd semesters shall consist of the period from July to November of each year and the even semesters from January to May of each year.

1.3 There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

2.1. The details of Eligibility for Admission

Bachelor's degree in Biochemistry, Chemistry, Microbiology, Nutrition & Dietetics and Life Sciences (10+2+3 pattern) and B.Sc Medical Lab Technology from a Recognized University or any other degree with Biochemistry as Core subject accepted as equivalent thereto by the Syndicate

3. MEDIUM OF INSTRUCTION

The medium of instruction is English.

4. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

A Candidate shall be eligible for the award of Degree only if he/she has undergone the prescribed course of study in VISTAS for a period of not less than two academic years and passed the examinations of all the prescribed courses of four Semesters earning a minimum of 90 credits for Core Courses and also fulfilled such other conditions as have been prescribed thereof.

5. COURSE

Each course / subject is to be designed under lectures / tutorials / laboratory or field work / seminar / practical training / Assignments / Term paper or Report writing etc., to meet effective teaching and learning needs.

6. COURSE OF STUDY AND CREDITS

The Course Components and Credit Distribution

(Minimum number of Credits to be obtained)

Credit Assignment Each course is assigned certain number of credits based on the following: Contact period per week CREDITS

1 Lecture Period	-	1 Credit
1 Tutorial Period	-	1 Credit
2 Practical Periods	-	1 Credit

(Laboratory / Seminar / Project Work / etc.)

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

7.1. **Eligibility:** Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed therefor by the Board of Management from time to time.

7.2. **Attendance:** All Students must earn 75% and above of attendance for appearing for the University Examination. (Theory/Practical)

7.3. **Condonation of shortage of attendance:** If a Student fails to earn the minimum attendance (Percentage stipulated), the HODs shall condone the shortage of attendance on medical grounds up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after paying the prescribed fee towards the condonation of shortage of attendance. The students with attendance of less than 65 and more than 50% shall be condoned by VC on the recommendation of HODs on genuine grounds, will be permitted to appear for the regular examination on payment of the prescribed condonation fee.

7.4. **Detained students for want of attendance:** Students who have earned less than 50% of attendance shall be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the University from time to time.

7.5. **Transfer of Students and Credits:** The strength of the credits system is that it permits inter Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities.

7.5.1. Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature, provided, there is a vacancy in the respective program of Study in the Institution where the transfer is requested.

7.5.2. The marks obtained in the courses will be converted into appropriate grades as per the University norms.

7.5.3. The transfer students are not eligible for Ranking, Prizes and Medals.

7.5.4. Students who want to go to foreign Universities upto two semesters or Project Work with the prior approval of the Departmental / University Committee are allowed to transfer of their credits. Marks obtain in the courses will be converted into Grades as per the University norms and the students are eligible to get CGPA and Classification.

Courses of Study and Scheme of Assessment

Course Components with credits

Component	I Sem	II Sem	III Sem	IV Sem	Total Credits
Core Courses	14	16	14	14	58
Ability Enhancement Courses (AEC)	-	-	-	-	-
Discipline Specific Elective (DSE) & Generic Elective (GEC)	8	4	8	4	24
Skill enhancement Course (SEC) & SI	2	4	2	-	8
Total Credits	**24**	**24**	**24**	**18**	**90**

Learning Outcomes based Curriculum Framework (LOCF)
for M.Sc. Biochemistry

1. Preamble

Completion of graduation course in biosciences basically delivers a platform for basic understanding of the subject. Inventions, innovations and technology have revolutionized and enriched the biological sciences. The demand of skilled manpower requires thorough knowledge of the subject. It also demands for incorporating latest knowledge and advanced technologies to fulfill the changing needs of society. The public private sector prefers the experienced manpower. Considering this, M.Sc. in any biological science course is designed to provide through and updated knowledge of the subject which makes easy entry of the students in public private sector. Uniqueness of the course is of having 6 months mandatory research projects. During the period students are getting an opportunity to work in nationally and internationally acclaimed research institutes and industries. This generates skilled human resources as per the demands of the society. The course has other research elements including scientific writing, writing research projects, preparing publications, preparing research posters for the conferences and the entire process also generates innovative minds to work in the capacity of scientists.

2. Introduction:

In the increasingly globalized society, it is important that the younger generation especially the students are equipped with knowledge, skills, mindsets and behaviors which may enable them to perform their duties in a manner so that they become important contributors to the development of the society. This will also help them to fully utilize their educational training for learning a decent living so that the overall standard of their families and surroundings improve leading to development of welfare human societies. To achieve this goal, it is imperative that their educational training is improved such that it incorporates the use of newer technologies, use of newer assessment tools for mid-course corrections to make sure that they become competitive individuals to shoulder newer social responsibilities and are capable of undertaking novel innovations in their areas of expertise. In the face of the developing knowledge society, they are well aware about the resources of self-development using on-line resources of learning which is going to be a major component of learning in the future. The learning should also be a continuous process so that the students are able to re-skill themselves so as to make themselves relevant to the changing needs of the society. In the face of this need, the educational curricula, teaching learning processes, training, assessment methods all need to be improved or even re-invented.

3. **Learning Outcomes based approach to Curriculum Planning: (LOCF)**

Learning Outcome based approach to curriculum planning (LOCF) is almost a paradigm shift in the whole gamut of higher education such that it is based on first and foremost identifying the outcomes of the learning required for a particular subject of study, and then planning all components of higher education so as to achieve these outcomes. The learning outcomes are the focal point of the reference to which all planning and evaluation of the end learning is compared and further modifications are made to fully optimize the education of the individuals in a particular subject. For the subject of bio science the outcomes are defined in terms of the understanding and knowledge of the students in biology and computer application in biology and the practical skills the students are required to have to be competitive biologist. So, that they are able to play their role as Biologist.

4. **Postgraduate attributes in life science:**

Broaden the outlook and attitude, develop the current skills and abilities, and learn

- New one to do extremely well in studies and career, grow into responsible global citizens. Contour the academic career of the students, make them employable, enhance
- To shape one's life and also that of colleagues and peers. Demonstrate behavioral attributes for the enhancement of soft skills, socialistic
- Research insight and support the participation in co-curricular and extracurricular activities. Instill skills and abilities to develop a positive approach and be self-contained
- Approach and leadership qualities for successful career and nurture responsible human being.
- Provide highly skilled and knowledgeable human resources for agricultural Sector, food industry, dairy industry, medical and paramedical field, pharmaceutical and research institutes

5. Qualification Descriptors:

The following may serve as the important qualification descriptors for a PG degree in Biochemistry/Biotechnology/Microbiology/Bioinformatics:

1. Knowledge of the diverse places where biological science is involved.
2. Understanding of diverse biological processes.
3. Advanced skills and safety issues related to handling of Microbes, Animals and Plants Good laboratory practices etc.
4. Advanced skills in working with microbes such as pilot scale culturing, downstream processes, diagnostics etc.
5. Generation of new knowledge through research projects
6. Ability to participate in team work through biological projects.
7. Ability to present and articulate their knowledge of biology.
8. Knowledge of recent developments in the area of biology.
9. Analysis of data collected through study and projects / dissertations / reviews / research surveys.
10. Ability to innovate so as to generate new knowledge.
11. Awareness how some biology leads may be developed into enterprise.
12. Awareness of requirements for fruition of a biology-related enterprise.
13. Ability to acquire intellectual property rights.

6. Objectives of the course:

The aim and objectives of the M.Sc. Biochemistry/ Biotechnology/ Bioinformatics/ Microbiology course program essentially focus to develop skills of student for a successful career.

- The course structure emphasizes to put enough efforts in theory as well as laboratory work so as to gain thorough knowledge of the subject.
- The course includes project work that would develop and nourish the scientific approach and research attitude of the students.
- Genetic engineering, Biotechnology, Bioinformatics, Immunotherapy are the new horizons of the interdisciplinary subject in biology which might provide solutions to various problems of the society. The course work is essentially framed to acquaint the students with all the recent advances in this field.
- It is compulsory & essential for the students to read research papers, publications and deliver seminars that would better help them to know the recent advances in the subject and also develop the communication skills.

- The program is designed in such a way that it is essential for the students to read original publications, put enough efforts in laboratory work for practical and project, be acquainted with all the recent advances in the field like Bioinformatics, drug designing and develop all the skills for a successful career

7. Programme Learning Outcome

(i) A advanced and systematic or coherent understanding of the academic field of Science, its different learning areas and applications, and its linkages with related disciplinary areas/subjects.

(ii) The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilized in modeling and solving real life problems.

(iii) Procedural knowledge that creates different types of professionals related to the disciplinary including professionals engaged in research and development, teaching and government/public service

(iv) Skills in areas related to one's specialisation area within the disciplinary and current and emerging developments in the field of Science

(v) Demonstrate relevant generic skills and global competencies such as (i) problem solving skills that are required to solve different types of problems with well-defined solutions, and tackle open-ended problems that may cross disciplinary-area boundaries;

(vi) Communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences

(vii) Analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language

(viii) ICT skills

(ix) Personal skills such as the ability to work both independently and in a group.

8. Teaching learning Process

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of respective discipline in a canonical manner. Students have great freedom of choice of subjects which they can study. The various components of teaching learning process are summarized in the following.

1. The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.

2. Assimilating ideas, deepening understanding, and gaining mastery of new concepts all take time, commitment, and intelligent effort. To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with.
3. Necessary and sufficient infrastructural facilities for the, laboratories and libraries equipped with adequate modern and modular furniture and other requirements. Modern and updated laboratory equipments needed for the undergraduate laboratories and reference and text books for the libraries
4. Home assignments at regular intervals and project work involving applications of theory are necessary to assimilate basic concepts of the respective discipline. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
5. The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships in their discipline. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.
6. Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.
7. Special attempts should be made by the institution to develop problem-solving skills and design of laboratory experiments for demonstration at the UG level. For this purpose a mentor system may be evolved where 3-4 students may be assigned to each faculty member.

9. Programme outcomes:

At the end of this course the students will be able to:

- Deliver his/her duties in the medical, paramedical, agricultural and research field which will aid the improvement of human life.
- Extend his/her duties in the field of biotechnology.
- Perform duties as research fellows/scientist in biological sciences.
- Learn desired skills through six months mandatory internship/Project.

CURRICULUM

Total number of Credits: 90

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 1								
Core	Core 1 – Chemistry of Biomolecules	4	0	0	4	40	60	100
Core	Core 2- Advanced Instrumental techniques	4	0	0	4	40	60	100
Core	Core 3 – Cellular Biochemistry	3	0	2	4	40	60	100
Core	Core 4 – Practicals I - Biochemistry & Instrumentation	0	0	4	2	40	60	100
DSE	DSE 1	4	0	0	4	40	60	100
DSE	DSE 2	4	0	0	4	40	60	100
SEC	Soft Skill 1/ Sector Skill Course	2	0	0	2	40	60	100
		21	**0**	6	**24**			
SEMESTER II								
Core	Core 5- Enzyme & Enzyme Technology	4	0	0	4	40	60	100
Core	Core 6 - Intermediary Metabolism	4	0	0	4	40	60	100
Core	Core 7 – Clinical Biochemistry	4	0	0	4	40	60	100
Core	Core 8 – Practical Enzymology	0	0	4	2	40	60	100
Core	Core 9- Practical Clinical Biochemistry	0	0	4	2	40	60	100
DSE	DSE 3	4	0	0	4	40	60	100
SI	Internship	0	0	4	2	40	60	100
SEC	Soft Skill 2/ Sector Skill Course	2	0	0	2	40	60	100
		18	**0**	**12**	**24**			
SEMESTER III								
Core	Core 10 – Genetics & Molecular Biology	4	0	0	4	40	60	100
Core	Core 11- Molecular Developmental Biology	4	0	0	4	40	60	100
Core	Core 12- Plant & Animal Tissue culture	4	0	0	4			

						40	60	100
Core	Core 13 – Practical Genetics & Molecular Biology	0	0	4	2	40	60	100
DSE	DSE 5	4	0	0	4	40	60	100
DSE	DSE 6	4	0	0	4	40	60	100
SEC	Soft Skill 3/ Sector Skill Course	2	0	0	2	40	60	100
		22	**0**	4	**24**			
SEMESTER IV								
Core	Core 14 –Toxicology & Forensic Biochemistry	4	0	0	4	40	60	100
GE	-	4	0	0	4	40	60	100
Core	Project Work	0	0	20	10	40	60	100
		8	**0**	**20**	**18**			

CA - Continuous Assessment , SEE - Semester End Examination

List of Discipline Specific Electives

1. Human Physiology and Basics of Anatomy
2. Research Methodology
3. Phytochemistry, Pharmacognosy & Quality Control
4. Immunology
5. Biotechnology and IPR
6. Modern Lifestyle Associated Diseases
7. Neurobiology
8. Endocrinology
9. Plant Biochemistry
10. Biochemical Toxicology
11. Molecular Developmental Biology
12. Nanotechnology
13. Stem cell technology
14. Cancer Biology
15. Environmental Science

List of Generic Electives

1. Statistical methods and their applications
2. Bioinformatics
3. Pathological Basis of Diseases
4. Medicinal Botany
5. Biomaterials

List of Skill Enhancement Course (SEC)

1. Soft Skills I
2. Soft Skills II
3. Soft Skills III

CORE COURSES

SYLLABUS

CORE CHEMISTRY OF BIOMOLECULES 4 0 0 4

Course objectives (Employability)

The objective is to study about the structure and biological functions of macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

Unit 1 Carbohydrates (12)

Carbohydrates: Classification of Carbohydrates. Structure and functions of Monosaccharides, Disaccharides and Polysaccharides. Structure and biological importance of sugar derivatives, Glycosaminoglycans, Proteoglycans, Glycoproteins and Lipopolysaccharides.

