

**Swami Ramanand Teerth Marathwada University
Nanded.**

FACULTY OF SCIENCE

SYLLABUS

B.Sc. (Biophysics) Third Year (MCQ Pattern)

SEMESTER V & VI

[Syllabus progressively effective from June 2013 onwards]

Swami Ramanand Teerth Marathwada University ,Nanded

Syllabus Pattern for B.Sc. Biophysics Third Year

Semester V (2013-14 onwards)

Course Code	Name of Paper	Semester	Teaching WL/Week	Evaluation Pattern		
				External	Internal	Total
BP IX	Immunology	V	3 Hrs	40	10	50
BP X	Bioinformatics & Structural Biology	V	3 Hrs	40	10	50
BP LAB V	Practical based on BP IX & BP X	V	4 Hrs	40	---	50
Total						150

Semester VI (2013-14 onwards)

Course Code	Name of Paper	Semester	Teaching WL/Week	Evaluation Pattern		
				External	Internal	Total
BP XI	Radiation Biophysics	VI	3 Hrs	40	10	50
BPXII	Medical Biophysics	VI	3 Hrs	50	10	50
BP LAB VI	Practical based on BP XI & BP XII	VI	4 Hrs	50	---	50
Total						150

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus B. Sc. [Biophysics] Third Year Semester V
Paper BP-IX: Immunology

[Total Marks: 50] (40Ext. +10 Int.) [Exam Duration: 1 hrs] [Total Workload:45 hrs]

Unit 1: - Introduction to Immunology.

Concept and principles of immune system, origin of immune system in invertebrates and vertebrates, Innate immunity, Barriers of innate immunity, Anatomical, physiological and chemical barriers, Adaptive Immunity, active and passive immune system. Molecules, Cells and tissues of immune system,

Unit 2: - Cells and Organs of the Immune System:

The lymphatic system, Haematopoiesis, Haematopoietic growth factors, Primary lymphoid organs: Thymus, Bone marrow and Bursa of Fabricius Secondary lymphoid organs: Thymus, Lymph nodes, Spleen, tonsils, Peyer's patches, Mucosa associated lymphoid tissues, B lymphocytes, T lymphocytes, NK cells, Granulocytes etc.

Unit 3 : Antigen and Antibody :

Concepts of antigen, Antigenic determinant, Antigenicity, Immunogen and Immunogenicity, Factors affecting Antigenicity, Exogenous antigens, Endogenous antigen, Alloantigens, Hapten, Carrier effect, Cross reactivity.

Immunoglobulin, Structure of Immunoglobulin, Classes and subclasses of Immunoglobulins, function of different Immunoglobulins, Immunoglobulin diversity .

Unit 4 : - Antigen- Antibody interaction.

Physico-chemical basis of Ag- Ab interaction, Avidity, strength of binding between Ag and Ab and its measurement, Detection of Ag-Ab interaction, Precipitation, Agglutination and Complement fixation, The complement system, Cytokines

Unit 5: - Immunotechniques.

Concept of Monoclonal and polyclonal Antibodies, Immunization, Methods for purification of antibodies, Antibody assays : Precipitation reaction in gel and solutions Double, Single, Radial immunoprecipitation, Agglutination reactions, Prozone effect, Haemagglutination, Bacterial agglutination, Passive agglutination, Coombs' test, Complement fixation test, Immunoelectrophoresis, Immunofluorescence, Radioimmunoassay, ELISA .

