UNIVERSITY OF CALICUT

(Abstract)

B.Sc Programme in Biophysics – under Choice based Credit Semester System – Scheme and Syllabus – implemented with effect from 2009 admission onwards – approved - Orders issued.

GENERAL AND ACADEMIC BRANCH – I 'J' SECTION

No. GA. I/J1/7699/07 Dated, Calicut University. P.O., 25.06.2009

Read : 1. U.O. No. GAI/J2/3601/08 (Vol. II) dated 19.06.2009.

2. Minutes of meeting of Board of Studies in Biophysics held on 05.12.2008 29.01.2009 and 23.04.2009.

3. Item No.2(i) of the minutes of the meeting of the Faculty of Science held on 05.05.2009.

4. Item No.IIA .1) of the minutes of meeting of the Academic Council held on 14.05.2009.

O R D E R

Choice based Credit Semester System and Grading has been introduced for UG Curriculum in all affiliated colleges under this University with effect from 2009 admission onwards and the regulation for the same implemented vide paper cited 1 above.

As per paper read as (2) above, the Board of Studies at its meetings held on 05.12.2008, 29.01.2009 and 23.04.2009 has resolved to approve the Syllabus of B Sc Programme in Biophysics under Choice based Credit Semester System.

As per paper read as (3) and (4) above, the Faculty of Science held on 05.05.2009 endorsed the minutes of Board of Studies and the Academic Council held on 14.05.2009 approved the same.

Sanction has therefore been accorded to implement the scheme & syllabus of B.Sc programme in Biophysics under Choice based Credit Semester System in this University from 2009 admission onwards.

Orders are issued accordingly . Scheme & Syllabus appended.

Sd/-
DEPUTY REGISTRAR (G&A I)
For REGISTRAR

To: The Principals of all affiliated colleges -
Offering B.Sc programme in Biophysics.

Copy to: Controller of Examination /EX I/EGI/DR B Sc/Enquiry/
System Administrator with a request to upload in the University website.
Tabulation Section/GA I 'F' Sections/SF/DF/FC.

Forwarded / By order
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SECTION OFFICER

B.Sc Biophysics Degree Course
Scheme and Syllabus under CCSS
Restructured through the five day Workshop

organized by

the Board of studies in Biophysics, University of Calicut

ANNEXURE-II

SCHEME OF B.Sc. BIOPHYSICS DEGREE UNDER COURSE AND CREDIT SEMESTER SYSTEM

6 Semesters, 35 Courses, 120 Credits

	Sl. No.	Course code	Course Title	Hrs / week	Credit	Total Credits
I Semester	1	BP A 01	Communicative skills in English	4	3	18
	2	BP A 02	Critical reasoning, writing and presentation	5	3	
	3	BP A 07(3)	Communication skills in other languages	4	4	
	4	BP 1B 01	Core Course I - Mathematics	2	2	
	5	BP 1B02	Core Course II - General Perspective and Methodology of the Stream	2	2	
	6	BP 1C 01	Complementary -I (Physics-I)	2	2	
		BP 1C 01 (P)	Complementary –I Practical (Physics Practical-I)	2	-	
	7	BP 1C 02	Complementary- II (Computer Application – I)	2	2	
		BP 1C 02 (P)	Complementary –II Practical I (Computer Application Practical-I)	2	-	
				25		

II Semester	8	BP A 03	Reading literature in English	4	4	20
	9	BP A 04	Readings on Indian constitution,Secularism and sustainable environment	5	4	
	10	BP A 09	Literature in languages other than English	4	4	
	11	BP 2B 03	Core Course III - Biostatistics	2	2	
	12	BP 2B 04	Core Course IV- Informatics and Bioinformatics	2	2	
	13	BP 2C 01	Complementary -I (Physics – II)	2	2	
		BP 2C 01 (P)	Complementary- I Practical (Physics Practical-II)	2	-	
	14	BP 2C 02	Complementary – II (Computer Application-II)	2	2	
		BP 2C 02 (P)	Complementary II -Practical (Computer Application Practical II)	2	-	
				25		
III Semester	15	BP A 06	History and philosophy of science	5	4	16
	16	BP A 12	General informatics	4	4	
	17	BP 3B 05	Core Course V - Chemistry I	2	2	
	18	BP 3B 06	Core Course VI - Introductory Biophysics	2	2	
		BP 3B 01(P)	Core Practical I (Part I- Chemistry)	2	-	
	19	BP 3C 01	Complementary - I (Physics-III)	3	2	
		BP 3C 01 (P)	Complementary -I Practical (Physics Practical-III)	2	-	
	20	BP 3C 02	Complementary -II (Computer Application-III	3	2	
		BP 3C 02(P)	Complementary –II Practical (Computer Application Practical –III)	2	-	
				25		

IV Semester	21	BP 4A 13	Basic numerical skills	5	4	24
	22	BP 4A 14	Entrepreneurship development	4	4	
	23	BP 4B 07	Core Course VII - Chemistry II	2	2	
	24	BP 4B 08	Core Course VIII - Cellular Biophysics	2	2	
		BP 4B 01 (P)	Core Course Practical I (Part-I Chemistry)	2	-	
	25	BP 4C 01	Complementary –I (Physics-IV)	3	2	
		BP 4C 01 (P)	Complementary –I Practical (Physics Practical IV)	2	4	
	26	BP 4C 02	Complementary –II (Computer Application –IV)	3	2	
		BP 4C 02 (P)	Complementary –II Practical (Computer Application Practical –IV)	2	4	
				25		
V Semester	27	BP 5B 09	Core Course IX - Biochemistry	4	3	16
		BP 5B 01(P)	Core Practical I (Part II-Biochemistry)	2	-	
	28	BP 5B 10	Core Course X - Radiation Biophysics	3	3	
	29	BP 5B11	Core Course XI - Molecular Biophysics	3	3	
	30	BP 5B 12	Core Course XII - Molecular Biology	3	3	
	31	BP 5D	Open Course I	3	4	
	32	BP B15 (Pr)	Project	2	-	
		BP B 02 &03 (P)	Core Practical II & III (Physiological Biophysics & Molecular Biology, Biomedical Instrumentation)	5	-	
				25		

VI Semester	33	BP 6B13	Core Course XIII - Physiological Biophysics	5	4	26
	34	BP 6B14	Core Course XIV - Biomedical Instrumentation	5	4	
	35	BP 6E	Elective course	3	3	
		BPB 01, 0 2,03(P)	Core Practical I, II & III	10	12	
		BP B15 (Pr)	Project Work	2	3	
				25	-	
V Semester			**Open Courses offered**			
		BP 5D 01	1. General Biophysics	3	4	
		BP 5D 02	2. General Microbiology	3	4	
		BP 5D 03	3. Human Physiological Chemistry	3	4	
VI Semester		BP 6E 01	1. Structural Bioinformatics	3	3	
		BP 6E 02	2. Biomedical Imaging	3	3	
		BP 6E 03	3.Experimental Techniques in Structure Elucidation	3	3	

Core Course 1

BP 1B 01 - MATHEMATICS

2hrs/week – 36 Hours/ 2 credits

Syllabus

Unit – I Differential Calculus (8hrs)

Differentiation – Derivative of a function of a real variable, derivatives of circular and inverse circular function, hyperbolic and inverse hyperbolic functions, successive differentiation, Leibnitz theorem (statement with out proof) and simple problems.