Unit 2 Proteins (12)

Classification, structure and properties of amino acids and proteins. Structural organisation of proteins(1^0 structure, 2^0 Structures, 3^0 Structures and Quarternary Structure). Peptide Synthesis. Isolation and purification of proteins. Conformational study on the structure of keratin, collagen and haemoglobin .

Unit 3 Lipids (12)

Lipids- Classification, structure and functions of fatty acids, alcohols and lipids. Physical and chemical properties of fatty acids. Structure and function of Eicosanoids, Lipoproteins-classes, transport and functions. Steroids.

Unit 4 Nucleic acids (12)

Structure of Nucleic acids (DNA & RNA) . A, B and Z forms of DNA. DNA super coiling and linking number. Properties of DNA – buoyant density, viscosity, hypochromicity, denaturation, renaturation, Cot curve. Chemical synthesis of Nucleic acids. Chemical and enzymatic methods of Nucleic acids sequencing. Major classes of RNA, their structure and biological role. Types of RNA, Si RNA, Micro RNA

Unit 5 - Vitamins (12)

Vitamins- Definition and classification. Source, Structure and biological role, daily requirement and deficiency manifestation of the fat soluble vitamins A,D,E & K. Water soluble vitamins-Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoicacid, biotin, folic acid and vitamin B12.

(60 Hours)

Course outcome:

After the completion of this course, the student will be able to

1. Understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems.
2. Describe the chemistry of carbohydrates ,lipids, amino acids and proteins and nucleic acids

3. Explain organization and working principles of various components present in living cell.
4. Interpret molecular structure and interactions present in proteins, nucleic acids, carbohydrates and lipids
5. Develop skills to determine amino acid and nucleotide structures using the sequences of proteins and DNA respectively.

Text Books

1. J.L.Jain et al. Fundamentals of Biochemistry by S.Chand and Company 4th edition, 1994.
2. M.N.Chatterjea and Ranashinde Text book of Medical biochemistry Jaypee Brothers Medical Publisher (P) Ltd, 6th edition 2005.

Reference Books

1. Lippincott's illustrated biochemistry – Champe and Harvey; 6th edition 2007.
2. D.Voet and J.G. Voet, Biochemistry, John Wiley & Sons, USA 2004.

WEBSITES

1. https://www.chem.uci.edu/~unicorn/243/papers/MSlec1.pdf
2. https://geneticeducation.co.in/dna-sequencing-history-steps-methods-applications-and-limitations/

CORE ADVANCED INSTRUMENTAL TECHNIQUES 4 0 0 4

Course objectives (Employability)

Advanced instrumental techniques are used to understand the theoretical principles involved in Bioinstrumentation which may be used for the determination of nutrients, major ions and trace elements, biological samples together with the analytical techniques. Some of these techniques are particularly useful for the detailed analysis of recent methodologies used in the chemical analysis of biota as discussed in the chapter.

Unit 1 Microscopy and Cytotechniques (12)

Microscopy - Principles of Microscopy – bright and dark field, fluorescence, phase contrast, scanning and transmission electron microscopy. Cytotechniques – tissue homogenization and Cell disruption, cell counting and sorting, cell culture techniques, preservation of cell and tissues.

Unit 2 Radioactivity and Biosensors (12)

Radioactivity- introduction, types, Detection and measurements - GM counter, Scintillation counter. Safety aspects. Biological applications: assessing the metabolic pathways, radio dating, isotope dilution technique, autoradiography. Biosensors - Introduction to Biosensors: Concepts and applications. Biosensors for diabetes management. Noninvasive Biosensors in Clinical Analysis.

Unit 3 Centrifugation and Electrophoresis (12)

Centrifugation: Basic Principles of Centrifugation. Instrumentation and applications of Preparative - Differential and Density Gradient Centrifugation, Analytical Ultracentrifugation – ultra centrifuge, applications. Electrophoresis: Principles and Factors Affecting Electrophoresis. Principle, methodology and applications of PAGE, SDS-PAGE, IEF, 2D PAGE, Agarose Gel Electrophoresis, PFGE.

Unit 4 Chromatography (12)

Chromatography: Principles, Instrumentation and Applications of Paper Chromatography, TLC, Column Chromatography, LPLC, HPLC, Gel filtration Chromatography, Ion-Exchange Chromatography, Affinity Chromatography and GLC.

Unit 5 Spectroscopy (12)

Spectroscopy: Basic Principles of Electromagnetic Radiation, Beer-Lambert's Law. Principle, instrumentation, operation and applications of UV-Visible, IR, Spectrofluorimetry, Flame Photometry, AAS, NMR, ESR, X-Ray Diffraction, Mass spectrometry

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Evaluate the applicability, advantages, limitations and sources of error of current analytical instruments through an understanding of the working principles of these instruments and the underlying biochemical basis.

CO2: Conduct biochemical analyses and instrument evaluations in the laboratory and link the practical applications to the theoretical background

CO3: Interpret and critically evaluate analytical data and communicate the results of biochemical analyses in the form of formal scientific reports

CO4: Work collaboratively in a team environment to discuss and solve mathematically-based biochemical problems

CO5: Understanding the principles of Electrophoresis, Spectrophotometry and their applications in biological investigations/experiments.

Text Books

1. Keith Wilson and John Walker, Principles and techniques of Practical Biochemistry, 2010, Seventh edition, Cambridge University Press
2. Asokan P, Analytical biochemistry Biochemistry, 2009, Chinna publication.

Reference Books

1. Holme. D. J. and Peck. H., Longman Analytical Biochemistry, 1998, 3rd edition.
2. **Chatwal, G & Anand, S**, Instrumental methods of chemical analysis, 2005, **Himalaya Publishing House**
3. S. K. Sawhney & Randhir Singh, Introductory Practical Biochemistry, 2014, Narosa Publications House

WEBSITES:

1. http://www.freebookcentre.net/Chemistry/Analytical-Chemistry-Books.html
2. https://bpc.uchicago.edu/
3. https://www.chem.uwec.edu/chem406_f06/pages/lectnotes.html

CORE CELLULAR BIOCHEMISTRY 3 0 2 4

Course Objectives(Employability)

The objectives of the course are to learn and understand the fundamentals of cell biology like cell orgenelles, cytoskeleton, cellular transport, cell-extracellular matrix interaction, cell division, and protein trafficking and signal transduction etc.

Unit-I (12)

Plasma Membrane : Biochemical composition :Membrane proteins glycophorin, bacteriothodopsin, membrane bound enzymes-cell surface antigens, Molecular organization, freeze fracture technique and fluid mosaic model, lipid and protein fluidity and molecular mobility of proteins. Isolation and characterization of plasma model membranes: isolation techniques for making multilamellar vesicle, bilayer, reconstitution of proteins into vesicles, liposomes.

Unit-II (12)

Mitochondria-Structure of mitochondria, inner and outer membrane, cristae, matrix aerobic respiration, respiratory chain carriers, respiratory enzyme complexes and redox potential, inhibitors of respiratory chain, uncouplers,. Thermodynamic principles, Energy rich bonds, coupled reactions and oxidative phosphorylations, Bioenergetics. Reconstitution experiments, theories on oxidative phosphorylation-Chemiosmotic hypothesis- loop mechanism, respiratory control, inhibitors of oxidative phosphorylation.

Microsomal electron transport: Components and function-cyt p450-biosynthesis of steroids and their detoxification, oxidation of xenobiotics, microsomal hydroxylations and NADPH- dependent mixed function oxidation.

Unit-III (12)

Membrane transport: Small molecules, simple diffusion, Donnan equilibrium, diffusion of charged and uncharged particles, Flick's law, Nernst law passive transport. Facilitated transport :Pores and channels-properties, carriers, specificity, ionophores. Transport proteins: Periplasmic binding proteins. Active transport : Energy for active transport. Na pump models mechanisms, Ca pump, ATP dependent proton pump. Co-transport: Symport and Antiport; sodium dependent glucose transport aminoacids and calcium.

Unit-IV (12)

Microtubules-Structure, function and assembly, Colchicine interaction- formation of centrioles, basal bodies and mitotic spindle, cytokinesis. Golgi apparatus: ultra structural organization – cisternae

dictysomes: functions: exocytosis: Protein maturation and modifications; sorting of proteins. Ribosomes: Assembly of ribosomal sub units. Lysosomes: formation and function- phagocytosis, nucleus-Nuclear envelope: pore complex: Nucleolus- Structure and composition: Chromosome: Chromatin structure. Nucleosome, histone and non histone proteins.

Unit-V (12)

Vesicular traffic in the secretory and endocytic pathways-Transport from a) the ER through Golgi apparatus b)Trans Golgi Network to Lysosomes. Mannose 6-Phosphate receptor shuttles. Transport in excitable cells. Internalization of macromolecules by phagocytosis, endocytosis and exocytosis. Pinocytosis: Receptor mediated endocytosis- delivery of iron by transferring and infection. The molecular mechanisms of vesicular transport and maintenance of compartmental diversity.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO 1: Describe the structure, functions and the mechanism of action of enzymes. Learning kinetics of enzyme catalysed reactions and enzyme inhibitions and regulatory process. Ability to perform immobilization of enzymes. Exposure of wide applications of enzymes and future potential.

CO 2: Demonstrate the fundamental energetics of biochemical processes, chemical logic of metabolic pathways. Knowing in detail about concepts to illustrate how enzymes and redox carriers and the oxidative phosphorylation machinery occur.

CO 3: Understand the utilization of proton gradient to drive the formation of high energy bonds and high energy compounds.

CO 4: Describe the detailed structures of eukaryotic and prokaryotic cells and methods used to examine them. Acquiring knowledge on cell-cell interactions, Cell cycle cell division and apoptosis.`

CO 5: Describe the composition, structure and function of organelles and cell organelles and other cellular components.

Text Books

1. Biochemistry by Donald Voet and Judith Voet, third edition, Published by John Wiley & Sons, USA, (2004)

2. Molecular Biology of the cell-Bruce Alberts Alexander John, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, fourth Edition, Garland Science, Taylor and Francis Group, New york, USA (2002)
3. The cell and molecular approach -Geoffrey M. Cooper and Robert E Hausmann, third edition, ASM Press, Sinauer Associates Inc, Washington, DC (2007).

Reference Books

1. Molecular cell Biology –Lodish Baltimore, Berk, Matsudaira, Kaiser, Krieger, Scott, Zipursky, Darnell, fifth edition, Published by WH Freeman and Company, USA (2004)
2. Biochemistry –Jeremy M Berg, John L Tymoczko and LubertStryer, fifth edition, Published by WH Freeman and Company, USA (2007).

Websites

1. https://www.isical.ac.in/~losiana_t/Intro_2_Molbio_Losiana_Nayak.pdf
2. https://biolympiads.com/notes-of-molecular-biology-of-the-cell-by-alberts/

CORE PRACTICALS I BIOCHEMISTRY AND INSTRUMENTATION LAB 0 0 4 2

Course objectives (Skill enhancement)

The course aims to develop skills of performing basic biochemical tests important in clinical investigations, to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions.

LIST OF EXPERIMENTS

Biochemical Studies

1. Estimation of Tryptophan
2. Estimation of Lactate
3. Estimation of pyruvate
4. Estimation of protein by Bradfords method
5. Isolation and estimation of DNA,
6. Isolation and estimation of RNA
7. Isolation and estimation of glycogen from tissues.

Instrumentation Lab

8. Separation of Aminoacids/ sugars by paper chromatography and TLC
9. Separation of Plant pigments by column chromatography
10. Separation of Proteins by gel filtration chromatography
11. SDS PAGE-Demonstration

(30 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Develop an understanding about the standardisation of various biomolecules.

CO2: Examine the various techniques adopted for separation of biomolecules.

CO3: Examine the separation of biomolecules by electrophoresis.

CO4: Compare and discuss the instrumentation and applications of different chromatographic techniques.

CO5: Develop an understanding about the fundamental and applications of the instruments that are routinely used for the characterization of biomolecules

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).

2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).
3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.
3. Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

CORE **ENZYMES & ENZYME TECHNOLOGY** **4 0 0 4**

Course objectives (Employability)

This course aims to provide a basic understanding of fundamental knowledge on enzymes and their importance in biological reactions and Mechanism of action of enzymes. This course also provides the understanding the enzyme kinetics and role of coenzymes/co-factors and an overview of industrial application of enzymes.

Unit 1 Introduction (12)

Enzymes- Introduction, Nomenclature and classification of enzymes, isolation and purification of enzymes –criteria of purity - specific activity. Enzyme units - Katal, IU. Measurement of enzyme activity - Active site - determination of active site amino acids - chemical probe, affinity label, and site directed mutagenesis. Investigation of 3-D structure of active site. Abzymes, metalloenzymes, Isoenzymes and Multienzyme complex.

Unit 2 Enzyme Kinetics (12)

Kinetics of single substrate enzyme - catalysed reactions - Michaelis – Menten equation, importance of Vmax, Km, MM equation, and turnover number; Lineweaver - Burk plot, Eadie - Hofstee plot, Hanes - Woolf plot . Kinetics of Allosteric enzymes - MWC and KNF models. Hill' equation coefficient. Kinetics of multi – substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism.

Unit 3 Enzyme Catalysis and Inhibition (12)

Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lvsozyme, carboxy peptidase A and ribonuclease. Reversible Inhibition- competitive, non-competitive, uncompetitive, mixed, substrate and allosteric inhibition, feedback inhibition. Irreversible inhibition.