REFERENCES :

1. Basic Immunology by Joshi and Osarano. Agrobotanical publishers Ltd. Bikaner.

2. Elementary Microbiology Vol.I and II Dr. A.H Modi. Akta Prakashan. Nadiad.
3. Medical Microbiology. N.C.Dey and T.K. Dey. Allied agency, Culcutta.
4. A text book , of Immunology. C.V.Rao.,Narosa Publishing House,New Delhi.
5. Molecular biology by David Freidfelder, Narosa Publishing house, New Delhi.
6. Text book of Immunology by B.S.Nagoba and D.V.Vedpathak. BI publications, New Delhi.
7. Text book of Microbiology by R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman,

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus B. Sc. [Biophysics] Third Year Semester V
Paper BP-X: Bioinformatics & Structural Biology
[Total Marks: 50] (40Ext. +10 Int.) [Exam Duration: 1 hrs] [Total Workload:45 hrs]

Unit 1: Bioinformatics I

Bioinformatics-Definition,history; aims and tasks of bioinformatics, applications of bioinformatics in pharmaceutical industry,intrinsic & extrinsic views in bioinformatics,**Data bases** - Major Bioinformatics Resources:, BTIS,EBI, ExPASy, RCSB; Nucleic acid sequence databases: NCBI , EMBL, DDBJ; GenBank; Searching Databases: SRS, Entrez, Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL, PIR-PSD; Derived & Pattern Databases: Sequence Protein family/domain/ pattern databases: InterPro, Prosite, Pfam, ProDom, Gene Ontology, Profile, Block;Structure classification database: CATH,SCOP, FSSP;Protein-Protein interaction database: STRING ;specialized genomic resources (KEGG, etc) ;Repositories for high throughput genomic sequences: EST, STS GSS, etc ;Genome Databases at NCBI, EBI, TIGR, SANGER ;Eukaryotic genomes with special reference to model organisms (Yeast, Drosophila, C. elegans, Rat, Mouse, Human, plants such as Arabidopsis thaliana, Rice, etc.);3D Structure Database - PDB, NDB ; Chemical Structure database: Pubchem; Gene Expression database: GEO, SAGE

Genomics: DNA Sequence Analysis-Introduction, why analyze DNA , gene structure and DNA sequences, feature of DNA sequence analysis, issue in the interpretation of EST searches, gene hunting, expression profile of a cell, cDNA libraries, and ESTS, different approaches to EST analysis, effect of EST data on DNA databases. Pattern and repeat finding, Gene identification tools. Pattern Recognition Methods in Sequence Analysis Concept of a sequence pattern, regular expression based patterns. The use of pattern databases like PROSITE and PRINTS. Concept of HMMS, Micro-array technology and its applications. Genome mapping – physical mapping, genetic mapping, gene ontology, gene annotation.

Unit 2:Bioinformatics II

Phylogenetic Analysis-Phylogenetics, cladistics and ontology, building phylogenetic trees, distance based methods and character based methods, molecular approaches to phylogeny, phylogenetic analysis databases

Sequence Alignment-Algorithm, goals and type of alignment, Method for the comparison of two sequences viz., dot plot/ Dot matrix plots, Needleman Wunsch & Smith Waterman algorithms. Analysis of computational complexities and the relative merits and demerits of each method. Theory of scoring matrices and their use for sequence comparison-PAM BLOSSUM, study of similarities, scoring mutations, deletions and substitutions, gaps & gap penalty, pair wise database searching, FASTA, BLAST, multiple sequence alignment, notion of Homology, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation Matrices, Interpreting results.

Unit 3: Structural Biology

Levels of structures in Biological macromolecules, the chirality of biomolecules, proteins, nucleic acids, carbohydrates and lipids, cofactors, vitamins and hormones, building blocks of proteins, motifs of protein structures, alpha domain structures, alpha/beta structures Basic structural & conformational principles, Conformational analysis-Forces that determine Protein and Nucleic acid structure, basic problems. Polypeptide chains; geometric, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and water structures; ionic interactions, disulphide bonds, Ramachandran plot, Folding and flexibility, Types of proteins and interactions that govern protein folding, folding mechanisms, Prediction, engineering and design of protein structures. The protein globule and hydrophic interactions organized folds, membrane proteins, helix-coil transitions, Methods to identify secondary structural elements;Bio-molecular interactions-forces involved in macromolecular interaction, Molecular recognition, supra-molecular interactions, Functional importance of Protein-protein and protein-nucleic acid interactions. Specific and non-specific DNA-protein complexes