Unit- II – Differential Equations (6hrs)

Variable separable, linear, Bernoullis and exact differential equations

Unit- III – Integration (6hrs)

Primitive, different methods of integration – integration by substitution and integration by parts, definite integrals and its properties, double integrals (simple cases only)

Unit- IV – Linear Algebra (8hrs)

Definition of a matrix, adjoint and inverse of a square matrix, orthogonal matrix, rank of a matrix, elementary transformation of a matrix – reduction of a matrix to normal and echelon forms.

Determinant of square matrix of order n, its properties, multiplication of determinants.

Unit- V – Vector Analysis (8hrs)

Dot and cross product of vectors, products of three or more vectors, derivative of a vector with respect to scalar parameter, gradient of a scalar point function, solenoidal and irrotational vectors.

References

1. Text Book of Calculus by Manicavavhagom Pillai

2. Differential Equations by George F Simmons

3. Integration by Manicavavhagom Pillai

4. Linear Algebra – Schaum Series

5. Matrices - Schaum Series

6. Matrix Theory by D Raghava Rao

7. Introduction to Vector Analysis by Harry F Davis

Core course II

BP 1B 02 GENERAL PERSPECTIVES AND METHODOLOGY OF SCIENCE

2hrs/week - 2 Credits/ 36hrs

Syllabus

Unit I 13 hrs

Science and Science Studies

Types of knowledge: Practical, theoretical and scientific knowledge

information:

What is science; what is not science, laws of science, Basis for scientific laws and factual truths.

Science as a human activity, scientific attitude, empiricism, vocabulary of science science disciplines.

Unit II 10 hrs

Methods and Tools of Science

Hypothesis; theories, and laws in science. Observations, evidences, and proofs Peer reveiews. Posing a question; formulation of hypothesis, Hypothetico-deductive model . Significance of verification, Corroboration and falsification ,auxiliary hypothesis,adhoc hypothesis.

Unit III 13 hrs Experimentation in Science

Design of an experiment; experimentation, observation data collection ; interpretation and deduction.

Experiments to test a hypothesis from Bioscience(Protein , DNA studies etc.)

Examples of great experiments in Bioscience.

References

1) **Philosophy of science an estemological study – K.V Subha Rao, Piblsh-**

Haryana Vijyan Munch , Krishna pura, Rothak, 124001.

2) **Research : How to plan speak and write about it. Editor – Clifford Hawkins & Marco Sorgi , Narosa Publishing House ,New Delhi**

3) **Research Methodology: A step –by step guide for beginners-**

Renjith kumar, Pearson Education-2006

Core course – III

BP 2B 03 - BIOSTATISTICS

2hrs/week- 36 hours/2 credits

Syllabus

Module I -Introduction to Biostatistics and Statistical Terms

Statistics – Biostatistics and Biometry- Descriptive and Inferential Biostatistics – Sample and test Biostatistics – Statistical Terms - Limitations of Statistical Methods – Aims of Biostatistics – Applications of Biostatistics.

Module II - Collection of Data

Census and Sampling Methods of Data Collection – Necessity of Sampling – Types of Sampling Methods Random or Probability Sampling – Nonrandom or Non Probability Sampling.

Module III -Classification of Data and Frequency Distribution.

Data – Data collection – Data Processing – Data Summarization – Classification of Data – Methods of classification of Data – Difference s Between Classification and Tabulation – Formation of Frequency Distribution.

Module IV -Presentation of Data

Tabular Representation of Data – Graphic Representation of Data – Line Diagram – Histogram – Frequency Polygon – Frequency Curve – Cumulative Frequency Cure or Ogive –Scatter or Dot Diagram – Bar Diagram – Pictogram – Cartogram.

Module V -Measures of Central Tendency and Dispersion.

Average – Objectives of Averages - Characteristics of an Ideal Measure of Central Tendency – Types of Averages - Mean, Median, Mode – Meaning of

Dispersion – Measures of Dispersion – Range, Standard Deviation – Coefficient of Variation, Standard Error.

Module VI-Correlation and Regression

Correlation – Types of Correlation – Measures of Simple Correlation – Rank Correlation. Regression – Simple Regression – Regression Equation – Regression Coefficients.

Module VII -Probability

Important Terms and Concept s – Sample point, Sample space, Trial and Event; Classical Definition of Probability – Frequency Definition of Probability – Rules of Probability (Addition Rule and Multiplication Rule) Random variable and Probability Distribution – Binomial Distribution, Poisson Distribution and Normal Distribution.

Module VIII - Test of Hypothes is and Test s of Significance.

Statistical Inference, Test of Significance, Procedure for Carrying out test of Significance – Computation of Test of Significance – Test for the mean of a Normal Population.

Reference s

1. Fundamentals of Mathematical Statistics by S.C. Gupta and V.K. Kapoor.

2. Fundamentals of Biostatistics by Veer Bala Rastogi.

3. Textbook of Biostatistics by A.K. Vashisth.

4. Introduction to Biostatistics and research Methods P.S.S. Sundar Rao, J. Richard.

5. Fundamentals of Applied Statistics by S.C. Gupta and V.K. Kapoor.

Core course IV

BP 2B 04 INFORMATICS AND BIOINFORMATICS

2hrs/week – 2 credits /36 hrs.

Syllabus

Module – 1. Basics (8 hrs.)

Introduction to bioinformatics, definition and history of bioinformatics, internet and bioinformatics, major bioinformatics resources – NCBI

Module – 2 .

Open access bibliographic resources and data mining, application of data mining to bioinformatics (5 hrs)

Module - 3

Bioinformatics software (5 hrs)

Module - 4

Introduction to molecular visualization software like rasmol, raswin, swissport etc. (8 hrs)

Module – 5

Basics of algorithms (5 hrs)

Module - 6

Scope and application of bioinformatics (5 hrs)

References:

1. **Letovsky, S. I. 1999. Bioinformatics. Kluwer Academic Publishers.**
2. **Baldi, P. and Brunak, S. 1998. Bioinformatics. The MIT Press.**
3. **Lesk, A. M. 2002. Introduction ro Bioinformatics . Oxford University Press.**
4. **Rastogi *et al.,* 2004. Bioinformatics- Concepts, Skills & Applications. CBS Publishers, New Delhi.**

Core Course V

BP 3B 05 CHEMISTRY I

2hrs/week – 36 hours/ 2 credits

Syllabus

Module I – Radio Activity and Isotope s (9hrs)

Radio activity – units- stability of nucleus – N/P ratio, mass defect – binding energy – theory of nuclear disintegration – decay law, half life period –radio active equilibrium.

