BCH 1238 **Medical Fitness and Health** **3 Hrs/2Cr**

The course introduces the various systems in human body and aims to innovative approach of physical and mental fitness in the daily life. The students are able to identify social responsibility to maintain their body and mind in a smart way in their daily life. They are also introduced to master health check up that is done to be medically fit.

Unit I: Overview of Human Systems

Introduction to CNS – digestive system – respiratory system – circulatory system – muscular system - Physiology of learning and memory.

Unit II: Introduction to Physical Fitness

Introduction – physical development – social construction of the human body – healthy eating, exercise – challenges – importance of human body for self, social identity – benefits.

Unit III: Mental Fitness

Correlation of food, exercise and rest – stress management – mental and emotional development. Mind – body connections – tips for mental fitness – skill learning and performance – theoretical concepts – practical situation – benefits.

Unit IV – Fitness and Health

Fitness and health – critical relationships – dominance of body & mind in health – modification – analyzing factors – skill acquisition, psychology – personality development – employing strategies – performance.

Unit V: Physical Tests and Master Health Check up

Physical Tests – BMI, eye power, ENT, dental, ECG, chest X-ray – master health check up - biochemical tests, hormonal analysis, electrolytes – urine analysis, hematology tests – blood grouping, blood pressure, bone density, stool analysis – special tests for Diabetes mellitus, heart diseases, HIV, Hepatitis, pap test, gynaecological tests.

Learning Outcome:

The students are able to understand the essentials of physical fitness, mental fitness to maintain body. The students are well versed with the relationship between body, mind and health and the importance of being fit.

References:

1. Sembulingam and Prema Sembulingam (2012), Essentials of medical physiology 6th edition, Jaypee brothers medical publishers, New Delhi. ISBN-10: 9350259362.
2. Harold Varley (2006), Practical Clinical Biochemistry 6th edition. CBS Publishers, New Delhi.
3. Jim Loehr, Tony Schwartz (2005), The Power of Full Engagement - Managing Energy, Not Time, Is the Key to High Performance and Personal Renewal. Simon & Schuster, London, ISBN13: 9780743226752.
4. John Kabat-Zinn, M.D. (1990) Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness. Delta Publishers, Illinois, ISBN-13: 978-0385303125.
5. Ted Polhemus (1978), The Body Reader: Social Aspects of the Human Body, Pantheon Books, New York, ISBN 0-394-48792-3.

BCH 1239 **Food Technology** **3 Hrs/2Cr**

This is course deals with the various substances used in food preparation and preservation. Special emphasis is given on the food adulterants, binders, colors, flavoring agents, artificial sweeteners, sequestering agents, emulsifying, stabilizing agents and antioxidants will be discussed. Students will be exposed to the methodology involved in the preparation of various food products in a simple way.

Unit I – Concepts of Food

Definition – basic concepts - nutritional and non - nutritional constituents of food - food quality – sensory evaluation – food safety – food adulteration and control of food quality.

Unit II – Cooking of Foods and Food additives

Definition - cooking media – changes in media – methods of cooking - shallow fry - deep fry - microwave oven – fireless – direct fire – steaming – roasting.

Food additives – definition – antioxidants – chelating – coloring – curing – ant caking – leavening – pH control and antifoaming agents - flavors – flour improvers – fumigants — nutrient supplements – non nutritive sweeteners – preservatives – stabilizers – thickeners – emulsifiers.

Unit III – Food Preservation and Processing

Food deterioration – preservation – processing by heat and cold – chill storage – deep freezing – drying – concentration – radiation and fermentation.

Unit IV – Preparation of Food Products

Beverages – preparation of coffee – tea – cocoa – soft drinks – fruit beverages – alcoholic beverages. Jams & Jellies – preparation – finishing – pickles preparation – storage.

Unit V –Preparation of Cereal, Milk Products & Confectionaries

Bread making – cakes – cookies – pastries and quick breads – milk processing – milk products – cream – butter - skim milk – ghee – ice cream – khoa – kheer – cheese preparation – milk substitutes – sugar boiled and chocolate confectionary.

Learning Outcome:

The students will be aware of the food quality and safety. They will have knowledge on preparation, processing and preservations of food materials.