Unit 4: Structural Bioinformatics

Molecular Modeling : Predictive methods using DNA and Protein Sequences, Gene-prediction and Proteins-prediction strategies, Methods for Prediction of secondary structure, tertiary Structure, homology modeling, fold recognition and ab-initio approaches, comparative modeling, threading, energy minimization ,bases prediction, molecular visualization, Comparative modeling, Molecular visualization-protein conformation and visualization tool (RASMOL),Structures of oligomeric proteins and study of interaction interfaces. **Drug Discovery and Pharmaco-informatics**-Discovering a drug, Drug discovery -role of bioinformatics in drug discovery target identification and validation, identification the lead compounds, optimization of lead compounds, pharmaco-informatics, chemical libraries, search programming docking and prediction of drug quality. Bioinformatics companies

REFERENCES :

Text Books:

1. Basic Bioinformatics by S. Ignacimuthu, S. J. Narosa Publishing House, 2005.
2. Bioinformatics: Sequence and Genome analysis by David W. Mount, Cold Spring Harbour Laboratory Press, 2001.
3. Protein structure, stability and folding (2001) K.P. Murphy Humana press.
4. Introduction to protein architecture (2001) Arthur M. Lesk Oxford University Press.
5. Introduction to Macromolecular Crystallography (2003) McPherson John Wiley Publications.
6. Introduction to Protein Structure, (1991) Carl Branden and John Tooze
7. Bioinformatics (2006) N. Gautham John Garland, Publication Inc Narosa publications.
8. Biophysics (2002) Vasantha Pattabhai and N. Gautham Narosa Publishers.
9. Physical Chemistry (2001): Tinoco, I., Jr., Sauer, K., Wang, J. C., & Puglisi, J. D.
10. Principles and Applications in Biological Sciences, 4th ed. Prentice Hall.
11. Introduction to Protein Architecture, by A.M. Lesk
12. Introduction to Protein Structure, by Branden and Tooze

Reference Books:

1. Introduction to Bioinformatics by S. Sundara Rajan and R. Balaji. Himalaya Publishing
2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Andreas D.
3. Baxevanis and B. F. Francis Ouellette, 2nd Edition, John Wiley & Sons, 2002.
4. Bioinformatics: Sequence, Structure and Databanks by Des Higgins and Willie Taylor.
5. Oxford University Press, 2000.
6. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids by
7. Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge Univ P
8. Proteins: structures and molecular properties Thomas E. Creighton
9. Chemoinformatics Edited by Johann Gasteiger and Thomas Engel
10. Structural Bioinformatics, Edited Philip E. Bourne and Helge Weissig
11. Computer Science, J.G. Brookshear, Pearson, Addison Wesley
12. Introduction to Bioinformatics – T. Attwood, Parry Smith

13. Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
14. Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
15. Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
16. Statistical Methods in Bioinformatics: An Introduction, G.R.Grant, W.J. Ewens, Springer

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus B.Sc. [Biophysics] Third Year Semester V Practical Course
Paper BP LAB V : Practicals Based on BP IX & BP X
[Total Marks: 50] (40Ext. +10 Int.) [Exam Duration: 1 hrs] [Total Workload:45 hrs]

LIST OF PRACTICALS [Based on BP IX-IMMUNOLOGY]

1. Demonstration of Immunization of Rabbit
2. To perform immunodiffusion by Ouchterlony method.
3. Single radial immunodiffusion(Mancini method)
4. Analysis of the Ouchterlony and Mancini method
5. Countercurrent Immuno electrophoresis
6. Characterization of the Blood Group by agglutination
7. To perform ELISA checkerboard experiment.
8. To perform Complement fixation assay
9. To perform Immuno affinity chromatography.
10. To perform Agglutination inhibition Assay
11. To perform sandwich ELISA.
12. To perform Immunoprecipitation
13. To perform Coomb's test.
14. Hemolytic plaque assays.