Radio active series – nuclear reactions – nuclear reactions induced by P,N,D – nuclear fission – fusion – reactors. Isotopes and their separation by mass spectrograph and diffusion methods – separation of H2 and Uranium.

Module II – Acids, Bas e s and Buffers (9hrs)

Various concepts of acids and bases and buffers – ionic product of water – pH – determination of pH – hydrolysis constant – buffer solution –

Henderson Hass elbach equation – determination of pH by indicators, glass electrode.

Module III – Chemical bonding (9hrs)

Ionic bonds – lattice energy of ionic compound – Born-Lande equation. Born-Haber cycle – covalent character of ionic bond . covalent bond – hybridization involving S,P,d and f orbitals – SP^3, SP^2, SP dSP^3,d^2SP^3 hybridization.

Hydrogen bonding in water, organic molecules and biomolecules (brief study).

Module IV – Chemical Kinetics (9hrs)

Rates of reactions – factors influencing rates of reactions – order and molecularity – first, second and third order – units – derivation of first order rate equation – half life –influence of temperature on reaction rates – Arrhenius equation. Calculation of Arrhenius parameters.

References

1. "Text book of Physical Chemistry" by P L Soni, O P Dharmashe

2. "Physical Chemistry" by Puri Sharma Pathani.

3. Advanced Physical Chemistry" by Gurdeep Raj.

Core Course VI

BP 3B 06 INTRODUCTORY BIOPHYSICS

2hrs/week – 36 Hours/2 credits

Syllabus

Unit I - Thermodynamics (8 hrs)

Laws of thermodynamics, concept of free energy, unavailable energy and entropy, heat content of food, bomb calorimetry, chemical kinetics – rate, order, molecularity of reactions and energy of activation.

Unit II – Redox potential (7 hrs)

Oxidation and reduction, redox potential and its calculation by Nernst equation, examples of redox potential in biological system.

Unit III – Bioenergetics (7 hrs)

Energy requirements in cell metabolism, role and structure of mitochondria, high energy phosphate bond, electron transfer phenomenon and biological transfer.

Unit IV - Biophysical properties (7 hrs)

Surface tension, adsorption, diffusion, osmosis, dialysis and colloids

Unit V – Molecular alphabets of life (7hrs)

Amino acids, nucleic acid bases and lipids, classification and properties of amino acids, peptides and poly peptides. Nucleosides, nucleotides, polynucleotides, pentose and hexose poly saccharides.

References

1. **Physical Chemistry for Life Sciences by Barrow C, MC-Grow Hill**
2. **Biophysical Chemistry by Bloomfield V A and Harrington R E, W A Freeman and Co.**
3. **Biophysical Chemistry by Cantor C R and Schimmel, P R, W A Freeman and Co.**
4. **Protein, by Hasehemyer R N and Hasehemyer ACBV, John Willy and Sons**
5. **Aspects of Biophysics, Hughe S W, John Willy and Sons.**
6. **Introduction of Biophysics by Pranab Kumar Banargy, S Chand and Co.**
7. **Principles of Nuclic acid structure by Saenge W, Springer-verlag.**
8. **Principles of Protein Structure by Schule G E and Schirmer R H, Springer-Verlag.**
9. **Biochemistry by Stryer L, W A Freeman and Co.**
10. **Essentials of Biophysics by P Narayanan, New Age International Publishers.**

Core Course VII

BP 4B 07 CHEMISTRY II

2hrs/week – 36 hours/ 2 credits

Syllabus

Module I – Organic Reaction Mechanism (9hrs)

Electron displacement in organic compounds – Inductive, Electromeric, Mesomeric effects. Hyper conjugation, Steric effects. Influence of inductive effect on acidic and basic properties of organic compounds.

Nucleophilic substitution – SN1 and SN2 mechanism – stereochemistry

Module II – Sterio Chemistry and Optical Isomerism (9hrs)

Optical isomerism – chirality – lactic acid, tartaric acid.

Racemisation and resolution – relative and absolute configurations –

asymmetric synthesis. Geometrical isomerism – E and Z notations, malic acid and fumeric acid. Aldoxime and Ketoxime.

Module III – Chromatography (5hrs)

Different types of chromatography: column, paper, thin layer, ion exchange and gas chromatography. Rf value – merits and demerits.

Module IV – Benzene and Aromaticity (9hrs)

Nomenclature – structure and stability, M.O concept.

Aromaticity and Huckels Rule –reactions of Benzene – electrophilic substitution reactions with mechanism – halogenation, nitration, sulphonation. Friedel Crafts reaction - naphthalene and anthrecene – structure and reaction.

Module V – Hetro Cyclic Compounds (4hrs)

Chemistry of furan, pyrrole, pyridine, indole, structure and importance of purine and pyrimidine.

References

1. "Modern Organic Chemistry" by M K Jain and S C Sharma

2. Principles of Chromatography" by Srivastava

3. "Organic Chemistry" Mc Murrey.

Core Course VIII

BP 4B 08 CELLULAR BIOPHYSICS

2hrs/week – 36 hours/2 credits

Syllabus

Unit I - Cell organization

Cell a the basic structural unit, Fine structure of prokaryotic and Eukaryotic cell organization, cell organelles, cytoskeleton.

Unit II – Cell membrane and Transport

Structure and function of cell membrane. Types of transport across cell membrane. Transport of ions and molecules through cell membranes.

Unit 3 - Cell growth and Division

Cell cycle, events in cell cycle – G1, S1, G2 phase, Control of cell cycle, Cell division, Cell transportation and malignant tumor growth. Cell aging and death, Apoptosis.

Unit IV - Cell differentiation

Primary and secondary induction, Differentiation of cultured cells, Fertilization, Molecules mechanism of fertilization.

Unit V - Cell: Cell recognition

Cell adhesion, cell signaling, concept of receptors, characterization and its function.

Receptor – ligand interaction. Signal transduction.

References

1. Molecular Cytology by Jean Brachet, Academic press

2. Molecular Biology by David Friefelder, Narasa Publishing House

3. Biophysics of the Cell by R Glaser and D. Gingell, Spring – Verlag

4. Molecular Cell Biology by Damell, Lodish and Baltimore, E H Freeman Press.

5. Introduction of Biophysics by Pranab Kumar Banerjee, S Chand anc Co.

6. Cell Biology Structure, Biochemistry and Function by Sheelle P and Bireh D E, John Willey and Sons.

7. Biochemistry by Lehningu A, Butter Worth Publication.

8. Biochemistry by Stryee L, W A Freeman and Co.

Core Course IX

BP 5B 09 - BIOCHEMISTRY

4hrs/week, 3 credit, 72hrs

Syllabus

Unit I – Biomolecules (22hrs)

Amino acids and proteins, carbohydrates, lipids, nucleic acids, vitamins and coenzymes

Unit II - Biochemical Techniques (8hrs)

General methods of biochemical separation techniques, principles and applications, chromatography, paper TLC techniques, centrifugation, electrophoresis, photometry.