Unit 4 Coenzymes (12)

Coenzymes - prosthetic group and cofactors with examples. Structure, functions and mode of action of TPP (oxidative decarboxylation) , FMN , FAD ,NAD , NADP (redox reactions), PALP and PAMP – (transamination), Coenzyme A (Acylation/acetylation reactions), biotin – (carboxylation), tetrahydro folate (one carbon transfer), cobalamine coenzymes-cyano, hydroxo, methyl and deoxy adenosyl cobalamine- role in methyl group transfer and mutase reactions. Coenzymic functions of vitamin C, lipoic acid and coenzyme Q in metabolic reactions .

Unit 5 Industrial and Clinical Uses of Enzymes (12)

Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Immobilization of enzymes, methods and their applications. A brief account of non-protein enzymes - ribozymes and DNA enzymes. Clinical Enzymology - diagnostic significance and therapeutic effects. Use of isoenzymes in diagnosis - LDH, CK.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Describe different classes of enzymes and their functions.

CO2: Demonstrate basics of enzyme catalyzed reactions and their mechanisms.

CO3: Develop the specificity of enzymes and the chemistry involved in enzyme action.

CO4: Elaborate the enzyme kinetics, various factors regulating catalysis, different models for analyzing the enzyme kinetics.

CO5: Summarize the fundamental knowledge on enzymes, kinetics and their importance in biological reactions.

Text Books

1. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005

2. Trevor Palmer. (2001). Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Horwood Chemical Science Series. Horwood Publishers.

3. Lewis Stevens and Nicholas C. Price. (1998). Fundamentals of Enzymology. 2nd edition,Oxford University Press.

Reference Books

1. Donald Voet, JudithVoet G., Fundamentals of Biochemistry, John Wiley and Sons , Inc., Asia, 2006

2. Trevor Palmer, Understanding Enzymes, 4th edition, 1995

CORE INTERMEDIARY METABOLISM 4 0 0 4

Course objectives (Employability

The paper intends to provide a basic understanding of the biochemical reactions of molecules, role of enzymes as key elements that govern the biochemical transformations, break-down and synthesis of various biomolecules and the turnover of carbohydrates, proteins, lipids and nucleic acids. To study the concepts of regulation of metabolic pathways. To elaborate the relation between biochemical defects and metabolic disorders

Unit 1 Carbohydrate metabolism (12)

Fate of dietary carbohydrates. Glycolysis and Gluconeogenesis pathway and significance with energetic & regulation, Cori cycle, Metabolism of Glycogen, TCA cycle - Energetics and its regulation. Pentose phosphate pathway. Uronic acid pathway. Gloxylate cycle. Malate/glycerol phosphate shuttle. Importance of Rate limiting enzymes. Futile cycles in carbohydrate metabolism. Interrelationship of metabolic pathways

Unit 2 Lipid Metabolism (12)

Fate of dietary carbohydrates. Oxidation of fatty acids - Beta oxidation, alpha oxidation and omega oxidation. Metabolism of Ketone bodies - Formation, Utilization, Excretion and significance. Metabolism of Triglyceride, Phospholipids, sphingolipids and cholesterol. Biosynthesis of saturated and unsaturated fatty acids. Importance of Rate limiting enzymes.

Unit 3 Protein Metabolism (12)

Introduction, fate of dietary proteins, catabolism of amino acids - transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle and its regulation.

Unit 4 Nucleic acid Metabolism (12)

Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides-denovo synthesis and salvage pathways. Regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides - denovo synthesis and salvage pathways. Regulation of pyrimidine synthesis.

Unit 5 Biological Oxidation (12)

Introduction - Laws of thermodynamics, free energy, free energy of hydrolysis of ATP and other organophosphates. Role of High energy compounds - Electron transport chain- Components and reactions of ETC. Role of ETC - Oxidative Phosphorylation - Chemiosmotic hypothesis. P/O ratio, ATP/ADP exchange, uncouplers of oxidative phosphorylation. Role of uncouplers in regulation of obesity.

(60 Hours)

Course outcomes:

After the completion of this course, the student will be able to

CO1: Discuss the overall concept of cellular metabolism – anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis.

CO2: Understand the organization of signaling pathways that regulates the metabolism.

CO3: Explain the integration of biomolecules that takes place in human system.

CO4: Apply the knowledge of intermediary metabolism in clinical biochemistry

CO5: Identify how changes in normal metabolism lead to disease.

Text Books

1. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005
2. JL Jain, Sanjay Jain and Nitin Jain, Fundamentals of Biochemistry, 6th edition; 2005
3. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2nd edition; 2006
4. Lubert Stryer, Jeremy M Berg and John L Tymoczko, Biochemistry 5th edition; 2005
5. Harper's Biochemistry (2012) 29th ed., Murray, R.K., Granner, D. K., Mayes and P.A., Rodwell, V.W., Lange Medical Books/McGraw Hill.

Reference Books

1. Malcolm Dixon and Edwin Clifford Webb, Enzymes (Volume 6), 1964
2. Robert K Murray, Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 27th edition; 2006
3. BD Hames, NM Hooper and JD Houghton, Instant Notes in Biochemistry, 1st edition, 1997

WEBSITE:

https://www.ncbi.nlm.nih.gov/books/NBK116085/

CORE **CLINICAL BIOCHEMISTRY** **4 0 0 4**

Course Objectives (Employability

The course aims to provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders. The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, mechanisms of causation of diseases of liver, kidney and pancreas. Students will get acquainted with the role of enzymes in diagnosis of various diseases.

UNIT I Specimen collection and Analysis (12)

Collection of blood - venipuncture, skin puncture, arterial puncture and anticoagulants. Collection of urine:- Timed urine specimens, urine preservatives. Test for urinary compounds. Clinical significance of urinary components with reference to sugars, proteins, ketone bodies, bilirubin and porhyrins. CSF:- Composition and collection, chemical examination and infections, spinal cord infections. Amniotic fluid:- Origin, collection, composition and analysis of amniotic fluid.

UNIT II Organ function tests (12)

Liver function test and related disorders:-Jaundice ,cirrhosis, hepatitis, fatty liver and gall stones. Renal function test and related disorder:- Acute renal failure, glomerular disease,tubular diseases, analysis of urinary calculi. Assessment of Gastric and pancreatic function test. Enzyme parameters in these pathological conditions.

UNIT III Clinical enzymology (12)

Principles of diagnostic enzymology - Factors affecting enzyme levels in blood. Principle, assay, and clinical significance of transaminases, creatine kinase, lactate Dehydrogenase, phosphatases, isocitrate dehydrogenase, 5'nuclotidase, gamma –glutamyl transferase, amylase, lipase, trypsin, chymotrypsin, choline esterase, glutamate dehydrogenase, glucose -6-phosphate dehydrogenase and ceruloplasmin

UNIT IV Metabolic disorders (12)

Carbohydrate metabolism: Diabetes mellitus – classification, metabolic abnormalities, diagnosis and management. Glycogen storage diseases, galactosemia, fructose intolerance and fructosuria. Lipid metabolism: Diagnostic significance of analysis of serum lipids, Lipoprotein metabolism and disorders. Lipid storage Diseases, Atherosclerosis and risk factors. Disorders of amino acid metabolism– amino aciduria, Phenylketonuria, Hartnup disease, alkaptonuria, albinism, cystinuria and maple syrup urine disease. Disorders of nucleic acid metabolism: Hyperuricemia and gout. Hypouricemia, xanthinuria.

UNIT V Free Radical and Cancer (12)

Free radicals in health and disease - Endogenous and exogenous free radicals. Oxidative damages to

lipids, proteins and DNA. Role of enzymatic and nonenzymatic antioxidants. Cancer: Morphological and metabolic changes in tumor cells. Tumor markers – Classifications and AFP, CEA, hCG. Medical imaging techniques – CT, MRI, PET and SPECT.

(60 Hours)

Course Outcomes:

After the completion of this course, the student will be able to

CO1: Elaborate on the role of health and its affliction by various diseases/disorders.

CO2: Eloborate the Basic concepts and principles of Clinical Biochemistry.

CO3: Recall the metabolism of carbohydrates, lipids and proteins.

CO4: Interpret the role of enzymes in clinical diagnosis of diseases.

CO5: Create awareness of different lifestyle diseases increasingly found in present day.

Text Books

1. M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Publisher. 6th edition, 2006.

2. Teitz, Textbook of Clinical Biochemistry. 3rd edition Burtis et al., William Heinmann Medical Books Ltd. 1999.

Reference Books

1. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.

2. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7th Edition, 2010.

3. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, Clinical Biochemistry. 5th edition, 2013.

PRACTICAL – ENZYMOLOGY 0 0 4 2

Course objectives (Skill enhancement)

The course introduces students to various practical aspects of enzymology and stimulates the students interest in learning the structure, function and kinetics of enzyme and their correlation in disease conditions. This course also makes the students to learn determination pH optimum, Km and Vmax of enzymes and to analyse enzyme kinetics and the effect of factors on enzyme activity.

LIST OF EXPERIMENTS

1. Determination of Optimum pH of Salivary Amylase.
2. Determination of specific activity of Salivary Amylase
3. Determination of Optimum pH of Acid Phospatase
4. Determination of Optimum temperature of Acid Phospatase.
5. Determination of specific activity of Acid Phospatase.
6. Determination of enzyme activity of Creatine kinase.
7. Determination of enzyme activity of Lactate Dehydrogenase
8. Isolation of β -Amylase from Sweet Potato
9. Assay of Urease from Horse – gram
10. Determination of enzyme activity of Adenosine Tri Phosphatase
11. Determination of enzyme activity of Serum Glutamate Oxaloacetate Transaminase
12. Determination of enzyme activity of Serum Glutamate Pyruvate Transaminase

(30 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Isolate enzymes from biological sources. Discern optimal conditions of enzyme activity.

CO2: Determine the Optimum pH and temperature of Acid Phospatase. Assay the specific activity of Acid Phospatase.

CO3: Determine the Optimum pH and specific activity of Alkaline Phosphatase. Determine the Optimum pH of Salivary Amylase. Assay the specific activity of Salivary Amylase.

CO4: Analyze and Estimate the enzyme activity of Creatine kinase. Assay the enzyme activity of Lactate Dehydrogenase.

CO5: Analyze and Estimate the enzyme activity of Adenosine Tri Phosphatase. Assay the enzyme activity of Serum Glutamate Oxaloacetate Transaminase. Determine the enzyme activity of Serum Glutamate Pyruvate Transaminase.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).

2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.

2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.

3. Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

CORE PRACTICAL – CLINICAL BIOCHEMISTRY 0 0 4 2

Course objectives (Skill enhancement

The course introduces students to apply various techniques for the analysis of body fluids, cells and tissues and interpretation of the results in relation to health and disease. This course also develop the students to analyze the biochemical parameters in urine and blood samples and indicate their clinical significance. The discipline encompasses fundamental and applied research into the biochemical and physiological processes of human life and application of the resulting knowledge and understanding to the diagnosis, treatment and prevention of disease.

LIST OF EXPERIMENTS

Analysis of Biological Samples

1. Hematological analysis-RBC, WBC-TC/DC, Hemoglobin content and ESR
2. Analysis of normal and abnormal urine constituents
3. Estimation of Calcium

Enzyme assays

4. Assay of Enzymic antioxidants-SOD, Catalase and GPx
5. Assay of Creatine kinase, LDH and Na K ATPase
6. Assay of SGOT/ SGPT

Biochemical Studies

7. Estimation of renal indices-Urea, Uric acid and Creatinine.
8. Estimation of Blood Glucose
9. Estimation of Serum Bilirubin
10. Estimation of A:G ratio in serum
11. Estimation of serum Cholesterol.
12. Estimation of Vitamins-A & E

(30 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the different biological samples and their collection procedures. Perform biochemical laboratory analysis in blood samples

CO2: Analyze biochemicals in urine samples. Distinguish serum, plasma and whole blood emphasizing the role of anticoagulants

CO3: Assess presence and absence of normal and abnormal constituents in urine by performing qualitative urine analysis.

CO4: Analyze glucose, urea protein, total protein and A/G ratio in blood

CO5: Determine analytes such as creatinine, uric acid, cholesterol and triglycerides in serum. Evaluate and interpret the generated results after analysis in order to determine the likely diagnosis.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).

2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009

3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.

2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.

3. Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

CORE GENETICS & MOLECULAR BIOLOGY 4 0 0 4

Course objectives Employability

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in different organisms.

Unit 1 Genetics (12)

Gene concept and interaction of genes. Molecular structure of genes and chromosomes. Mendel's work on heredity, Mendel's mono and dihybrid experiments. Mendel's Laws, Linkage and crossing over, coupling and repulsion hypothesis, sex linked inheritance. Non-chromosomal inheritance. Gene expression, Genetic change.

Unit 2 Replication (12)

Evidences for DNA as the genetic material. DNA structure, Structural organization and functional elements of eukaryotic chromosomes. Prokaryotic and Eukaryotic replication, Regulation of replication, Mutation and its types, Recombination, DNA Repair, Replication fork, DNA replicating proteins.

Unit 3 Prokaryotic Transcription (12)

Prokaryotic transcription. RNA polymerase, Inhibitiors of transcription. Post transcriptional processing of rRNA and tRNA. Regulation of transcription in prokaryotes– the lac operon, negative and positive regulation and tryptophan operon.

Unit 4 Eukaryotic Transcription (12)

Eukaryotic transcription and regulation. RNA polymerase I,II and III, promoters, transcription factors, Transcription factor motifs, Activators, repressors and enhancers, transcription complex assembly and mechanism of transcription. Post transcriptional processing of mRNA, rRNA and tRNA. Splicing, Alternative splicing, catalytic RNA (ribozymes), RNA editing, Antisense RNA.