LIST OF PRACTICALS [Based on BP-X-BIOINFORMATICS & STRUCTURAL BIOLOGY]

1. Searching of scientific information in NCBI, EBI, DDBJ using Entrez, SRS
2. Surveying Primary, Derived, specialized & structural biological databases & compiling information

3. Identification of gene using gene scan & EST analysis
4. Primer designing using software
5. Pair wise alignment BLAST & FASTA
6. Multiple sequence alignment CLUSTAL W
7. Prediction of primary and secondary structure and various parameters in protein structure and function
8. 3D analysis of protein molecule & molecular visualization using RASMOL, Cn3D
9. Phylogenetic analysis using PHYLIP or other software
10. Molecular Docking using AUTODOCK or other software

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus B. Sc. [Biophysics] Third Year Semester VI
Paper BP-XI: Radiation Biophysics

[Total Marks: 50] (40Ext. +10 Int.) [Exam Duration: 1 hrs] [Total Workload:45 hrs]

Unit 1: Basics of Radiation Physics

Atomic structure models, Constituents of atomic nuclei, Isotopes, Isobars, Isotones, Isomers, stability of nuclide, binding energy forces radioisotopes, Radioactivity, law of Radioactivity, Alfa, Beta, Gamma rays, General properties of alpha, beta and gamma radiations, decay process, parent-daughter relationship. Metastable state and isomeric transition, modes of beta decay, electron capture processes, internal conversion, Auger effect, positron emission, Specific activity and carrier-free activity. Physical, Biological and effective half lives of radioisotopes. Radiation units: Units of measurement of radioactivity. Curie, Becquerel. Units of exposure, Roentgen, units of measurement of absorbed dose Rad, Gray, relative biological effectiveness, Dose equivalent, quality and modifying factors, Roentgen equivalent man, Sievert, Interaction of radiation with matter: Excitation and ionization, Photo electric effect, Compton effect, pair production, annihilation radiation, Radiation energy loss (Bremsstrahlung) and characteristic radiation. Range of α -particles in air and tissues, half value thickness, linear and mass absorption coefficients, backscatter and self absorption, specific ionization and linear energy transfer, X-rays-production, Properties, Characteristics X-rays, Interaction with different biosystems, Nonionizing radiations-UV, IR, Microwaves & Radio waves, their characteristics, interactions & implications in biosystems.

Unit 2: Basics of Radiochemistry & Radiobiology

Radiolysis of water, Production of free radicals & their interactions, Direct and indirect effects of radiation. Radiation chemical yield and G value, Target theory, Single hit & Multi hit theory, Effect of radiation on Nucleic acids, Proteins, Enzymes, Action of radiation on living system – Viruses, Prokaryotic & Eukaryotic cells Cellular effects of radiation, somatic & genetic effects, Inhibition of mitosis, survival curves, concept of **LD₅₀**, acute and chronic (whole body) effects of radiation, Radiation syndrome in human beings

Unit 3: Introduction to Radiation Detection & Measurement

Radiation sources, Tele-gamma Unit (Cobalt unit), Gamma chamber, Particle Accelerators, Nuclear reactors, gamma camera, Principles of radiation detection and measurement, General principles of Dosimeters., Basic principle, design and utility of ionization chamber, proportional counter, GM-counter, Scintillation Detectors. Thermo-luminescent dosimeter, chemical dosimeter-Fricke, methyl orange, FBX, Free radical dosimeters, low & high dose indicator

Unit 4 : Radiation Safety measures and Application

Natural & Man-made radiation exposures, Basic Principles of Radiation protection concept of Maximum permissible dose (MPD) or dose equivalent limit (DEL), radiation protection procedures, personal & area monitoring, licensing & other administrative procedures for procurement of radioisotopes, legal aspect of radiation protection, Disposal of radioactive waste.