Unit III – Enzymology (10hrs)

Classification, kinetics, specificity, inhibition and regulation of enzymes

Unit IV – Nutritional aspects (5hrs)

Carbohydrates, lipids, proteins, vitamins and minerals, daily requirements,

deficiency diseases

Unit V – Intermediary metabolism (20hrs)

Glycolysis, gluconeogenesis, fatty acid metabolism, amino acid metabolism (Glycine and Phenylalanine), transamination, oxidative deamination and decarboxylation, urea cycle.

Mitochondrial metabolism, TCA cycle, ETC and oxidative phosphorylation, its mechanisnm, bioenergetics.

Unit – VI - Nucleotide metabolism (7hrs)

Purine synthesis and degradation, Pyrimidine synthesis and degradation.

References

1. Biochemistry by A. L Lehninger

2. Biochemistry by Voet & Voet

3. Biochemistry by Zube

4. Biochemistry by Stryer L

Core Course X

BP 5B 10 – RADIATION BIOPHYSICS

3hrs/week, 3 credits/ 54hrs

Syllabus

Unit I - Basic Radiation Physics (10hrs)

Introduction, Classification of radiation – ionizing and non-ionizing, Nuclear structure, Nuclear reactions, Radioactivity, Modes of radioactive decay-alpha decay, beta decay, gamma decay, Activation of nuclides, Accelerators, Cyclotron, LINAC, reactors Photon interactions, types of indirectly ionizing radiation, Photon beam attenuation, HVT & TVT, Types of photon interaction, Photoelectric effect, Coherent scattering, Compton effect (inherent scattering), Pair production, Photonuclear reactions, attenuation coefficients, application in imaging, Effects following photon interactions- physical, chemical and biological, Electron interactions-Electron-orbital

electron interactions, Electron-nucleus interactions, Stopping power, Mass scattering power.

Unit II - Production and properties of X-rays (10hrs)

Physics of X ray production-Characteristic X-rays and Bremsstrahmung (continues) X-rays, X-ray spectrum, X-ray technology – X-ray tubes, diagnostic and therapy tubes, Coolidge tube, stationary and rotating anode, line focus principles – dual focus tube – Hooded anode tube – Basic X-ray generators circuits – auto transformer – filament transformer-rectification of anode voltage – self rectifier circuit, half wave rectifier circuit, full wave rectifier circuit.

Unit III - Dosimetric principles & Quantities (10hrs)

Photon fluence and energy fluence, kerma,cema absorbed dose, quantities used in describing a photon beam, photon fluence and rate, energy fluence and rate, inverse square law, penetration of photon beam into a phantom or patient, surface dose, buildup region, depth of dose maximum, exit dose, Percentage Depth Dose (PDD).

Tissue Air Ratio (TAR), Tissue Maximum Ration (TMR), Physics of radiation therapy (qualitative concept)

Unit IV - Radiation detection and measurement (10hrs)

Gas filled detectors - regions of operation, ion chamber, proportional chambers and GM counters, film detectors, radiographic film, radiochromic film,luminescence dosimetry – scintillators, thermo luminescence, optically stimulated luminescence, semiconductor dosimetry, silicon diode dosimetry systems, MOSFET dosimetry systems.

Unit V- Radiobiology (10hrs)

Introduction, classification of radiations in radiobiology, cell cycle and cell death, irradiation of cells, type of radiation damage, cell survival curves, measurement of radiation damage in a tissue, normal and tumour cells, therarpeutic ratio, oxygen effect, relative biological effectiveness, dose rate and fractionation, radio protectors and radio sensitizers.

Unit VI - Radiation Protection (4hrs)

Principles of radiation protection – time, distance, shielding, quantities and units used in radiation protection, physical quantities, radiation protection quantities, organ dose, equivalent dose, effective dose, committed dose, collective dose, justification of medical exposure, optimization of exposure and protection, dose limits, ALARA, ICRP and AERB regulations.

References

1."Basics of Radiobiological Principle" by Thayalan, Jaypee Brothers Medical Publisher, New Delhi 2003.

2. "The Physics of radiation Therapy" by Faiz M Khan, Edn 3 ,Lippincott Williams and Wilkins.

3. "Radiobiology for the Radiologists" by Eric J Hall, JB Lippincott 1994

4. "Radiation Detection and Measurement" by Glenn Knol, John Wiley and Sons INC.

5. Christensen's Physics of Diagnostic Radiology by Thomas S Curry, Jemes E Dowdey, and Robert E Murry, Edn 4, Lea and Febiger (Philadelphia).

6. "Radiation Physics for Medical Physicists (Biological and Medical Physics, Biomedical Engineering)" by Ervin B Podgorsak, Springer.

Core Course XI

BP 5B 11 MOLECULAR BIOPHYSICS

3 hrs/week -54 hours/3 credits

Syllabus

Unit I- Structure and Conformation of proteins (15 hrs)

Different levels of protein structure: Primary, secondary, tertiary and quaternary structure. Main chain and side chain torsion angles. Alpha helix, beta sheet, turns. Ramachandran map - Allowed conformations for a pair of linked peptide units - (map for glycine and alanine residues), Motifs and domains-examples such as hairpin motif, Greek key motif, alpha helix bundles, alpha-beta barrels etc.

Unit II- Classification of proteins (15 hrs)

Based on structure – globular, fibrous. Based on functions - structural proteins, collagen, keratin, actin, myosin, silks fibroin as examples. Enzymes- Lysozyme as example, Transport proteins- Hemoglobin as example - allostery and co-operativity. Immunoglobulins Receptors. Hormones-insulin as example, Membrane proteins.

Unit III- Structure and Function of Nucleic Acids (14hrs)

Nucleosides and nucleotides, Structure of oligonucleotides, Structure of DNA - Watson and Crick model - base pairing and base stacking, DNA polymorphism - A, B and Z forms. Supercoiling of DNA. Structure of tRNA. Genetic code.

Unit IV- Macromolecular assemblies (5 hrs)

Protein-protein interactions, protein-nucleic acid interactions, chromatin and ribosomes. DNA binding motifs-HTH, Leucine zipper, Zn-finger motifs.

Unit V- Protein folding (5 hrs)

Forces stabilizing the macromolecular structure and assembly: Disulphide bonds, Hydrophobic Interactions, Electrostatic Interactions and Hydrogen Bonding.

Kinetic factors of protein folding. Burying of hydrophobic side chains.

Chaperonins.

References

1. Principles of Biochemistry by A.L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers, New Delhi, 1993.

2. Biochemistry by L. Stryer, W.H. Freeman and Co., Newyork 1997.

3. Conformation of Carbohydrates by V.S.R. Rao, P.K. Qasba, P.V. Balaji and R. Chandrasekaran, Harwood Academic Publishers, 1998.