Unit 5 Translation (12)

Genetic code and translation. The genetic code – general features, Deciphering the code, Wobble Hypothesis. Translation- activation of aminoacids, initiation, elongation, termination in prokaryotes and eukaryotes. Regulation of gene expression in eukaryotes. DNA methylation, chromatin remodelling, DNA response elements, degradation of proteins. Protein sorting, targeting of proteins to mitochondria, chloroplast and nucleus, Receptor mediated endocytosis

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Organize and understand the basics of heredity population genetics and master fundamental genetic calculation

CO2: Understand and construct the synthesis of DNA and Post replication processes and the molecular mechanisms behind DNA damage and repair

CO3: Understand the differentiate synthesis of RNA and post transcriptional modification and Differentiate the synthesis of protein and its post translational modifications cell division

CO4: Describe and compare different molecular mechanisms to bring about cell death and explain how this is linked to DNA damage

CO5: Explain and compare different principles of how extracellular signals can reach the cell interior, be amplified, transmitted and terminated, and exemplify how signal routes are integrated and how specificity can be achieved

Text Books

1. De Robertis, Cell and molecular biology. Dhanpat Rai Publisher, 8th Edition, 2001.

Nalini Chandar, Susan Viselli, Lippincott Illustrated Reviews: Cell and Molecular Biology.LWW :North American Edition (2010).

2. Robert Franklin Weaver, Molecular Biology. Mc-Graw Hill science, 5th edition, 2011.

Reference Books

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Molecular biology of the cell. Garland Science, 6th edition (2014).
2. Benjamin Lewin, Genes IX. Jones & Bartlett Learning; 9 edition (2007).
3. Harvey Lodish, Arnold Berk & Chris A. Kaiser, Molecular Cell Biology. W. H. Freeman; 6th edition (2007).
4. James D. Watson, Tania A. Baker, Stephen P. Bell, Molecular Biology of the Gene. Benjamin Cummings, 7th Edition (2013).
5. Gerald karp, Cell and Molecular Biology: Concepts and Experiments, Wiley; 7th Edition edition (2013).

WEBSITES:

1. https://microbenotes.com/category/molecular-biology/
2. https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notes-study-materials/

CORE MOLECULAR DEVELOPMENTAL BIOLOGY 4 0 0 4

Course objectives Employability

The course integrates the descriptive, experimental and biochemical approaches into a conceptual framework for the analysis of development. The course deals with key steps in the transformation of the single-celled zygote into the complex, multicellular, adult organisms and links genetics with embryology.

Unit 1 Evolution and Fertilization (12)

Introduction, history and evolution – an overview. Development among unicellular eukaryotes Acetabularis, Naegleria. The origins of sexual reproduction. Fertilization: structure of gametes, recognition of sperm and egg –action at distance and contact of gametes. Cleavage: Patterns of embryonic cleavage, radial holoblastic cleavage, spiral holoblastic cleavage, mechanisms of cleavage –regulation of cleavage cycles.

Unit 2 Model organisms (12)

Major model organisms. Availability/ culture and cost; access and micromanipulation. Examples: Drosophila, zebrafish, Caenorhabditis elegans, chicks

Unit 3 Embryonic development in animals (12)

Early Embryonic Development, morphogenesis and organogenesis in animals: Blastula formation, Types of Cleavage, Gastrulation and formation of germ layers in animals. Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, organogenesis –vulva formation in Caenorhabditis elegans; eye lens induction, limb development in vertebrates, neuron differentiation, larval formation, metamorphosis; environmental regulation of normal development.

Unit 4 Early Embryonic Development in plants (12)

Early Embryonic Development in plants: Gametogenesis, Fertilization, Embryo sac development and double fertilization in plants.

Unit 5 Regeneration and Apoptosis (12)

Cell death and regeneration. Concept of regeneration; cell cycle, programmed cell death; aging and senescence. Basics of cancer development.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1:Develop knowledge and understand the biological process increases by using a historical approach to science.

CO2: Explain the molecular mechanisms that underlie animal development

CO3: Explain underlying developmental biology processes during tissue development and organogenesis

CO4:Develop an understanding about the basic concepts of developmental biology

CO5: Compare and contrast the different process of differentiation to many different types of cells and tissues.

Text Books

1. T. Subramoniam, Molecular developmental biology. 2nd Edition, 2011.

2. Manju Yadav, Molecular Developmental Biology. Discovery Publishing Pvt.Ltd. 2008.

3. Abhilash jain, Advanced developmental biology. 2010.

Reference Books

1. Scott F. Gilbert, Susan Singer, Developmental Biology. Sinauer Associates Inc.; 8th ed, 2006.

2. Jonathan M. W. Slack, Essential Developmental Biology. Wiley-Blackwell. 3rd Edition, 2012.

3. Fred Wilt and Sarah Hake, Principles of Developmental Biology. First edition, 2003.

4. R.M. Twyman, Developmental Biology. First edition, 2001.

5. Lewis Wolpert, Developmental Biology: A Very Short Introduction. Oxford University Press; 1st edition, 2011.

WEBSITE:

https://plato.stanford.edu/entries/biology-developmental/

CORE **PLANT & ANIMAL TISSUE CULTURE** **4 0 0 4**

Course objectives Employability

The objectives of this course is to educate students about the fundamental concepts of plant, animal and microbial cell system, their differences, related applications, thus preparing them to meet the challenges of the new and emerging areas of biotechnology industry.

Unit I (12)

Introduction of plant tissue culture and cell suspension culture, physico-chemical conditions for propagation of plant cells and tissues, composition of media, nutrient and hormone requirement; Types of culture – callus, embryo, protoplast culture.

Unit II (12)

Invitro pollination and fertilization; somatic embryogenesis and somoclonal variation. Immobilised plant cells. Conservation of germplasts.

Unit III (12)

Plant tissue culture – genetic engineering : Transfer of nucleic acid to plant cells: - Direct transformation by electroporation and particle gun bombardment; - Agrobacterium, Ti plasmid vector. Theory and techniques for the development of new genetic traits, conferring resistance to herbicide, pesticide, plant pathogens. Biosynthesis of secondary metabolites of biotechnological importance

Unit IV (12)

History of animal cell culture and development, Development of primary culture, Development of cell line by enzymatic disaggregation, Culture media and growth conditions. Cell type and characterization, origin of animal cell line, maintenance and characterization of different cell lines, Marker gene characterization. Cryopreservation.

Unit V (12)

Cell growth characteristics and kinetics, Micro-carrier attached growth, Cell culture in continuous, perfusion and hollow fibre reactor, Mass transfer in mammalian cell culture. Hybridoma technology, Organ culture technology.

(60 Hours)

Course Outcomes:

After studying this course, students will be able to:

CO1: Develop a fundamental understanding of basic concepts of animal and plant tissue culture methods and their applications in the field of Biotechnology.

CO2: Differentiate between the various sources of cells to be used in cell culture techniques

CO3: Correlate between different biological samples and understand the importance of different media in tissue culture

CO4: Comprehend the applications of plant, animal and microbial cell culture in industry, healthcare and environment.

CO5: Evaluate applications of various concepts¬ & techniques of animal and plant tissue culture to facilitate biotechnological advancement and innovations.

Text Books:

1. Introduction to Biotechnology, P.K.Gupta, Kalyani Publishers,second edition.
2. Introduction to plant Biotechnology, H.S.Chawala, second ed., PHI

Reference Books

1. Plant Biotechnology – P. C. Trivedi
2. Applied Plant Biotechnology – Ignacimuthu
3. Animal Biotechnology – Babinnk and Philips. 6. Biotechnology – B. D. Singh.
4. Plant Tissue Culture – S.S. Bhojwani, M.K. Razdan

CORE PRACTICAL – MOLECULAR BIOLOGY LAB 0 0 4 2

Course objectives (Skill enhancement

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases. Hands –on training of the latest molecular biology techniques.

LIST OF EXPERIMENTS

1. Separation of proteins by SDS PAGE.
2. Determination of molecular weight of serum proteins by SDS PAGE
3. Study of enzyme activity on Native PAGE.
4. Isolation of protein and analysis.
5. Amplification techniques
6. Isolation of plasmid DNA genomic DNA from plant source.
7. Separation of DNA by Agarose gel electrophoresis.
8. Determination of size of DNA by agarose gel electrophoresis
9. RFLP.
10. Gene amplification by PCR.
11. RT-PCR (Demonstration)
12. Southern hybridization (Demonstration).
13. Western blotting (Demonstration).

(30 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Determine and understand the basic principle involved in isolation of biomolecules from various biological sources

CO2: Isolate and purify DNA and RNA from various sources – viz plant, microbes and animals

CO3: Separate Proteins by SDS PAGE, Native PAGE

CO4: Understanding the mobility differences of macromolecules in electrophoresis and the optimal conditions essential for protein/nucleic acid separation and purification and determine molecular weight and molecular size of protein

CO5: Understand the application of these techniques

References

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Ed.
2. S.K.Sawhney and Randhir Singh. Introductory practical biochemistry. 2nd edition.2005.

CORE TOXICOLOGY AND FORENSIC BIOCHEMISTRY 4 0 0 4

Course objectives Employability

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

Unit 1 Introduction to toxicology (12)

Fundamentals of Toxicology and dose-Response Relationships. Factors Affecting Toxic Responses. Disposition: Absorption, Sites of absorption, distribution, Excretion. Metabolism: types of Metabolic changes - phase-I reactions; Phase-2 reactions. Toxication vs. Detoxication. Biochemical basis of toxicity: Mechanism of toxicity. Covalent binding to cellular macromolecules & genotoxicity, Tissue specific toxicity.

Unit 2 Clinical toxicology (12)

Types of poison, Clinical signs and Symptoms, diagnosis, management and medicolegal aspects of corrosive poisons; irritant poisons; neural poisons; somniferous; inebrient; delirient; spinal; peripheral; cardiac poisons; asphyxiants; drug abuse.

Unit 3 Introduction to forensics (12)

Legal procedures in India; medical and medico Legal documents; evidences; witnesses; laws related to medical profession. Medical Council of India, State Medical Council: structure, functions, powers; duties of medical practitioners towards patients and relatives, medical negligence: civil, criminal; Consumer Protection Act: rights and liabilities of doctors, medical indemnity insurance; human rights and violation; duties of medical practitioners to victims of torture; Human organ transplantation Act.

Unit 4 Identification procedures (12)

Identification of the living and the dead. Forensic thanatology; death; causes of death; mechanism and manner of death; changes after death; artifacts; medico-legal death investigation; exhumation. Forensic science; Locard's exchange principle; lie detector; superimposition; DNA finger printing, HLA typing.

Unit 5 Pathology (12)

Injuries - mechanical injuries; injuries due to electricity, lightning and radiation; train and road traffic accidents; firearm and explosion injuries; medico legal aspects of wounds.

General aspects of patho-physiology and classification of mechanical asphyxia: hanging; strangulation, drowning, smothering, choking, garroting, burking, yoking.

(60 Hours)

Course outcomes:

After the completion of this course, the student will be able to

CO1: Describe the basic concepts of toxicology, toxins, the biochemical basis of toxicity and injuries.

CO2: Implement the knowledge of medico-legal procedures in India and the proceedings involved in criminal cases and also the basic understanding of identification procedures employed under the Forensic toxicology lab.

CO3: Examine, predict and give solution to the problems when handling or exposed to various toxic materials and also make assessments in forensic lab.

CO4: Implement the knowledge gained from this subject to protect and aware the people about toxins and medico-legal aspects in India.

CO5: Describe the various identification procedures employed under the Forensic toxicology

Text Books

1. Narayanareddy K. S., The Essentials of Forensic Medicine & Toxicology, 2007. Published by K. Sugana Devi, 26th Edition, Hyderabad.
2. Basu, R. Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition. Books and Allied (P) Ltd. Kolkata.

Reference Books

1. Parikh C.K. Parikh's Textbook of Medical Jurisprudence and Toxicology, Publishers Bangalore. 6th Edition 1999, Reprint 2007
2. Franklin, C.A Modi's medical Jurisprudence and Toxicology, published by M. Tripathi Private Limited, 21st Edition. Bombay.
3. Keith Simpson, Bernard Knight, 1988, Forensic Medicine, ELBS. 9th Edition
4. Pillay V.V., Text book of Forensic Medicine, 2009, Paras Publication. Hyderabad
5. JB Mukherjee's Forensic Medicine and Toxicology – Volume I and II (combined)-edited by Karmakar, III Edition 2007.

WEBSITES:

1. https://mrssmithsblog.net/fs-class-notes/
2. https://msrobbinspnhs.weebly.com/forensic-science-notes.html

CORE **PROJECT WORK** **0 0 8 4**

(Skill enhancement

The final requirement for awarding the MSc degree is the completion of a substantial and original research project.

The successful completion of this requirement is demonstrated through the production of a dissertation document, describing the research project and its results, and the defense of the project from challenges offered by the members of the student's faculty Dissertation Committee.

The quality of the dissertation and the defense of its thesis are evaluated by the Dissertation Committee in order to determine if the student has successfully completed this final requirement for the MSc degree in Biochemistry.

(60 Hours)

DISCIPLINE SPECIFIC ELECTIVE SYLLABUS

DSE **HUMAN PHYSIOLOGY** **4 0 0 4**

Course objectives Employability

The objective is to impart knowledge and understanding of the human body. To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various organs.