Radioisotopes in biology, Medicine(Therapy & diagnosis),Agriculture, Plant breeding, Soil plant relationship & plant physiology, Biological applications of radioisotope, Radio-labeling & Tracer techniques, Food irradiation, radiation sterilization of medical product,

Autoradiography-Principle of autoradiography. Type of nuclear emulsions for beta and alpha particles. Properties of Photographic emulsions. Formation of latent image. Conversion of latent image into visible image. sensitivity specks and photographic reaction, photographic processing- Use of developer and importance of fixation. Techniques for placing emulsions and sample in contact. Autoradiography image & resolution.

Reference Books:

1. Primer in Applied Radiation Physics: F.A. Smith.
2. Introduction to Experimental Nuclear Physics: R.M. Singru.
3. Radiation Biophysics: E.L. Alpen.
4. Atom, Radiation and Radiation Protection: J. Turner.
5. Atomic and Nuclear Physics Vol. II: Ghoshal.
6. Nuclear Structure: Preston and Bhaduri.
7. Nucleon-nucleon Interaction: Brown and Jackson.
8. Introductory Nuclear Physics: S.S.M. Wong.
9. Nuclear Structure: M.K.Pal
10. Radiation Detection and Measurement: G.F. Knoll.
11. Nuclear Physics Techniques: W.R. Leo.
12. Introduction to Nuclear and Particle Physics(2nd Edition): A Das and T. Ferbel.
13. Radiation Biophysics by L.Alpen Edward, Academic Press, (1988).
14. Biophysics—An Introduction. John Wiley and Son, (2002).
15. Yurii B. Kudryashov Radiation Biophysics (Ionizing Radiations)
16. Edward L. Alpen Radiation Biophysics, Second Edition
17. Biophysics by Glaser Rowland (2001). Springer Verlag, Berlin
18. Bushong, Stewart, Radiologic Science for Technologists, C. V. Mosby, 2009,9th edition.
19. NCRP Report 105. Radiation Protection for Medical & Allied Health Personnel.
20. NCRP Report 116. Limitation of Exposure to Ionizing Radiation.
21. NCRP Report 102. Medical X-ray, Electron Beam, and Gamma-Ray Protection.

22. J A Parrish, R Rox Anderson, F Urbach, and D Pitts. UV-A: Biological Effects of Ultraviolet Radiation Plenum Press,
23. An Introduction to Lasers – theory and applications, M.N. Avadhanulu, S.Chand and Experiments with He+Ne Laser by Sirohi
24. Optical fibre and Laser – Principle and applications, Anuradha De, New Age International
25. Thormod Henriksen Radiation & Health Taylor & Francis
26. F.R. Hallett, J.L. Hunt, E.L. McFarland G.H. Renninger, R.H. Stinson and D.E. Sullivan Physics for the Biological Sciences 3rd and 4th Ed.
27. H. Cember and T.E. Johnson, Introduction to Health Physics, (McGraw Hill)

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus B. Sc. [Biophysics] Third Year Semester VI
Paper BP-XII: Medical Biophysics

[Total Marks: 50] (40Ext. +10 Int.) [Exam Duration: 1 hrs] [Total Workload:45 hrs]

Unit 1: Basic Electrophysiology:

Nature of bioelectric signal, Fundamental concepts in bioelectricity & bioelectronics, bio-transducers & bioamplifiers, principles & utility of patch-clamp and voltage-clamp techniques, ELECTROCARDIOGRAPHY (ECG) Fundamental principles of electrocardiography, Cardiac electrical field generation during activation ,Cardiac wave fronts ,Cardiac electrical field generation during ventricular recovery ,Electrocardiograph lead systems ,Standard limb leads, Pre-cordial leads and the Wisdom central terminal Augmented limb leads, The hexaxial reference frame and electrical axis ,Recording adult and pediatric ECG ,The normal electrocardiogram Atrial activation ,The normal P wave ,Atrial repolarization ,Atrio-ventricular node conduction and the PR segment ,Ventricular activation and the QRS complex ,Ventricular recovery and ST-T wave U wave ,Normal variants ,Rate and rhythm Principle, instrument design and medical utility of EEG ,EMG ,ERG ,EOG ,Visual evoked potentials, biological impedance and its significance

Unit 2: Medical Imaging:

Physical aspects of medical imaging, LASER beam in biology & medicine, Fundamentals of laser physics, Medical lasers(Carbon Dioxide Laser, Nd:YAG Laser, Argon Ion Laser),Applications of Lasers in therapy and diagnosis(optical properties of tissue, tissue luminescence, photo-thermal effects, photochemical effects, photomechanical and photo-ablative effects, Clinical applications of laser systems. Principle, instrumental set up, procedure and medical utility of X-ray imaging, Xero-radiography, Fluoroscopy, Computer Tomography Scan, Magnetic Resonance Imaging, Ultrasound in medicine-Physical properties of ultrasound (the velocity, the frequency, intensity, acoustic impedance, reflection ratio, acoustic pressure). Generation and detection of ultrasound (the piezoelectric effect and magnetostriction). Ultrasound interactions with the tissues (reflection, diffraction, refraction, absorption, attenuation, scattering, stationary waves, total internal reflection). The biological effects of ultrasound interaction with the tissues (thermal, mechanical,Cavitation , biochemical) Ultrasound application in medicine (therapy, diagnostic –

USG ultrasonography, ultrasound flow measurement and imagine with Doppler). Considerations for the safety of diagnostic and therapeutic ultrasound.

Unit 3: Nuclear Medicine :

In-vitro & in-vivo imaging using radioisotopes, Blood volume determinations by isotopic method, Radioiodine diagnosis & therapy in thyroid disorders, Principle, method and applications of Radioimmunoassay, organ scans-thyroid, liver, brain, bone, renal imaging, cardiac imaging, myocardial scintigraphy, PET scan, SPECT scan, nuclear medicine for therapy, radiopharmaceuticals-concept, production & use

Unit 4: Biomedical Instrumentation

Basic concepts in medical instrumentation, Basic sensors-principles, transducers, amplifiers, measurement of blood pressure, blood volume, blood flow, respiratory measurements, cardiac output measurements, therapeutic and prosthetic equipments, patient monitoring equipments, audiometers, hearing aids, difibrillators, cardiac pacemakers, surgical diathermy, physiotherapeutic equipments, hemo dialysis machine, lithotripters, ventilators, automated drug delivery systems, ICU and Operation theater equipments, blood bank instrumentation, electrical safety

References

1. Beiser A.: Physics, Addison-Wesley, Massachusetts 1991, Chapter 27, pp. 803-807
2. Katzir A.: Lasers and Optical Fibers in Medicine, Academic Press, Inc. 1993
3. Medical Instrumentation applications and design by John G. Webster.
4. Biomedical Instrumentation Technology and applications by Khandpur. Mc Graw –Hill.
5. Biomedical Instrumentation systems by Shakti Chatterjee.
6. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', McGraw Hill Publishing Co Ltd. 2003.
7. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson Education
8. M. Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies,
9. L.A. Geddes & L.E. Baker, Principles of Applied Bio-Medical Instrumentation, John Wiley
10. J. Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
11. C. Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Ins
12. James Moore George Zouridakis Biomedical Technology and Devices Handbook CRC Press
13. Bronzino Biomedical Engineering Handbook CRC Press
14. Physics of Diagnostic Imaging, Universities press (India) Ltd, Orient Longman ltd, 2000.
15. Goddess & Baker Principles of Applied Biomedical Instrumentation, John Wiley
16. Carr & Brown Biomedical Instrumentation & Measurement, Pearson
17. Cromwell Biomedical Instrument Prentice Hall of India, New Delhi
18. Sanjay Guha Medical Electronics and Instrumentation, University Publication
19. Edward J. Bukstein Introduction to Biomedical electronics Sane and Co. Inc. USA.