4. Steno Chemistry of Carbohydrates J.F. Stoddart , Wiley Interscience 1971.

5. Complex Carbohydrates their Chemistry by N. Sharon, Biosynthesis and Functions, Addison- Wesley, London, 1975.

6. Bio active carbohydrates in Chemistry, Biochemistry and Biology by J.F. Kennedy and C.A.White, Ellis Harwood, New York, 1983.

7. Principles of Protein Structure by G. Schulz and R.H. Schirmer, Springer - Verlag, 1984.

8. Introduction to Protein Structure by C. Branden and J. Tooze, Gar land Publishing, 1991.

9. Proteins Structure and Molecular Properties Thomas E. Creighton, W.H. freeman and Company, New York, 1993.

10. Principles of Nucleic acid Structure, W. Saenger, Springer verlag, 1984.

11. Biophysics by W. Hoppe. et. al., Springer - Verlag, 1989.

12. Biophysics by Vasantha Pattabhi and N. Gautham, Narosa Publishmg House, New Delhi,2002.

13. Essentials of Biophysics by P. Narayanan, New Age International (P) Ltd. Publishers, New Delhi, 2000.

Core Course XII

BP 5B 12 - MOLECULAR BIOLOGY

3hrs/week – 54 Hours/3 credits

Syllabus

Unit 1 - (12 hrs)

Introduction to molecular biology, The Central Dogma, DNA Structure and Chemistry, The Molecular Nature of Genes & Organization, Gene Function, Protein-DNA Interactions (prokaryote and eukaryote), DNA Topology and the Nucleosome, Inrtroduction to bacterial genetics

DNA Replication: The Replication Fork, Origins and Telomeres, Enzymes of DNA synthesis, DNA Repair, DNA Recombination: General, Site-specific, plasmids

Unit II- (17 hrs)

Prokaryotic Transcriptional Machinery , RNA Structure, RNA Types, genetic code , Eukaryotic RNA Polymerases and Their Promoters, reverse transcriptase, General Transcription Factors and Transcription Activators in Eukaryotes Messenger RNA Processing: Splicing, Capping and Polyadenylation , Major Shifts in Prokaryotic Transcription

Eukaryotic Transcriptional Machinery, Ribozymes, and Regulatory RNA Phage, Bacterial & Eukaryotic transcriptional Control.

Unit – III (20 hrs)

Ribosomal RNA and Transfer RNA

The Mechanism of Translation: Initiation, Elongation and Termination, Post Translational processing, Translational Control, Posttranslational modifications.

Control of genetic expression, Lac, Trp, Ara, His, operons, regulation of protein synthesis.

Unit – IV (5hrs)

Basic principles of rDNA technology, restriction enzymes, and its applications in medicine, agriculture, and in the production of commercially important proteins

Core Course XIII

BP B 13 – PHYSIOLOGICAL BIOPHYSICS

5hrs/Week- 90 hours/4 credits

Syllabus

Unit I- Basic Human physiology (10 hrs.)

Nervous System, digestive system, cardiovascular system, reproductive system, endocrine system, respiratory system, excretory system

Unit II- Bioelectricity (5 hr.)

Electrophysiology and bio-potentials, Origin of the bioelectric events, Polarisation and depolarisation of the cell, Measurement of biopotential.

Unit III- Cellular Neurophysiology (20 hrs.)

General design of Nervous System. Structure of neuron. Neuroglia. Myelinated and nmyelinated nerve fibers. Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibers, Properties of nerve fibers – excitability, conductivity, all-or none law, accommodation, adaptation, summation, refractory period, Concept of chronaxie and rheobase.

Synapses –types, structure, synaptic ransmission of the impulse, synaptic potentials, neurotransmitters. Motor unit. Injury to peripheral nerves- degeneration and regeneration-brief idea. The neuromuscular junctions – structure, events in transmission, end-plate potential, post titanic potential.

Unit IV- Respiration and lung function (15 hrs.)

Structure of Respiratory tract, Lungs, Diaphragm, Mechanics of Pulmonary Ventilation, Pulmonary Volumes and Capacities, Physical Principle of Gas Exchange, Regulation of respiration, Pulmonary function testing, Artificial Respiration.

Unit V- Special senses (5hrs.)

Vision: Eye as a camera, Mechanism of accomodation, Visual acuity, Ophthalmoscope, Colour vision, Perimetry.

Hearing: Tympanic membrane and the Ossicular system, the cochlea, Hearing mechanics and abnormality, Deafness, Audiometry.

Mechanism of olfaction, Primary taste sensation and constituents, structure of taste buds and pathways.

Unit VI- Ergonomics (5hrs.)

Muscular system: Classification of muscles, muscle contraction

mechanism, sliding filament theory, muscle fatigue, rigor mortis, slow and fast muscle fibers, isotonic and isometric contraction Analysis of Human Movements and Postures, Basics of human locomotion: kinematics and kinetics, Details of Posture-Analysis, Regular postures: walking, running, standing, sitting and Special occupational Postures: Squatting, cart pulling, load lifting etc., Postures in Games and Sports.

Unit VII- Cardiovascular system and heart function (25hrs.)

Composition and functions of blood. Plasma proteins – normal values, origin and functions. Brief idea on Bone marrow. Formed elements of blood – origin, formation, functions and fate. Hemoglobin – functions, compounds and derivatives. Abnormal hemoglobin-overview. Thalassemia-brief idea. Different types of anemia and their causes-overview. Erythrocyte sedimentation rate (ESR) and its significance. Hematocrit. PCV, MCV, MCH, MCHC. Blood volume –normal values, regulation. Blood coagulation – factors, process, anticoagulants, Prothrombin time. Clotting time. Bleeding time. Blood groups – ABO systems and Rh factors. Blood transfusion.

Structure of Heart, Heart valves, Arteries, Veins, Coronary Circulation, Heart as a pump, Physiology of Cardiac muscle, Cardiac Cycle, Rhythmic excitation of heart, Control of excitation and conduction in the heart, Physics of Blood pressure, flow and resistance, Vascular distensibility and functions of Arterial and Venous Systems, Heart rate and normal Heart sounds.

Unit VIII- Body fluids (5hrs.)

Properties of body fluid, determination of conduction of body fluid, measurement of EMF of cells, temperature and reaction rates, Rheological properties of blood and plasma, blood buffers, acid base balance, cerebrospinal fluid, bile, saliva, seminal fluid, lymph and urine.