Unit 1 Circulatory System and Muscles (12)

Definition and scope of anatomy, physiology. Anatomical terms in relation to parts of the body, system and organs. **Blood:** Composition and function. Types and function of blood cells. Haematopoiesis. Blood grouping- ABO, Rhesus system and Bombay blood group system. Blood coagulation. Structure and function – Spleen and lymphatic System. Circulatory system and Heart - Structure and functions of heart and associated blood vessels, Cardiac cycle. Blood Clotting. Hormones involved in the regulation of circulatory system. **Tissues:** Types of tissues and their functions. Muscles -Types of muscle cells and their functions. Mechanism of muscle contraction. Hormones involved in the regulation of respiratory system

Unit 2 Digestive and Respiratory System (12)

Digestive System: Structure and functions of alimentary canal - mouth, oesophagus, stomach, small intestine, large intestine – Digestion and absorption of food in the mouth, stomach and intestines. Various movements of digestive system. Salivary gland, Pancreas and Liver – structure and function. Defecation. Hormones involved in the regulation of digestive system. **Respiratory System:** Outline of various components of respiratory system. Mechanism and chemistry of respiration - considerations, transport of gases, exchange of gases. Bohr effect and role of 2,4 DPG.

Unit 3 Excretory system (12)

Structure and role of kidney, nephrons, ureter, urinary bladder and urethra. Mechanism of urine formation- Glomerular filtration, GFR, tubular secretion and reabsorption. Regulation of water balance, electrolyte balance, acid-base balance. Hormones involved in the regulation of excretory system.

Unit 4 Nervous System (12)

Brief outline of nervous system- types of nerve cells and nerve fibres, brain, spinal cord. Communication: Electrical and chemical communications - Transmission of nerve impulse, action potential, neurotransmitters and synapses, Membrane channels/carriers. Sleeping: Circadian rhythm, SEM and

REM. Reward circuit of brain. Sense organs – Vision, hearing and tactile response. Hormones involved in the regulation of Nervous system.

Unit 5 Reproductive system (12)

Structure and functions of male and female reproductive system: Ovulation, menstrual cycle. Spermatogenesis and factors influencing sperm count and viability. Biochemistry of fertilization. Physiological changes during pregnancy, parturition and lactation.

(60 Hours)

Course outcome: After the completion of this course, the student will be able to

CO1: Discus in-depth the structure and physiology of major human organs and explain their role in the maintenance of healthy individuals.

CO 2: Discuss in detail how the activities of organs are regulated for maximum efficiency.

CO 3: Explain in-depth the interplay between different organ systems and how organs and cells interact to maintain biological equilibrium in the face of a variable changing environment.

CO 4: Identify how changes in normal physiology lead to disease.

CO5: Implement the knowledge of human physiology in clinical biochemistry to predict and understand the disease.

Text Books

1. Guyton AC. Text book of Medical Physiology, 8th Edition. Prism books (pvt), Bangalore, India. TATA McGraw-hill publishing Company, 1991.
2. C.C. Chatterjee, Human Physiology (Vol. I & Vol. II), Medical Allied Agency, Calcutta, 11thedition, 1985.

Reference Books

1. Ganong (Williams) Review of medical physiology. 25th edition. 2015. McGraw-Hill.
2. Ross and Wilson. Anatomy and physiology In health and illness. 12th ed, 2014. Elsevier.

WEBSITES:

1. https://microbenotes.com/category/human-physiology/
2. https://www.embibe.com/study/human-physiology-unit

DSE **RESEARCH METHODOLOGY** **4 0 0 4**

Course objectives Employability

The course was designed in such a way to understand the aspect of doing research; this will help the students to have focused idea about the research methodologies and how to write research findings.

Unit 1 Introduction (12)

Research; definition, objective, motivation, types and significance. Collection of primary data, Collection of secondary data, selection of appropriate method for data collection, sampling techniques, Reliability and validity of research tools.

Unit 2 Data analysis (12)

Defining the Research Problem: Concept and need, Identification of Research problem, defining and delimiting Research problem.observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with available statistic package

Unit 3 Research design (12)

Research design. Meaning and Need, Features of Good Design, Concepts, Types. Basic principles of Experimental Design, various methods of Research. Survey, Philosophical, Historical, Experimental, Causal Comparative, Genetic, Case Studies.

Unit 4 Research ethics(12)

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty; scholarly publishing design of research paper,, plagiarism, reproducibility and accountability.

.**Unit 5 Thesis Preparation and Writing (12)**

Basics Steps in research –Problem Selection- Experimental design- Review of Literature- Types of Literature- Reprint requisition, Preparation of Research Report/ Dissertation/Review- Abstract, Short notes, Contents of Dissertation (Introduction, Methodology, Results, Discussion, Summary, References/ Bibliography), Citation of Reference- Presenting Tables, Figures, Plates, Annexure, Acknowledgement, Formatting and Typing- Proof Reading.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Hypothesize and design a research objective

CO2: Modify a research problem and get an output using the primary and secondary data

CO3: Prepare a questionnaire for a research problem. Invent or design an outcome for a research problem Learn the ethics of research and the property rights for the research design

CO4: Explore selection of test material, designing an experiment, different methods of literature collection

CO5: Learn how to prepare a dissertation, preparation of articles, communication of articles to journals

TextBooks

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.

3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.

Reference Books

1. Anderson.j.et al, Thesis and assignment writing, 1970, Wiley eastern Pvt. Ltd. Delhi
2. Alexis Lcon and Mathew's icon, Fundamentals of Information Technology, 1999, Wikas Publisher.
3. C. R. Kothari, Research Methodology: Methods and Techniques, 2005. 2nd Edition, New Age international(P) Limited, India.

Website

1. https://www.jou.ufl.edu/grad/forms/Guidelines-for-writing-thesis-or-dissertation.pdf

DSE **BIOTECHNOLOGY & IPR** **4 0 0 4**

Course objectives Employability

The content of the syllabus consist of basic biotechnology and its application such as new tools, products developed by biotechnologists such as cell culture, transgenic animals, Genetic engineering are useful in research, agriculture, industry and the clinic. It also helps to understand the Basic principles involved in Intellectual properties rights , scope and importance of marketing and its systems.

Unit 1 Vectors (12)

Restriction enzymes and joining DNA molecules by DNA ligase, double linkers, adaptors,homopolymer tailing. Plasmids vectors (pBR322, pUC 18), phage vectors (M13), cosmids,expression vectors, yeast vectors –YAC. Selection and screening of recombinants by geneticmethods, immunochemical methods, nucleic acid hybridization methods. Synthesis of probes byradioactive and non–radioactive labeling. Analyzing DNA sequences by Maxam and Gilbert method and Sanger's methods.

Unit 2 Gene transfer methods (12)

Introduction of Foreign Genes into Cells using direct gene transfer methods - electroporation, biolistic transfer, transfection, microinjection, lipofection and ultrasonication. Genomic DNA libraries, chromosome walking, cDNA cloning, PCR, RAPD and RFLP.

Unit 3 Cell culture (12)

Cell and organ culture, primary cell culture, cell media and its types, transfer of genes into animal cells in culture. Viral vectors: SV40, retrovirus and adenovirus. In vitro fertilization and embryo transfer. Selectable markers and reporter transgenes. Gene therapy and Antisense therapy.

Unit 4 Transgenic animals (12)

Production of medically important biomolecules - insulin, growth hormone, interferons, blood proteins, vaccines, lyphokines and monoclonal antibodies. Production of transgenic animals – transgenics and knock-outs. Production of transgenic sheep, cattle, pigs, fish etc. Development and applications of transgenic animals.

Unit 5 IPR (12)

Intellectual Property Rights (IPR) and Protection, Intellectual Property rights for Plant Breeding,Biosafety in biotechnology and Bioethics. Biotechnology Entrepreneurship.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO 1: Explain the general principles of generating transgenic plants, animals and microbes. Identify and debate the ethical, legal, professional, and social issues in the field of biotechnology and design and deliver useful modern biotechnology products to the Society**.**

CO 2: Understand the role of vectors, plasmids in gene technology. Understand the gene transfer methods

CO 3: Understand the DNA sequencing methods. Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP. Identify, apply and assess issues relating to each of the relevant areas of intellectual property in various fields of scientific research.

CO 4: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development. Understand the potential role of ownership rights and marketing protection in encouraging, or discouraging, scientific research.

CO 5: Be familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.

Text Books

1. Sathyanarayana, Biotechnology, Books and allied Publishers, 3rd edition, 2006

2. RC Dubey, Text book of Biotechnology , S. Chand & Co, 2009

Reference Books

1. Brown TA “Gene cloning: An introduction” Nelson Thornes, 3rd edition, 1995

2. SS Purohit. Biotechnology Fundamentals and applications. Agrobios Publication. 4th edition. 2007

WEBSITES:

1. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
2. https://www.easybiologyclass.com/topic-biotechnology/

DSE **ENDOCRINOLOGY** **4 0 0 4**

Course objectives Employability

This paper ascertains that the biochemists get an accurate information about various hormones, functions, mechanism of action, and related disorders.

Unit 1 Pituitary Hormones (12)

Hormones – Classification, biosynthesis, transport, modification and degradation. Structure of receptors, Feedback regulation. Mechanism of hormone action. Hypothalamic and pituitary hormones. Hypothalamic releasing factors. Hypothalamic hypophysealportal system. Anterior pituitary hormones-GH, TSH, ACTH, LH, FSH and PRLbiological role, feedback regulation and related disordersof hypo and hyper secretion.. Posterior pituitary hormones-oxytocin and vassopressin – biological actions, regulation and related disorders.

Unit 2 Thyroid hormones (12)

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Parathyroid hormones-Parathormone and Calcitonin -biological actions, and related disorders-. Hypercalcemia and hypocalcemia, Rickets and osteomalacia.

Unit 3 Adrenal Hormones (12)

Hormones of Adrenal cortx- Synthesis, action, biological role, regulation, transport and metabolism. Adrenal function tests. Disoders of adrenal cortex-Cushing's syndrome, aldosteronism, Congenital adrenal hyperplasia, Adrenal cortical insufficiency. Hormones of Adrenal medulla synthesis, biological role, metabolism, regulation and related disorder- Phaeochromocytoma.

Unit 4 Pancreatic hormones (12)

Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagon, somatostatin and insulin. Insulin receptors. Related Disorders – Diabetes mellitus. Brief account of gastrointestinal Hormones.

Unit 5 Gonadal hormones (12)

Gonadal hormones - Biosynthesis, biological actions, transport, regulation and metabolism of androgens, oestrogen and progesterone., The menstrual cycle. Pregnancy –Biochemical changes and diagnostic tests. role of hormones during parturition and lactation.Gonadal disorders.

(60 Hours)

Course outcome:

After the completion of this course, the student will be able to

CO1**:** Understand the hormonal regulation of physiological processes in animals with special reference to humans.

CO2: Describe the various endocrine systems, hormones, and their role in nutrition.

CO3: Analyze the role of the endocrine glands and their neuronal networks.

CO4: Identify the class and functions of various types of second messengers and their action.

CO5: Discuss the pathophysiology, diagnosis, treatment and management of endocrine disorders

Text Books

1. Prakash.S.Lohar, Endocrinology, MJP Publishers, 2005
2. R.Radheshyam, Textbook of Endocrinology, Neha Publishers, 2012.

Reference Books

1. **Hadley ME**, The vertebrate **endocrine** system, in. **Endocrinology**, 4th **Edition** (Prentice Hall, NJ) 1996.
2. C. Guyton, MD and John E. Hall, Textbook of Medical Physiology, 11th Edition, 2006
3. Larsen: Williams Textbook of Endocrinology, 10th ed. , 2003 Elsevier
4. R.Radheshyam, Behavior endocrinology, Neha Publishers, 2013

DSE **IMMUNOLOGY** **4 0 0 4**

Course objectives Employability

The paper should give sound knowledge of essential elements of the immunology with special consideration to the importance of the immune system in medicine and the mechanism of action of immune system.

Unit 1 Introduction to Immunity (12)

Types of immunity: non-specific physiological and cellular barriers, Acquired immunity – characteristics. Antigen, Haptens and Adjuvants, Antibody. Structure and types of immunoglobulins. Distribution and function of immunoglobulins

Unit 2 Cells and Organs of Immune System (12)

Organs of immune system – primary and secondary, Cells of immune system. Humoral and Cell Mediated immune response. Structure and functions of MHC, association of MHC with disease susceptibility. Autoimmunity and Hypersensitivity.

Unit 3 Immuno-techniques (12)

Introduction to Antigen-antibody interactions. Affinity, avidity, cross reactivity, precipitation, agglutination, complement fixation test, tissue typing, Radial immune diffusion, Ouchterlony double diffusion, ELISA, RIA, immunofluorescence, Immunodiffusion; Immunoblot.

Unit 4 Hypersensitivity (12)

Hypersensitivity reactions- type I, II, III, IV. Immunological tolerance & autoimmunity. Vaccines- active and passive immunization, commonly used toxoid vaccines, killed vaccines, live attenuated vaccines and bacterial polysaccharide vaccines. Polyclonal and monoclonal antibodies

Unit 5 Clinical immunology (12)

Transplant immunity - clinical manifestation, therapy, bone marrow and organ transplants. Immunology of malignancy - tumor antigens, immune response to tumors, immunotherapy. Immunohematology - Blood groups and blood grouping. A, B, Rh antigens and antibodies, Rh typing. Bombay group.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Discuss on how the immune system works building on their previous knowledge from biochemistry, genetics and cell biology.

CO2: Describe the immunological processes at a cellular and molecular level.

CO3: Develop an understanding about the defence mechanisms against infectious agents and tumors.

CO4: Differentiate the key mechanisms and cellular players of innate and adaptive immunity and how they relate.

CO5: Describe the mechanisms involved in immune system alterations as well as comprehend the function of vaccines and immunotherapy.