20. JohnG Webster, Medical Instrumentation application design, Houghon Mifflin Co.
21. Joseph Dfu Bovy, Introduction to Biomedical Electronics, Mc Graw Hill.
22. J.B.Cameron & Skofornik Medical Physics, Academic Press

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus For B. Sc. [Biophysics] Third Year Semester VI Practical Course
Paper BP LAB VI: Practicals based on BP XI & BP XII
[Total Marks: 50] (40Ext. +10 Int.) [Exam Duration: 1 hrs] [Total Workload:45 hrs]

LIST OF PRACTICALS [Based on Paper BP-XI: Radiation Biophysics]

1. To calibrate the UV source using Potassium ferrioxalate actinometry.
2. To measure the UV intensity using UV meter
3. To study the effect of UV, X-rays on mitotic cell division .
4. To study the effect of UV, X-rays on biomolecules – amino acids, proteins ,
Nucleic acids, enzymes.
5. To study the effect of UV, X-rays on seed germination and study cytogenetic changes
6. To study the effect of UV, X-rays on cell membrane- RBC
7. To study the effect of UV, X-rays on bacterial cell growth and evaluate **LD₅₀**
8. To investigate background radiation, learn how to measure it, and compensate for it.
9. To study the characteristics of a Geiger-Muller counter and to determine plateau and operating voltage of the GM counter.
10. To determine the resolving time of a GM counter.
11. To estimate the efficiency of the Geiger-Mueller tube for a particular source.
12. To demonstrate the Statistical Nature of Radiation Counting & investigate the statistics related to measurements with a Geiger counter.
13. To investigate the relationship between the distance and intensity of radiation and verify the inverse square relationship between the distance and intensity of radiation.
14. To investigate the relationship between absorber material (atomic number) and backscattering and study the relationship between absorber thickness and backscattering.
15. To determine the range of an alpha particle in air, and consequently the alpha particle's energy.
16. To investigate the attenuation of radiation via the absorption of beta particles.
17. To determine the maximum energy of decay of a beta particle.
18. To investigate the attenuation of radiation via the absorption of gamma rays.

LIST OF PRACTICALS [Based on Paper BP-XII: Medical Biophysics]

1. Identification of different block/sub system of circuits in X-Ray machine
 2. Operation and function of all the controls of hospital X-Ray machine (visit to hospital)
 3. Operation and function of all the controls of dental X-Ray machine (Visit to Hospital)
 4. Observe its wave shape on CRO the output of blood pressure transducers, body Temperature transducers and pulse sensors
 5. Measurements of B.P. and recording of Kortov sound
 6. Measurements of body temperature using GSR and thermister probe
 7. Measurements of skin resistance using GSR
 8. Use of sphygmomanometer for measurement of blood pressure
 9. To determine respiratory parameters using Spirometry(PFT).
 10. Concept of ECG system and placement of electrodes
 11. Measurement of leakage currents with the help of safety tester
 12. To study EMG system and placement of electrode
 13. To study EEG system and placement of electrode
 14. To study ophthalmologic instruments
 15. Identification of different types of pH electrode
 16. Visit to hospital and demonstration of biomedical equipments in ICU,ICCU & operation theater
 17. Basic electronic experiments- transistor, semiconductor diode characteristics, rectifier , operational amplifiers, use of CRO etc.
 18. To perform computer based Lab Tutor experiments using Power Lab instrumentation(AD-Instruments, Australia)
 19. Visit to Medical Imaging centres and demonstration of CT Scan, MRI, Ultrasonography, Angiography.
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