References

1. Boobeck. J R (Ed), "Best and Taylor's Physiological basis of Medical Practice", The Williams & Wilkins Co.

2. Howell- Fulton, "Physiology and Biophysics", T.C. Iwch & H.D. Palton, W.B.Saunders Co.

3. Berne.R.M & Levy. M.N (Eds), "Physiology", The C.V. Moshy Co. St. Louis, Toronto.

4. Hamilton.W.F, " Hand Book of Physiology", Section 2, Circulation Vol II, American Physiological Society.

5. Arthur .C. Gayton & John.E.Hall, "Text Book of Medical Physiology", W. B. Saunders Co.

6. Widmaier, Raff & Strang, "Vander's Physiology- The mechanism of body Function. Mc Graw- Hill.

Core Course XIV

BP 6B 14 BIOMEDICAL INSTRUMENATION

5hrs/Week- 90 hours/4 credits

Syllabus

Unit I- Fundamentals of biomedical instrumentation (10hrs)

Basic biomedical instrumentation system, functional components, intelligent iomedical instrumentation systems, general constraints in design of biomedical instrumentation systems, regulation of biomedical devices, bioelectric signals, recording electrodes, physiological transducers, biological signal recording systems, classification of biomedical equipments.

Unit II Fundamentals of biomedical microscopic imaging (20hrs)

Physics of light and color, basic concepts in microscopy, anatomy of the microscope, sample preparation methods for biomedical applications (light microscopy), specialised microscopy techniques- differential interference contrast (DIC), phase contrast and dark field microscopy, simple fluorescence microscopy, confocal microscopy, time lapse fluorescence, fluorescence resonance energy transfer (FRET), labeling biomolecules for fluorescence microscopy, electron microscopy, interaction of electron beam with samples, scanning and transmission electron microscopy (SEM and TEM), atomic force microscopy (AFM).

Unit III Biomedical recorders and patient monitoring systems (20hrs)

Electrocardiograph (ECG), Electroencephalograph (EEG), Electromyograph (EMG), cardiac monitor, measurement of heart rate, measurement of pulse rate, measurement of blood pressure, blood flow

meter, measurement of temperature, blood gas analysers,blood cell counters, pulmonary function analysers, oximetry, audiometers and hearing aids.

Unit IV- Modern medical imaging systems and therapeutic equipments (20hrs)

Introduction to medical imaging, principles of computed tomography, nuclear medical imaging system- principles of NMR imaging systems, biological effect of NMR imaging, advantages of NMR imaging system, Ultrasonic imaging system- principles of ultra sound imaging system, biological effects of ultrasound, Echocardiograph, cardiac pacemakers, haemodialysis machine, portable kidney machine, anaesthesia machine, ventilators.

Unit V- Laser applications in biomedical field, radiotherapy and telemedicine (20hrs)

LASER- principles of operation, use, types and LASER safety, Radiotherapy- principles, dosage data for clinical applications, Gamma Camera, Positron Emission Tomography, Cobalt-60 machine, Therapeutic application of radio isotopes, application of UV radiation for treatments, biological effects of radiation and ultrasound, different telemetry systems, telemedicine applications, concepts, telemedicine technology

References

1. R. S. Khandpur "Handbook of Bio-Medical Instrumentation", Tata McGraw Hill.

2. Carr & Brown, "Introduction to Biomedical Equipment Technology" Pearson Education, Asia.

3. J.Webster, "Bioinstrumentation", Wiley & Sons

4. Sanjay Guha, "Medical Electronics and Instrumentation", University Publication.

5. Edwand J. Bukstein "Introduction to Biomedical electronics",Sane and Co. Inc. USA.

6. Paustetal, "Biological Effect of UV radiation", Plenum Press

7. Wagner H N, "Principles of Nuclear Medicine", W B Saunders & Co

8. Guyton A C, "Text Book of Medical Physiology", W B Saunders & Co

9. Suckling", "Bioelectricity", Mc-Graw Hill.

10. Dom & O Brien Dowden "Ultra sonic Biophysics", Hutdrinson & Ross.

11. Douglas B. Murphy, "Fundamentals of Light Microscopy and Electronic Imaging."

12. Shinya Inoue and Kenneth R. Spring, "Video Microscopy: The Fundamentals".

13. Elizabeth M. Slayter and Henry S. Slayter, "Light and Electron Microscopy".

14. John J. Bozzola and Lonnie D. Russell, "Electron Microscopy: Principles and Techniques for Biologists".

15. Leon Goldman, "The Biomedical laser Technology and Clinical Applications" Springer-Verlag.

16. Leon Goldman, " Lasers in Medicine", Springer-Verlag.

17. Pratesi E.D.R, and Sacchi, "Lasers in photomedicine and photo biology", Springer-Verlag.

Open Course I for Semester V

BP 5D 01 GENERAL BIOPHYSICS

3hrs/week – 4 Credits /54 hrs

Syllabus

Unit I (11 Hrs)

Scope of Biophysics (1hr)

Fundamentals of Biophysics (10 hrs) – Surface tension – Adsorption – Osmosis –Osmotic pressure – Dialysis – Colloids – Colloidal systems of life – Buffer – Buffer capacity – Buffers in life system – pH, its importance.

Unit II - Biomembranes (15 Hrs)

Membrane structure – composition, function, membrane transport – simple diffusion – passive transport and active transport (all types).

Unit III - Transuducing Membranes (15 Hrs)

Mitochondrial membrane, chloroplast membrane, chemical potential, redox potential, mitochondrial electro transport and photosynthetic electron transport.

Unit IV Techniques in Biophysics (Preliminary)

Basics of spectroscopy – X-ray crystallography – NMR – UV etc.

References

1. Biophysics by W Hoope Edtr., Springer – Verlag New York

2. Molecular Biophysics by R B Setlaw & EC Pollard Addison Wesley Reading MA.

3. Biophysics by Volkensyteinl M V.

4. Molecular Biology of the cell by Watson *et al.*

5. Biophysics by C Sybesma.

6. Biophysical Chemistry Vol. 1,2 & 3 by C R Cantor & P R Sachimmel.

7. Physical Chemistry of Nucleic Acid by V A Bloomfield.

8. Physical Biochemistry by K E Van Holde.

9. Biological Spectroscopy by J Campbell.

10. Intermediate Physics for Medicine and Biology by R K Hobble.

11. Biophysics by Roy.

Open Course II for Semester V

BP 5D 02 GENERAL MICROBIOLOGY

3hrs/week, 4 credits, total 54 hrs

Syllabus

Unit- I Introduction and history of Microbiology (5hrs)

Unit- II Diseases caused by different microbes (Bacteria, Virus, Fungus) (5hrs)

Unit- III Ultra structure of bacterial cell (5hrs)

Unit – IV Structural and nutritional classification of bacteria. (5hrs)

Unit – V Growth, identification and reproduction of microbes (invivo/invitro) (5hrs)

Unit – VI Sterilization and disinfection (4hrs)

Unit – VII Transmission of microbial diseases (food, water, air) (5hrs)

Unit – VIII Industrial application of microbes (fermented food, beverages and diary products) (5hrs)

Unit – IX Microbial spoilage of food and prevention techniques (5hrs)

Unit- X Microbial toxins (5hrs)

Unit- XI Useful microbes in health care, agriculture and industry (5hrs)