Textbooks

1. Microbiology- Prescott 2003, 3rd edition, Magrawhill, Boston.

2. Roitt, Brostoff, Mal, Immunology, 6th edition, 2001

Reference Books

1. Panicker , Microbiology, orient Longman , Hyderabad, 6th edition, 2005.

2. M.J.Pelzar, Microbiology, Tata mac hran, Hill New Delhi, 5th edition, 2005.

3. Donald.M.Weir, Immunology, John Stewart, 7th edition, 1993

4. P.M.Lydyard, A.Whelan, M.W. Fanger, Immunology, 2003

DSE PHYTOCHEMISTRY, PHARMACOGNOSY & QUALITY CONTROL 4 0 0 4

Course objectives Employability

This paper deals with the study of the physical, chemical, biochemical and biological properties of drugs, drug substances or potential drugs of natural origin as well as the search for new drugs from natural sources. It enables the students to study procedures undertaken to ensure the identity and purity of a particular pharmaceutical compounds.

Unit 1 Phytoconstituents of medicinal importance I (12)

Glycosides, Anthraquinones. Flavonoids (definition, natural sources, classification, biogenesis, extraction, isolation, identification and therapeutic applications). Anthocyanins Coumarins, Terpenes, Volatile Oils (definition, classifications, natural sources, medicinal and non medicinal uses, pharmacological and toxicological effects).

Unit 2 Phytoconstituents of medicinal importance (12)

Saponins and Alkaloids (definition, natural sources, classification, physical and biological properties, localization,nomenclature, physico-chemical properties, extraction, detection, isolation, purification, biosynthetic origin and pharmacological activities.

Unit 3 Pharmacognosy (12)

Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine *viz*; Ayurveda, Unani, Homeopathic, Siddha and Allopathic systems practiced in India. Common drugs of plant origin. Quantitative microscopy-an overview. Importance of authentication of plants. Preparation of herbal extracts. Natural pesticides and Insecticides-Tobacco, Pyrethrum, Neem. Introduction to herbicides and fungicides. Study of Indian toxic plants.

Unit 4 Pharmaceutical regulations (12)

Harmonization of regulatory requirements including ICH activity. Regulatory requirements of different regions applicable to pharmaceutical developments, manufacturing, quality control on finished products, extended release products, biopharmaceutical and bioequivalence assessment and good clinical practices and comparison with regulation in India. Filing of INDA, NDA and ANDA for approval and registration.

Unit 5 Stability testing (12)

Role of stability testing, stability test guidelines. Protocol of stability testing including testing under different climatic zones and conditions. Conduct of stability testing, presentation and recording of stability data, determination of shelf life. Stability test equipment and recent developments in this area.

Documentation: Importance of documentation, statuatory requirements and procedure for documentation, critical examination of documents.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic terminologies: pharmacognosy, medicinal plant, crude drug, folk medicine and flora.

CO2: Classify herbal drugs according to botanical origin, chemical constituents, and medicinal activity.

CO3: Explain different methods of cultivation, collection, curing, drying, adulteration and storage of medicinal plants.

CO4: Discuss different types of plant cells, secretory structures, different classes of secondary metabolites and their chemical identification.

CO5: Describe methods for detection and identification of natural drugs, especially leaves, fruits, seeds, herbs, barks and wood macro- and micro-morphologically and chemically

Text Books

1. C.K. Kokate, A.P. Purohit and S.B. Gokhle, Pharmacognosy, Nirali prakasham, 42nd edition: sep 2008.
2. Gupta, Vijay Kumar and Singh, Medicinal plants: Phytochemistry , Pharmacology and Therapeutics –Vol 3, Daya publishing house, 1st edition, 2014.

Reference Books

1. Herbal Medicines, A Guide for Health Care Professionals- By Carol A. Newal, Linda A. Anderson and J. David Phillipson. (1997).
2. Biren Shah, Avinash seth, Text books of Pharmacognosy and Phytochemistry; Elsevier india publishers, 1st edition,2012.
3. Ashutosh Kar, Pharmacognosy and Pharmacobiotechnology; New age india (P) ltd publisher; 2nd edition, 2007.

DSE MODERN LIFESTYLE ASSOCIATED DISEASES 4 0 0 4

Course objectives: **Employability**

The objective is to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

Unit 1 Modern lifestyles and habits (12)

Modern lifestyles - Sedentary habits, Junk food, Polluted environment, Sleeping habits, Smoking, Alcoholism, Drugs, Stress.

Unit 2 Food (12)

Elementary knowledge of balanced food. Obesity, Acidity, Dieting, Anorexia, Food poisoning. Deficiency of nutrients- Vitamins, Minerals, Beverages- hot and cold.

Unit 3 Cardiovascular complications (12)

Elementary knowledge of cardiovascular system: Atherosclerosis, Ischemia, Myocardial infarction (Heart attack), Hypertension.

Unit 4 Diseases of the Digestive system (12)

Elementary knowledge of digestive system and liver- Hepatitis, Fatty liver, Cirrhosis, Gallstones. Stomach- Gastritis, Acidity, Ulcer, Amoebiasis, Constipation, Piles.

Unit 5 Diseases of the Digestive system (12)

Elementary knowledge of Respiratory system- Common cold, Asthma, Wheezing, Allergic sinusitis. Elementary knowledge of Excretory system, Hypertension, Uncontrolled Diabetes, Kidey Stones.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understanding the basics about the human anatomy and physiology

CO2: Describe the effects of current lifestyle as a consequence of industrialization

CO3: Understand global scenario on sedentary lifestyle nutrition

CO4: Understand Basics of nutrition, RDA, balanced diet and BMR

CO5: Describe about cardiovascular system, respiratory system, digestive system, excretory system and associated disorders

Text Books

1. Carl A. Burtis and Edward R. Ashwood . Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 5edition, 2012. Saunders Publication.
2. M N Chatterjee and Rana shinde. Textbook of Medical Biochemistry-,8th edition, 2011. Jaypee Publishers.

Reference Books

1. Thomas M. Devlin. Biochemistry with Clinical Correlation, 7th edition, John Wiley & Sons. 2004.
2. Harold Varley, Practical Clinical Biochemistry, fourth edition, 2005. CBS Publisher
3. Dennis L. Kasper, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo. Harrison Principles of Internal Medicine- 19th edition, 2015

DSE **NEUROBIOLOGY** **4 0 0 4**

Course objectives Employability

This paper provides a basic understanding of the nervous system, Structure and function relationship and integration of the nervous tissue networking and insights in to neurotransmission

Unit 1 Neuron (12)

Neuron- Neurocellular anatomy, neural membrane, classification of neuron, nerve fibers, axonal transport, neural growth, neuroglia , nervous system, blood brain barrier, cerebrospinal fluid.

Unit 2 Nerve potential (12)

Neuronal signaling -Membrane potentials, ion channels, recording neuronal signals, ionic basis of resting potential and action potential, propagation of action potential.

Unit 3 Synapse (12)

Synaptic transmission- Synapse, Electrical synapse transmission, chemical synaptic transmission, Synaptic transmitter release, synaptic potentials, synaptic delay, synaptic plasticity, molecular mechanism of synaptic transmission, myoneural junction.

Unit 4 Neurotransmitters (12)

Neurotransmitters- Chemistry, synthesis, storage, release, receptors and function- acetyl choline, catecholamines, serotonin, histamine, glutamate, asparatate, GABA, glycine, neuropeptides, nitric oxide.

Unit 5 Neuro disorders (12)

Neural processing and neurodegenerative disorders-Learning and memory, neurochemical basis of drug abuse, neurodegenerative disorders, Parkinson's disorder, Alzheimer's disorder, Amyotrophic Lateral Sclerosis, Senile Dementia.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the physiology of human nervous system

CO2: Understand the anatomy of the central nervous system and its integration with the peripheral nervous system

CO3: Explain the anatomy and physiology of neurons

CO4: Demonstrate on the structure and function of different types of cells of the nervous system

CO5: Understand neuronal signaling and synaptic transmission importance

Text Books

1. Arthur C. Guyton and John E Hall, Text book of medical physiology 11th Edition; 2006
2. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005

Reference Books

1. Bruce Alberts, Alexander Johnson, Juliana Lewis, Martin Raff, Keith Roberts and Peter Walter, Molecular biology of the cell, 4th Edition; 2004
2. Gordon Shepherd, Neurobiology, 3rd Edition; 1994
3. Mark F Bear, Barry W Connors and Michael A Paradiso, Neuroscience: Exploring the brain, 4th Edition; 201

DSE **PLANT BIOCHEMISTRY** **4 0 0 4**

Course objectives Employability

This paper provides insights into the primary metabolic pathways occurring in plants, the types of plant metabolites and the industrial potential of those metabolites and the role of hormones in plant growth.

Unit 1 Photosynthesis (12)

Ultra Structure and organization of chloroplast membranes, lipid composition of chloroplast membranes, electron transport chain. Thylakoid membrane protein complexes. Calvin cycle: Biochemistry of RuBp Carboxylase or oxygenase, Hatch and slack pathway, CAM plants; productivity of C_4 plants.

Unit 2 Nitrogen Metabolism (12)

Nitrogen fixation, nitrogenase complex, electron transport chain and mechanism of action of nitrogenase. Structure of 'NIF'genes and its regulation, Hydrogen uptake and bacterial hydrogenases, Nitrate Metabolism: Enzymes of nitrate metabolism, Ammonium assimilation enzymes: glutamine synthetase, glutamate synthase and GDH.

Unit 3 Plant Hormones (12)

Plant growth regulators: Auxins; gibberellins, cytokines, abscicic acid and ethylene - biosynthesis and their metabolic functions, synthetic growth hormones, inhibitors. Stress response in Plants.

Unit 4 Secondary metabolites I (12)

Major chemical classes of secondary metabolites: A brief account of the following classes: Alkaloids, terpenoids, flavonoids, Phenolics and phenolic acids,steroids, coumarins, quinines, acetylenes, cyanogenic glycosides, amines and nonprotein amino acids,gums, mucilages, resins etc. (Structures not necessary. Give examples of the compounds and the plants in which present and their importance).

Unit 5 Secondary metabolites I (12)

Importance of secondary metabolites: Uses of secondary metabolites to man: as drugs, precursors of drugs in pharmaceutical industry, as natural pesticides/insecticides; other uses of secondary metabolites.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Develop a basic understanding of biochemical events associated with structural arrangement of plant cell and organization.

CO 2: Explain and understand the biochemistry of photosynthetic process and its relation to man and its environment.

CO3: Understand the mechanism of Nitrogen fixation and its importance in agricultural production and economics.

CO4: Know the significance of plant growth regulators in the development of plants.

CO5: Acquire knowledge about the importance of secondary metabolites and its industrial applications. Growth regulators and secondary metabolites and its potential in crop development.

Text Books

1. H.D Kumar and H.N Singh. Plant Metabolism Publisher. Macmillan, ISBN-10: 0333256387: ISBN-13:978-0333256381.1st Ed, 1980.
2. K.G Ramawat, Biotechnology: Secondary Metabolites Publisher: Science Publishers, U.S. ISBN-10: 1578080576 ISBN-13: 978-1578080571, 1st Ed., 2000.

Reference Books

1. P.M Dey and J.B. Harborne (Editors) Plant Biochemistry, Publisher: Academic Press ISBN-13:978-0122146749, 1st Ed, 1997.
2. Prof David T. Dennis, Prof David H. Turpin, Dr Daniel D. Lefebvre and Dr David B. Layzell(Ed) Plant Metabolism, publisher: Longman; ISBN-13:978-582259065, 1st Ed, 1997.
3. Hans-Walter Heldt Professor Em, Plant Biochemistry, publisher: AcademicISBN-10: 0120883910 ISBN- 13: 978-0120883912, 3rd Ed, 2004.

DSE BIOCHEMICAL TOXICOLOGY 4 0 0 4

Course objectives Employability

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

Unit 1 Fundamentals of toxicology (12)

Fundamentals of Toxicology and dose-Response Relationships: Introduction Biomarkers Criteria of Toxicity New Technologies Evaluation of Toxicity Interactions; Dose Response; Measurement of Dose-Response; Relationships Linear Dose Response Hormesis; Hazard and Risk Assessment Duration and Frequency of Exposure and Effect

Unit 2 Toxic responses (12)

Factors Affecting Toxic Responses: Disposition : Absorption ,Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication vs. Detoxication

Unit 3 Toxicity testing (12)

Test protocol, Genetic toxicity testing & Mutagenesis assay: *In vitro* test systems: bacterial mutation tests-Reversion test,Ames test, Fluctuation test, and Eukaryotic mutation test. *In vivo* test system Mammalian mutation test-Host mediated assay and Dominant Lethal test. Biochemical basis of toxicity: Mechanism of toxicity: Disturbance of excitable membrane function, Altered Calcium homeostasis, Covalent binding to cellular macromolecules & genotoxicity, Tissue specific toxicity

Unit 4 Xenobiotics (12)

Toxic Responses to Foreign Compounds: Direct Toxic Action: Tissue Lesions; Mechanism and response in cellular toxicity, pharmacological, physiological and Biochemical effects; Developmental Toxicology-Teratogenesis; Immunotoxicity Genetic Toxicity; Chemical Carcinogenesis

Unit 5 Mechanisms of toxicity (12)

Biochemical Mechanisms of Toxicity:Tissue Lesions: Liver Necrosis; kidney Damage; Lung Damage, Liver damage, Cardiac damage; Neurotoxicity; Exaggerated and Unwanted pharmacological effects; Physiological effects; Biochemical Effects: Lethal Synthesis and Incorporation, Interaction with specific Protein Receptors; Teratogenesis; Immunotoxicity; multi-Organ Toxicity:

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic principles of and have current, cutting-edge knowledge in human health toxicology

CO2: Describe toxicological mode of actions for most important groups of chemical substances to humans and environmental species.

CO3: Define the most vulnerable target organ(s) or organism(s) for most important group of xenobiotics.

CO4: Demonstrate knowledge on safety toxicology, and extrapolation from animal to human.