References

1. Industrial Microbiology by Casida

2. Fermentation Techniques by Stanberry

3. Fundamentals of Microbiology by Ananthanarayanan

4. Microbiology by Prescott

5. Microbiology by Pelzar

Open Course III for Semester V

BP 5D 03 HUMAN PHYSIOLOGICAL CHEMISTRY

3hrs/week, 4 credits, 54hrs

Syllabus

Unit I - Respiration and gas exchange (8hrs)

Unit II- Digestion and absorption (8hrs)

Unit III- Biochemical aspects of organ function, kidney, liver, heart and nerve (14hrs)

Unit-IV- Biological fluids, blood, urine and lymph (8hrs)

Unit- V - Nutrition – nutrients, minerals, vitamins – deficiencies (8hrs)

Unit VI - Endocrynology – pititutary, pancreas, adrenal, thyroid and reproductive hormones (8hrs)

References

1. Boobeck. J R (Ed), "Best and Taylor's Physiological basis of Medical Practice", The Williams & Wilkins Co.

2. Howell- Fulton, "Physiology and Biophysics", T.C. Iwch & H.D. Palton, W.B.Saunders Co.

3. Berne.R.M & Levy. M.N (Eds), "Physiology", The C.V. Moshy Co. St. Louis, Toronto.

4. Hamilton.W.F, " Hand Book of Physiology", Section 2, Circulation Vol II, American Physiological Society.

5. Arthur .C. Gayton & John.E.Hall, "Text Book of Medical Physiology", W. B. Saunders Co.

6. Mount V B, "Medical Physiology Vol I, II", The C V Mosby Co. St.Louis – Toronto.

7. Harris D T, Gliding H P & Smart, "Experimental Physiology for Medical Structure", WAN Ja Churchill Ltd. London.

8. Widmaier, Raff & Strang, "Vander's Physiology- The mechanism of body function", Mc Graw- Hill.

Elective course I for Semester VI

BP 6E 01 STRUCTURAL BIOINFORMATICS

3 hrs/week 54 hours – 3 credits

Syllabus

Unit 1 (8 hrs)

Introduction; Definitions; Challenges of structural bioinformatics; computational aspects of X-ray diffraction, NMR-spectroscopic and electron microscopic 3-D data; Molecular visualization.

Unit 2 (8hrs)

PDB Format and other data formats; Protein Data Bank; SCOP Data Base; Nucleic Data Base; Domain Data Base, Quality assurance of data bases; structure comparison and alignment.

Unit 3 (8hrs)

Secondary structure assignment; Domain structure identification; Inference of function from Structure.

Unit 4 (8hrs)

CASP and CAFASP experiments; Homology modeling; Fold recognition method; ab initio **structure prediction methods; membrane-protein structures.**

Unit 5 (8hrs)

Prediction of protein-protein interactions; Electrostatic interactions Between proteins; proteins as drug targets-principles of docking and ligand design; An example for drug discovery through structural bioinformatics.

Unit 6 (8hrs)

Structural genomics.

Unit 7 (8 hrs) (not for theory examination):

General study of software packages (one each) for sequence alignment; 2-D and 3-D structure prediction; protein-protein interaction & protein-ligand interaction and modeling study; primer design for molecular biology; computerized wet lab experiment planning.

References

1. **Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.**

2. **Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley & Liss.**

3. **Biochemistry by Voet D. and Voet J.G, John Wiley & ons.**

4. **4. Introduction to Protein structure by Brandel C. and Tooze, J**

Elective course II for Semester VI

BP 6E 03 EXPERIMENTAL TECHNIQUES IN STRUCTURE ELUCIDATION

3hrs/week – 54hrs/3credits

Syllabus

Unit 1- Principles of x-ray crystallography (15 hrs)

Unit cell, cell content, crystal symmetry, crystal systems, Bravais lattices, symmetry elements and operations, point groups and space groups. Bragg's law. Diffraction of x-rays by crystals, Atomic scattering factors and structure factors, amplitude and phase, Fourier transformation.

Unit II- Crystal structure determination (15 hrs)

Different techniques of crystallization, Data collection- x-ray generators and detectors, diffractometer, imaging plates, phase determination, Patterson method, direct methods, Molecular replacement methods, isomorphous replacement method, anomalous dispersion. Structure refinement. Important software for visualization and refinement. R- factor, Validation of the structures.

Unit III- NMR spectroscopy (15 hrs)

Basic principles, Instrumentation, Chemical shift, Shielding constant, Relaxation processes, spin-spin and spin-lattice relaxation, Free Induction Decay, FT-NMR, Dipole-dipole interaction, spin-spin coupling, Multidimensional NMR, Applications of NMR spectroscopy in determination of molecular structure, conformational changes, intermolecular interaction.

Unit IV- Infra-Red and Raman spectroscopy (5 hrs)

Rotational and vibrational motions and corresponding energy levels, IR spectroscopy, FT-IR spectroscopy, Raman spectroscopy- Complementarity of IR and Raman spectra, Applications in determining protein structural features.

Unit V- Other spectroscopic techniques (4 hrs)

UV-visible spectroscopy- Molecular orbitals and energy levels, electronic transitions . Atomic absorption spectroscopy and atomic emission spectroscopy. Mass Spectroscopy.

References

1. Principles of Biochemistry by A.L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers, New Delhi, 1993.

2. Biochemistry by L. Stryer, W.H. Freeman and Co., Newyork 1997.

3. Conformation of Carbohydrates by V.S.R. Rao, P.K. Qasba, P.V. Balaji and R. Chandrasekaran, Harwood Academic Publishers, 1998.

4. Steno Chemistry of Carbohydrates J.F. Stoddart , Wiley Interscience 1971.

5. Complex Carbohydrates their Chemistry by N. Sharon, Biosynthesis and Functions, Addison- Wesley, London, 1975.

6. Bio active carbohydrates in Chemistry, Biochemistry and Biology by J.F. Kennedy and C.A.White, Ellis Harwood, New York, 1983.

7. Principles of Protein Structure by G. Schulz and R.H. Schirmer, Springer - Verlag, 1984.

8. Introduction to Protein Structure by C. Branden and J. Tooze, Gar land Publishing, 1991.

9. Proteins Structure and Molecular Properties Thomas E. Creighton, W.H. Freeman and Company, New York, 1993.

10. Principles of Nucleic acid Structure, W. Saenger, Springer verlag, 1984.

11. Biophysics by W. Hoppe. et. al., Springer - Verlag, 1989.

12. Biophysics by Vasantha Pattabhi and N. Gautham, Narosa Publishmg House, New Delhi,2002.

13. Essentials of Biophysics by P. Narayanan, New Age International (P) Ltd. Publishers, New Delhi, 2000.

Elective course II for Semester VI

BP 6E 02 BIOMEDICAL IMAGING

Syllabus

Unit I (12 Hrs)

X- ray Machine and Digital Radiography:

Basis of Diagnostic Radiology, Nature of X- ray, Production of Xrays, X-ray Machine, visualization of X-rays, Dental X-ray Machines, Portable and mobile X-ray units, Physical Parameters for X-ray Detectors, Digital Radiography, X-ray Computed Tomography:

Computed Tomography, System Components, Gantry Geometry, Patient Dose, in CT Scanner.