CO5: Understand the use of physico-chemical parameters of compounds to predict toxicity, bioaccumulation and biomagnification

Text Books

1. Narayanareddy K. S., The Essentials of Forensic Medicine & Toxicology, 2007. Published by K. Sugana Devi, 26th Edition, Hyderabad.
2. Basu, R. Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition. Books and Allied(P) Ltd. Kolkata.

Reference Books

1. Parikh C.K., Parikh's Textbook of Medical Jurisprudence and Toxicology, Publishers, Bangalore.6th Edition 1999,Reprint 2007.
2. Franklin, C.A Modi's medical Jurisprudence and Toxicology, published by M. Tripathi Private Limited,.21st Edition. Bombay.

DSE **NANOTECHNOLOGY** **4 0 0 4**

Course objectives Employability

To make students to understand the basics of nano, nanoparticles, nanomaterials, various methods of synthesis of nanoparticles, applications of nanoparticles, Synthesis and characterization of new nanoparticles.

Unit 1 Introduction (12)

Background to Nanotechnology: Scientific revolution- Atomic structures-Molecular and atomic size-Bohr radius – Emergence of Nanotechnology – Challenges in Nanotechnology - Carbon age–New form of carbon (from Graphene sheet to CNT).

Unit 2 Nanostructures and nanomaterials (12)

Definition of a Nano system - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO2, CeO2, ZnO), Biological system - DNA and RNA - Lipids – Size dependent properties - Mechanical, Physical and Chemical properties.

Unit 3 Synthesis of nanomaterials (12)

Synthesis of bulk nanostructured materials - Sol Gel processing- Mechanical alloying and milling-inert gas condensation technique-bulk and nano composite materials - Grinding - high energy ball milling-types of balls-WC and ZrO2-materials –ball ratio-limitations- melt quenching and annealing

Unit 4 Characterization of nanomaterials (12)

Characterisation: Spectroscopic techniques - Infra red spectroscopy (IR)- UV-visible-Absorption, Imaging techniques - Diffraction analysis – XRD, Imaging techniques – Scanning Electron Microscope, Transmission Electron Microscope.

Unit 5 Nanomedicine (12)

Nanotechnology for drug discovery - protein and peptide based compounds for cancer and diabetes - drug delivery - nanoparticle based drug delivery - lipid nanoparticles - vaccination - cell therapy -Gene therapy.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Acquire knowledge about basics of nano scale, nano particles and nanomaterials

CO2: Gain expertise in designing experiments and research hypothesis

CO3: Understand the principle and industrial application of nanoparticle

CO4: Understand the mechanism for synthesis of nanoparticles

CO5: Know the principle and operating systems of bio analytical instruments

Text Books

1. S.Shanmugam, Nanotechnology, MJP Publishers, 2010
2. Edited by Jurgen Schulte, Nanotechnology, John Wiley & Sons Ltd., 2010

Reference Books

1. Charles.P.Poole.Jr., Frank.J.Owens, Introduction to Nanotechnology, John Wiley & Sons, Inc., 2009
2. Richard.E.Smalley, Nanotechnology,Jaico publishing house, 2011
3. Richard Booker, Earl Boysen, Nanotechnology, Wiley publishing Inc., 2010
4. Nanosystems, K.Eric Drexler, John Wiley & sons Inc., 2010
5. R.Balasubramaniam, Callister's material science and engineering, Wiley India, 2011

DSE **STEM CELL TECHNOLOGY** **4 0 0 4**

Course objectives Employability

This paper aims to provide thorough information on the basic properties of stem cells and the regulation at molecular level. It also describes the application of stem cell technology in the therapy of different diseases.

Unit 1 Stem cells (12)

Definition, characterization, pluripotency, niche specification – Drosophila germ line stem cells, self renewal and differentiation. Adult versus embryonic stem cells, post genomic adult stem cells, stemness, characteristics, hierarchy, stem cell niche. Adult stem cell from amniotic fluid, cord blood. Isolation and maintenance of murine stem cells, primate embryonic stem cells, human embryonic stem cells.

Unit 2 Embryonic stem cells (12)

Principle of cell passage, colony formation, techniques for derivation of embryonic stem cells, differentiation and transdiffrentiation. Derivation and maintenance of human embryonic stem cells, derivation and differentiation of human embryonic germ cells, isolation and maintenance of avian embryonic stem cells, Xenopus embryonic stem cells, zebrafish embryonic stem cells.

Unit 3 Culture (12)

Trophoblast stem cells – Identification and lineage specificity, isolation and maintenance of neural precursors, primitive hematopoietic cells. GF and serum free culture of stem cells, feeder free culture, genetic manipulation of human embryonic stem cells, gene silencing, RNAi, vector modified transformation on lentivirus. Recombination, homologous recombination.

Unit 4 Properties (12)

Surface antigen markers, lineage markers, microarray, chemical mutagenesis. Hitchhiker effect, gene silencing, epigenetic mechanism, nuclear transfer cloning, parthenogenetic stem cells.

Unit 5 Applications (12)

Pluripotency of neural and cloned mouse embryo, genomic reprogramming, immunogenicity of stem cells, tolerance in transplantation. Therapeutic application- neurodegenerative disorders, spinal cord injury, heart diseases, diabetes, tissue engineering.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Know about various stem cells, their characteristics and their niches

CO2: Understand the importance of growth factors

CO3: Understand the basis of media composition for growth of stem cells

CO4: Discern the molecular concepts of stem cell self-renewal and tissue and organ development.

CO5: Demonstrate the routine methods used in stem cell biology.

Text Books

1. Kiessling, A.A. Human Embryonic Stem cells. Jones & Barlett Publishers. 2nd Ed, 2006.

2. Lanza, R . Essentials of Stem Cell Biology. Academic Press. 1st Ed, 2005

References Books

1. Turksen, K. Adult Stem Cells. Humana Press, Inc. 1st Ed, 2004

2. Thomson, J et al. Handbook of Stem Cells: Embryonic/ Adult and Fetal Stem cells (Vol. 1 & 2). Academic Press , 1st Ed, 2004.

3. Institute of Medicine (Corporate author). Stem cells and the future of regenerative medicine. National Academy Press., 1st Ed, 2002.

DSE **CANCER BIOLOGY** **4 0 0 4**

Course objectives Employability

This curriculum is designed to provide students a broad understanding of the molecular, genetic, cell biological, and pathobiological aspects of cancer. Students will also learn about the current state of clinical diagnosis, treatment of human cancers, and hurdles to overcome to realize its potential.

Unit 1 Cell cycle (12)

Regulation of Cell cycle - Cell cycle control and pRb tumor suppressor. Apoptosis and p53 tumor suppressor. Mutations that cause changes in signal molecules - effects on receptor - signal switches. Tumor suppressor genes.Modulation of cell cycle in cancer. Different forms of cancers. Diet and cancer.

Unit 2 Carcinogenesis (12)

Chemical Carcinogenesis, Metabolism of Carcinogenes is, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis. DNA repair mechanisms.

Unit 3 Oncogenes (12)

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes Oncogenes / Proto Oncogenes activity RAS, NFkB, Wnt signaling in cancer. Epigeneitcs of cancer – DNA methylation, Histone modification, gene silencing by micro RNA.

Unit 4 Metastasis (12)

Clinical significances of invasion, Metastatic cascade Three step theory of invasion, Proteinases and tumour cell invasion. Multi-step tumorigenesis and the evolution of cancer. Tumor-promoting stimuli. Cancer stem cells.

Unit 5 Treatment (12)

Different forms of therapy - Chemotherapy, Radiation Therapy, Immunotherapy. Detection of Cancers.Prediction of aggressiveness of Cancer. Advances in Cancer detection

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Explain the different types of cancer and the treatment strategies involved

CO2: Explain the mechanism of replication in cancer and genes involved in it

CO3: Describe the cell cycle as well as apoptosis processes

CO4: Differentiate about types of cancer and its development stages

CO5: Describe the mechanism of carcinogenesis and the genes involved for cancer formation & Development

Text books

1. Vincent.T, Devita, Cancer-Principles & practice of oncology, 3rd edition, 2014.
2. Momna Hejmadi, Introduction to Cancer Biology. 2nd edition.

Reference Books

1. Kinnell Parchment G. Mc. R. E, Perantoni. The Biological Basis of Cancer, Cambridge University Press, 2nd Edition, , 2006
2. Robert A. Weinberg, The Biology of Cancer. Garland Science. 2006.
3. Lauren Pecorino, Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics Oxford University Press; 3 edition, 2012.
4. Raymond W. Ruddon, Cancer Biology. Oxford University Press,2007.

DSE ENVIRONMENTAL SCIENCES 4 0 0 4

Course objectives Employability

The core Module Syllabus for Environment Studies includes class room teaching and Field Work. The course structure includes the continuing problems of pollution, loss of forget, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

Unit 1 Principles and Concepts of ecosystem (12)

Structure of ecosystem and Homeostasis- Energy transfer in an ecosystem-Food chain. Food web- Ecological efficiencies- Trophic structure and energy pyramids. Biogeochemical cycles(N, C, P cycles). Biodiversity: Types of diversity; Genetic diversity,Species diversity and Ecosystem diversity. Molecular taxonomy –Methods of biodiversity conservation- Gene banks; Cryopreservation. Assessing, analyzing and documenting biodiversity – Vulnerability and extinction of biodiversity.

Unit 2 Properties of water (12)

Water quality parameters- pH, Dissolved Oxygen (DO),Chemical Oxygen demand (COD); Biological Oxygen demand(BOD); Atmospheric toxicants- CO, NO_2, CO_2, SO_2-; Toxic heavy metals. Radionuclides. Sampling of air , soil and water pollutants - Monitoring techniques and methodology; Pesticide residue – classification, degradation, analysis, pollution due to pesticides; phenols and petrochemicals

Unit 3 Traditional Biological treatment (12)

stabilization pond, aerated lagoon, activated sludge process trickling filter anaerobic treatment. Use of microbes (bacteria and fungi) in biodegradation and Biotransformation: Bioremediation. Microbial transformation; Accumulation and concenteration of metals; Biosorption- Oil field microbiology; Improved oil recovery; Biotechnology and oil spills.

Unit 4 Environmental Biotechnology (12)

Biodegradation of agricultural chemicals; GM Crops and their impact on environment; Biofertilizers; Biological control of insect pests; Role of biopesticides/ insecticides; Biocontrol of plant pathogens; Integrated pest management-practical implementation

Unit 5 Role of biotechnology in management of resources (12)

Reclamation of wasteland: Biomass production: Biogas and biofuel production; Development of environment-friendly processes such as integrated waste management. Nature of Environmental Policies; International Agreements and Treaties:Stockholm Conference (1972); Rio Conference (UNCED) (1992); Johnesburg treaty; GAAT and Environment; CITES; Montreal protocol National Policy on Environment, Constitutional provisions for Environmental Protection.

(60 Hours)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand complex relationships between natural and human system

CO2: Demonstrate awareness of ecosystem

CO3: Understand the ecological knowledge and its consequences

CO4: Easily assess the environmental changes and challenges

CO5: Understand natural science, how biology, chemistry and physics interlinked

Text Books

1. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R). 2006
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner. 2001

Reference Books

1. Sharma B.K. Environmental Chemistry. Geol Publ. House, Meerut. 2001
2. Jadhav, H & Bhosale, V.M. Environmental Protection and Laws. Himalaya Pub. House, Delhi 1995.

INTERNSHIP

Course objective (Skill enhancement)

To earn academic credit and develop new skills at the same time. Internship must take place outside a university research lab.

Course outcome

CO1: Enhancing learning in a professional environment

CO2: Gaining experience with current technology

CO3: Contributing to significant projects

CO4: Building personal skills

CO5: Networking with people working in the science community

CO6: Developing a resume that highlights desirable skills

GENERIC ELECTIVE

SYLLABUS

STATISTICAL METHODS AND THEIR APPLICATIONS 4 0 0 4

Course objectives Employability

The course was designed in such a way to get hands on training in the Biochemical methods in the aspect of doing research and to impart the knowledge of Statistics to the students.

UNIT-I Measures of Central tendency and Dispersion (12)

Introduction-Types of Averages- Mean, Median, Mode– Measures of Dispersion- Range, Quartile Deviation, Standard Deviation and Coefficient of variation-Measures of Dispersion- Range, Quartile Deviation, Standard Deviation and Coefficient of variation.

UNIT-II Probability (12)

Probability- Different approaches of Probability-Addition theorem, Multiplication theorem-Conditional probability- Baye's theorem-Simple problems

UNIT-III Correlation and regression analysis (12)

Correlation: Types of Correlation-Methods of studying correlation- Scatter diagram method, Karl Pearson's Coefficient of correlation, Spearman's Rank Correlation Coefficient. Regression: Regression Lines and Regression equations - simple problems.

UNIT –IV Testing of Hypothesis (12)

Introduction-Concept of Sampling and Sampling Distribution –Parameter and Statistics- Standard error – Tests of Significance for small samples : t-test for Single mean - difference of means , F-test(variance –Ratio test) , Chi-Square tests for Goodness of Fit and test for independence of attributes in contingency table.

UNIT-V Analysis of Variance (12)

Analysis of Variance- One way and Two Way Classifications – Basic Principles of Experimentation – Completed Randomized Design – Randomized Block Design- Latin Square Design

Course Outcomes

On completion of this course, the students will be able to:

CO1: Describe and discuss the key terminology, concepts tools and techniques used in Probability

CO2 :Critically evaluate the underlying assumptions of analysis tools of measures of central tendency and Dispersion

CO3: Understand and critically discuss the issues surrounding of correlation and Regression

CO4: Analyze the uses and limitations of Testing of hypothesis

CO5: Analyze the classifications of ANOVA

TEXT BOOKS

1. S.P.Gupta, Statistical Methods. Sultan Chand & Sons, New Delhi
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons, 3rd Edition, 2001.