Unit II (12 hrs)

Magnetic Resonance Imaging System:

Principle of NMR Imaging System, Image Reconstruction Techniques, Basic NMR, Functional MRI (FMRI) Components, Biological effects of NMR Imaging, Advantages of NMR Imaging System.

Unit III (10 hrs)

Ultrasonic Imaging System:

Diagnostic Ultrasound, Physics of ultrasonic waves, Medical ultra sound, Basic pulse – echo apparatus, A- scan, Echocardiograph, B-scanner, real time ultrasonic Imaging System, Multi- element linear array scanners, Digital Scan converter, Biological Effects of ultrasound.

Unit IV (8 hrs)

Thermal Imaging System.

Medical Thermography, Physics of thermography, Infrared Detectors, Thermo graphics Equipments, Quantative medical thermography, pyroelectric vidicon Camera, Thermal Camera based on IR Sensor with digital focal plane array.

Unit V (15 hrs)

Nuclear Medical Imaging System:

Radio Isotopes in medical diagnosis, Physics of radioactivity, Radiation detectors, pulse height analyzer, uptake monitoring equipment, radio isotopes rectilinear scanner, the gamma Camera, Multi Crystal Gamma Camera Emission Computed Tomography (ECT), Single Photon emission Computed Tomography (SPECT), Positron Emission Tomography (PET Scanner).

References

1. Introduction to Biomedical Imaging, By: Andrew Webb.

2. Medical Imaging System. By Maco vski, Albert Printsol.

3. Hand Book of Biomedical Instrumentation " R.S Khandpur"

4. Essential physics of medical Imaging By, Jerold T. Bushburg

5.Physics of diagnostics radiology. By Christensen.

ANNEXURE - III

PROJECT SUGGESTIONS

Simple group projects (Five in a group) submitted even in hand written form (CD form along with hard copy)

Subjects like Physics, Mathematics, Biostatistics, Computer Science, Chemistry, Biochemistry and Biophysics may be preferred by the students

Works like :

1. Literature survey and analysis in the above mentioned areas.

2. Based on basic theories and simple experiments

3. Projects from Structural Biology and Bioinformatics

4. Projects using new software from the areas like Structural Biology and Bioinformatics

In addition to this, the Departments have the freedom to select topics of their interest in specialized areas.

Core Course Practical I

BP B 01 (P) – CHEMISTRY AND BIOCHEMISTRY

Part I – Chemistry

1. Qualitative analysis – Analysis of a mixture containing two cations [lead, copper, bismuth, cadmium, aluminum, iron, zinc, manganese, cobalt, nichel, barium, calcium, strontium, magnesium, ammonium].

2. Quantitative analysis – Acidimetry and Alkalimetry – permangenometry, dichrometry, iodometry.

Part II – Biochemistry

1. General reactions of biochemicals (carbohydrates, protein, amino acid, lipids).

2. Schematic analysis of biochemicals to identify a single biochemical component.

3. Principles of colorimetry, verification of Beer's Lambert law using colorimeter.

4. Demonstration of TLC, paper choromatography, paper electrophoresis.

5. Demonstration of enzyme hydrolysis using salivary amylase.

6. Estimation of protein by Biuret method.

7. Estimation of protein by Lowry 's method.

8. Estimation of amino acid by Ninhydrin method.

9. Estimation of cholesterol by Zak method.

10. Estimation of glucose by Benedict's titration method

CORE COURSE PRACTICAL PAPER II

BP 02 & 03 (P) PHYSIOLOGICAL BIOPHYSICS AND MOLECULAR BIOLOGY

Syllabus

Part – 1 Physiological Biophysics

1. Study of Neubauer's Counting Chamber

2. Red blood cell count/µl of blood

3. White blood cell count/ µl of blood

4. Haemoglobin content estimation

5. Differential count of White blood cells

6. Determination of ESR

7. Determination of Clotting time

8. Determination of Bleeding time

9. Determination of Blood groups

10. Determination of fragility of erythrocytes

11. Oscilloscope Experiments

12. Spirometry- Measurement of vital capacity, tidal volume, different timed volumes, peak flow rate.

13. Anatomical study of different body systems by using virtual CD Rom/ DVDs (Educational Software).

14. Research laboratory / Clinical laboratory visits to observe neurophysiology and cardiovascular experiments and instrumentation.

Part – II Molecular Biology

1. Mitosis

2. Bacterial cell culture

3. Growth curve

4. Mutation

5. Protein synthesis, inhibition

6. Induction of beta galactosidase

7. Isolation of genomic DNA and RNA.

8. Southern blotting.

9. Northern blotting.

10. Western blotting

11. PAGE

12. Finger printing Techniques

13. UV spectra of DNA

CORE COURSE PRACTICAL –III

BP 03 (P) BIOMEDICAL INSTRUMENTATION

Syllabus

1. Methods of sample preparation for microscopy

2. Handling of different microscopes

3. ECG recording

4. Blood pressure monitoring

5. Pulse rate recording

6. Blood gas analysis

7. Hospital / Clinical Laboratory visit to study the biomedical instrumentation and procedure for recording the following clinical instruments:

(a) ECG

(b) EMG

(c) EEG

(d) Pulmonary function testing

(e) X-ray

(f) Echocardiography

(g) CT scan

(h) Hemodialysis

(i) Anesthesia machine

(j) Ventilators

(k) Telemedicine technology

(l) NMR

(m)Electron microscopy

LIST OF BASIC EXPERIMENTS THAT COULD BE INCLUDED IN THE

PRACTICAL COURSE (BIO-MEDICAL) FOR B.SC BIOPHYSICS PROGRAMME.

1. Familiarization of components: Active, Passive, Symbols, Identification, Specification and Testing

2. Familiarization of Equipments :Voltmeter and Ammeter

3. Familiarization of Equipments : Multimeter (analog and digital)

4. Familiarization of Equipments : CRO, Function Generator and Power Supply

5. Soldering Practice : Familiarization of soldering materials – wire to wire, wire to PCB, good and bad soldering joints.

6. Desoldering Practice : Using desoldering pump and wick

7. Characteristics of PN junction diode

8. Characteristics of Zener diode

9. Characteristics of LED

10. Characteristics of Photo diode

11. Familiarization of Rectifier Circuits –Half-Wave

12. Familiarization of Rectifier Circuits –Full Wave

13. Familiarization of Rectifier Circuits –Bridge Rectifier

14. Low pass and High pass filters and frequency response

15. Passage of Laser through optical fibres using small semiconductor lasers and optical fibres.

16. Familiarization of Mathlab Software

17. Basic simulation experiments using Mathlab software.

18. Galvanic currents in physiotherapy

References

1. Electronics Lab Manual –Nawas

2. Electronics Lab Manual – Vol I –T.D.Kuryachan