REFERENCE BOOKS

1. P.R. Vittal, Business Statistics, Margham Publications, Second Edition, 2012.
2. Beri G, Business Statistics, Tata McGraw Hill Publishing Company Limited, 2009.
3. S.P. Rajagopalan and R. Sattanathan, Business Statistics and Operations Research, Vijay Nicole Pvt. Ltd.

BIOINFORMATICS 4 0 0 4

Course objectives Employability

The course aims to provide students with a practical and hands-on experience with common bioinformatics tools and databases.

Unit I DNA and Proteins (12)

Nucleic acids: double helix, melting temperatures, closed circular DNA and supercoiling, Open Reading Frames (ORFs), Introduction to Proteins, Protein Structure: Secondary, Tertiary, Quarternary. The notion of Homology as evolutionary relatedness. Similarity and Identity of sequences..

Unit 2 Sequence databases and formats (12)

Primary and secondary databases. Nucleotide sequence databases, nucleotide sequence flat files. Functional divisions in sequence databases. Protein sequence databases: Genpept, Uniprot, Swissprot, PIR. Genbank, FASTA,ASN. Information retrieval for biological databases. The NCBI resource. Entrez, Pubmed, Medline. Entrez Boolean search terms and statements. Locuslink, NCBI bookshelf

Unit 3 General introduction to computers (12)

Organization of computers, computer algorithms.Various devices, memory and application. Computers as a system : Basic concepts, stored programs, functional units, and their interrelation: communications with computer. Data storage devices primary storage: storage addressed and capacity, types of Memory: Secondary storage devices : Magnetic tape – data representation and R/W: Magnetic disks, fixed and removable, data representation and R/W : Hard disks, Optical disks, CD-ROM, Mass storage devices.

Unit 4 Role of statistics in bioinformatics (12)

Fundamentals of statistics: Data types, collection and representation of data. Mean, median, mode, measures of dispersion. Probability definition, addition and multiplication theorems, Baye's Theorem.

Unit 5 Practicals (12)

1. Retrieval of DNA sequences from Entrez databases
2. Retrieval of protein sequences
3. Retrieval of sequences in different sequence formats
4. Searching for publications in Pubmed by different criteria

Course outcomes

After the completion of this course, the student will be able to

CO1: Demonstrate practical skills and gains hands on experience in common bioinformatics tools and databases.

CO2: Attain knowledge to interpret the relation among living things and solve biological problems, from the molecular to ecology level using bioinformatics tools.

CO3: Learn the physical, chemical and biological properties of Nucleic acids and proteins as a prerequisite for gene sequencing analysis.

CO4: Learn about primary and secondary databases of nucleic acids and proteins(Swissport, PIR, FASTA, Pubmed, Medline & NCBI).

CO5: Understand the basic concepts of Computer organization, functioning, data storage devices(Primary & Secondary).

Text Books

1. Arthur lesk. Introduction to bioinformatics. 4th edition. 2014. Oxford University press.
2. Jin Xiong. Essential Bioinformatics: 2006. Cambridge University Press.
3. Mount David. Bioinformatics: sequence and genome analysis, 2nd edition. 2000, Cold Spring harbor Laboratory.

Reference Books

1. Stephen Misener, Stephen A. Krawetz. Methods and Protocols (Methods in Molecular Biology) 1999, Humana Press.
2. Jonathan Pevsner. Bioinformatics and Functional Genomics 2nd Edition2009, Wiley Blackwell.

PATHOLOGICAL BASIS OF DISEASES 4 0 0 4

Course objectives Employability

The syllabi of Pathology compliments and supplements the necessary knowledge students have gained in Physiology. Consequently it incorporates topics like cellular adaptations, inflammation, neoplasia, cellular ageing and other infectious diseases. Pathology also provides the necessary inputs for the other disciplines like Pharmacology, social and preventive medicine, medicinal biochemistry etc.

Unit 1 Introduction (12)

History of pathology, Basic definitions and common terms used in pathology, Survival mechanism and disease, microscopic and cellular pathology, scope and techniques used.

Unit 2 Cell Injury and responses of cells: Cellular Adaptations, and Cell Death (12)

An overview of cellular adaptation: Hyperplasia, Hypertrophy, Atrophy, Metaplasia; Causes and mechanisms of cell injury, reversible and irreversible injury, Necrosis, Apoptosis, Types of apoptosis, Intracellular accumulations, Cellular ageing

Unit 3 Role of Inflammation in disease (12)

Basic concepts with suitable examples of general features of acute and chronic inflammation: Vascular Changes, cellular events, important chemical mediators of inflammation, Morphological effects inflammation response, Granulomatus Inflammation.

Unit 4 Role of Tissue repair Healing and Fibrosis (12)

Basic mechanism of tissue regeneration, and repair by healing, scar formation and fibrosis

Unit 5 Common Hemodynamic Disorders in diseases (12)

An overview of Edema, hyperemia, congestion, hemorrhage, hemostasis and thrombosis, Embolism, Infarction and shock with suitable examples

Course outcomes

After the completion of this course, the student will be able to

CO1: Attain a thorough knowledge on the cellular adaptations and the response of tissues to neoplasia.

CO2: Understand the pathological changes during cellular ageing and other infectious diseases.

CO3: Provide An insight into the history of pathology covering all the basic definitions and common terms.

CO4: Detail on the survival mechanism in diseases, an insight into microscopic and cellular pathology.

CO5: Elaborate the overview of cellular adaptation including Hyperplasia,
Hypertrophy, Atrophy, and Metaplasia.

Text Books

1. Robbins and Cotran. Pathologic Basis of Disease, 8th edition (2009), Vinay Kumar, Abul. K. Abbas, Jon C. Aster, Nelson Fausto; Saunders Publishers, ISBN-13: 978-1416031215

Reference Books

1. J.,Ed. Underwood and J. C. E. Underwood General And Systematic Pathology, 2nd edition (1996); Churchill Livingstone, ISBN-13: 978-0443052828

2. Ramnik. Sood Medical Laboratory Technology Methods and Interpretations, 6th edition (2009),; Jaypee Brothers Medical Publishers, ISBN-13: 978-8184484496.

MEDICINAL BOTANY **4 0 0 4**

Course objectives Employability

The kinds of alternative medicines and the importance of medicinal plants has been well described in this paper.

Unit 1: Indigenous medicinal sciences I **(12)**

Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments,

Unit 2: Indigenous medicinal sciences II **(12)**

Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit 3: Conservation of endangered and endemic medicinal plant **(12)**

Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant. Gardens.

Unit 4: Propagation of Medicinal Plants **(12)**

Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit 5: Ethnobotany and Folk medicines **(12)**

Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases.

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the basic terminologies and scope of indigenous system of medicine

CO2: Discuss about the preparation and application of plant based drugs.

CO3:Demonstrate the preparation and applications of Ayurveda, Siddha, Unani medicines.

CO4: Explore knowledge on different methods of plant conservation and propogation.

Text Book

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.

Reference Book

1. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edition. Agrobios, India.

BIOMATERIALS **4 0 0 4**

Course objectives Employability

Biomaterials restore the body of a person back to normalcy following any trauma or disease. The paper comprises of topics which describes the properties, synthesis and application of biomaterials.

Unit 1: Introduction to biomaterials **(12)**

Classification, Chemistry and characterization of biomaterials. The state of the art of biomaterials and the challenges. Disciplines involved in biomaterials science and the path from a need to a manufactured medical device. Material selection requirements for biomaterials – metals, composites, ceramics and polymers. Tissue environment of the implanted biomaterial: unit cell processes. Tissue responses to implants. Nanomaterials: fullerenes, carbon nanotubes, nanomembranes. Synthesis of bio-materials, Characterization of chemical, physical, mechanical properties, visco elasticity, end group analysis, determination of molecular weight of a polymer.

Unit 2: Biocompatibility **(12)**

Biocompatibility of Bio-materials, wound-healing process, body response to implants, blood compatibility. Tests to assess biocompatibility of a polymer, modifications to improve biocompatibility. Reactions of biomaterials with cellular and extra cellular components.

Unit 3: Modified biomaterials **(12)**

Biodegradative biomaterials, Bioactive polymers and biosynthetic polymers, inert biomaterials, genetically engineered biomaterials

Unit 4 : Applications of Biomaterials – 1 **(12)**

Tissue Replacement Implants, Acute Wound Healing, Blood Clotting, Chronic Wound Healing and Foreign Body Response. Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal Fractures fixation devices, joint replacements.

Unit 5: Applications of Biomaterials - 2 **(12)**

Artificial Organs Artificial Heart, Prosthetic cardiac Valves, Limb prosthesis, Externally Powered limb, prosthesis, Dental Implants, Other applications. Liposomes, hydrogels and Nanomaterials in drug delivery. Biomaterials in diagnostics and bioanalytical techniques.

Course outcomes

After the completion of this course, the student will be able to

CO1: Discuss fundamentals of biomaterials with emphasis on classification, chemistry and characteristics

CO2: Elaborate the methods of synthesis of biomaterials

CO3: Identify biomaterials appropriate for given application

CO4: Study the advantages and disadvantages of different biomaterials

CO5: Analyze biocompatibility and tissue-material interaction for different kinds of biomaterials

Text Book

1. Sujata V. Bhat, Biomaterials , 2 nd edition, Narosa Publishing House, New Delhi, 2006.

Reference Books

1. Buddy D. Ratner, B. D. Ratner,Allan S. Hoffman, Biomaterials Science: An Introduction To Materials In Medicine, 2nd Edition(2004) Publisher: Academic Press.

2.Fred W.Billmeyer, Text book of Polymer Science. 3 rd edition John Wiley and sons publications.

SKILL ENHANCEMENT

COURSES

SYLLABUS

SOFTSKILLS – I - 2 0 0 2

Course Objective:

- To enable participants Business Communication Skills
- To enhance participants E-mail writing skills
- To impart Leadership and Team Bonding skills

Credit Hours

1. READING COMPREHENSION AND VOCABULARY 06

Filling the blanks – Cloze Exercise – Vocabulary building – Reading and answering Questions.

2. LISTENING AND ANSWERING QUESTIONS. 06

Listening and writing – Listening and sequencing sentences – Filling in the blanks – Listening and answering questions.

3. GROUP DISCUSSIONS 06

Why GD part of a selection process – Structure of a GD – strategies in GD – Team Work – Body Language

4. CONVERSATION. 06

Face to face Conversation and Telephone conversation.

5. SELF- INTRODUCTION AND ROLE PLAY 06

Total 30 Hours

Course Outcome

At the end of this course the students will be able to,

CO 1 Prioritize power of understanding and aids assimilation of vocables. Vocabulary to charge communication with educated words

CO 2 Develop comprehensive knowledge through listening leading to answering questions

CO 3 Build observation power and infuse self-confidence through group discussions

CO 4 Identify methodology for befitting constructional ability

CO 5 Experiments with inward looking and visualization of the 'otherness' of situations

Books Recommended

- Barun K. Mitra. Personality Development and Soft Skills. Oxford University Press. New Delhi.2011.
- S.P. Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

- Tiko, Champa & Jaya Sasikumar. Writing with a Purpose.OUP. New Delhi. 1979

Web Source:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://blog.smarp.com/top-5-communication-skills-and-how-to-improve-them
- https://blog.hubspot.com/service/phone-etiquette

SOFT SKILLS – II - 2 0 0 2

Course Objective:

- To enable students to develop their communication skills effectively
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence through communication

Credit Hours

1. PRESENTATION SKILLS 06

Elements of an effective presentation – structure of presentation – voice modulation – Audience analysis – Body language

2. SOFT SKILLS 06

Time Management – Articulateness – Assertiveness – Stress management

3. RESUME / REPORT PREPARATION / LETTER WRITING 06

Structuring the resume / Report – Business letters – E-Mail Communication

4. INTERVIEW SKILLS 06

Kinds of Interviews – Required by Skills – Corporate Culture – Mock Interviews

5. 30 FREQUENTLY ASKED QUESTIONS 06

Total 30 Hours

Course Outcome

At the end of this course the students will be able to,

CO1 Illustrate the essential of presentation skills, thoughts, structure, voice modulation, audience analysis and body language

CO2 Utilize the psychological skills pertaining to time management, articulation, assertion and stress management

CO3 Construct methodology for preparation of resume, reports, business letters and email communication

CO4 Appraise learners with varied skills needed for expose to interviews

CO5 Categorize the nature of questions asked usually in interviews

Books Recommended

- Barun K.Mitra. Personality Development and soft skills. Oxford University Press. New Delhi. 2011.
- S P Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.
- Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

Web Sources:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://www.businessnewsdaily.com/5836-top-interviewing-skills.html
- https://gdpi.hitbullseye.com/Group-Discussion.php

SOFT SKILLS III 2 0 0 2

Course Objective:

- To enable students to develop their soft skills and Body Language
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence to excel at Interviews

	Credit Hours
UNIT–I	**06**
Powerful Presentation	
UNIT–II	**06**
Reinforcement	
UNIT–III	**06**
Using visual aids	
UNIT–IV	**06**
Types and Methods of Presentations	
UNIT–V	**06**
Obstacles to Presentation	
Total	**30 Hours**

Course Outcome:

CO1	To develop participants social and professional skills
CO2	To help participants manage time effectively
CO3	To build a strong resume to suit corporate requirements
CO4	To face interviews confidently
CO5	To enhance their aptitude abilities

Books Recommended:

- Roz Townsend: Presentation Skills for the Upwardly Mobile, Emerald, Chennai.
- Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.
- Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

Web Sources:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://venngage.com/blog/presentation-skills/
- https://gdpi.hitbullseye.com/Group-Discussion.php