BCH 1240 **First Aid** **3 Hrs/2Cr**

The course is designed to introduce the students on basics of life saving first aid and its safety principles during emergencies and other situations. The students will be prepared to make appropriate decisions regarding first aid care, and how to provide care for injuries or sudden illness in sustaining the life of the victims and minimizing the consequences of injury, relieving pain or sudden collapse until professional help arrives. First aid emergency action principles through demonstrations by professionals first aid trainers from St. John's Ambulance will provide practical knowledge and exposure to the students.

Unit I – Basic Concepts of First aid

Definition – ABC rule – emergency action principles – emergency management systems – spot analysis - primary assessment - secondary assessment - emergency moves (Medivac) – legal awareness & responsibilities of first aid – first aid kit.

Unit II- Minor Emergencies

First aid - accident care - wounds & bleeding - burns – hypothermia/hyperthermia - dehydration – electric shock – allergies – bites and stings – sprains – cramps – eye injuries – pain –air way obstructions - breathing emergencies – choking.

Unit III - Major Emergencies

First aid - head injury – concussion – cerebral compression – spinal injuries – chest injury – angina - heart attack – CPR – AED – stroke – epilepsy – fractures - dislocations – splinting - suicide emergencies- drowning- cold shock – bleeding – unconsciousness – levels of response (AVPU scale) – soft tissue injuries – poisoning.

Unit IV – First Aid in Special conditions

Special care and first aid for infants, children's and aged persons – first aid in pregnancy-diabetic emergency – Weil's disease – Marine stings – fish hooks for divers – disaster emergencies – management - do's & don'ts.

Unit V – Certification and Organizations

First aid training methods – Hand on training demonstrations - volunteers - Youth Red Cross – management measures – guidelines of first aid – role of government and voluntary organizations – National and International organizations – Red Cross – Red Crescent & St. John Ambulance Association.

Learning Outcome:

The students learn how to assess a victim during a medical emergency and to determine what care would be appropriate.. They will be equipped to perform CPR, AED, manage breathing emergencies, manage soft tissue injuries and bleeding, musculoskeletal injuries. They have a clear idea on National and International Agencies organizing first aid.

References:

1. Alton L. Thygerson, (2006), First Aid, 5th edition, Jones Bartlett Publishers, London ISBN: 07-637-4244-9.
2. Jon R. Kroner (2004), First Aid Manual, 2nd edition. D.K. Publications, London, ISBN: 07 -566 -0195-9.

BCH 1435 **Biomolecules Lab** **4 Hrs/4Cr**

This is an introductory level course designed to provide a broad based analysis of biomolecules. It will aid to get the students acquainted with the fundamental knowledge in preparation of solutions and reagents. General strategies for identification of biomolecules will be introduced with basic biochemistry lab techniques.

1. Preparation and numerical problems on normal, molar, percent solutions and dilutions
2. Analysis of carbohydrates – glucose, fructose, lactose, sucrose, starch
3. Analysis of amino acids – phenylalanine, tyrosine, tryptophan, cysteine, arginine
4. Test for proteins – albumin
5. Test for lipids – cholesterol
6. Starch from potato
7. Casein from milk
8. Lecithin from egg yolk
9. Reducing Sugar – Benedict's quantitative method
10. Amino acid – Formal titration
11. Determination of acid number, saponification number, iodine number.
12. Principle and use of pH meter
13. Measuring and adjusting pH of given sample – water, soft drinks
14. Preparation of different types of buffer solutions
15. Verify Beer-Lambert's law - colorimetric method.

Learning Outcome:

The students are able to prepare solutions of different normal, molar and perentage and analyze biomolecules form various sources.

References:

1. Jayaraman J. (2011), Laboratory Manual in Biochemistry, 5th edition, New Age International Publishers (P) Ltd., New Delhi. ISBN: 978-8122430493.
2. Sadasivam S, Manickam A, (1996), Biochemical Methods 2nd edition. New Age International Publishers, (P) Ltd., New Delhi. ISBN: 81-224-0976-8.
3. Harold Varley (2006), Practical Clinical Biochemistry, 6th edition. CBS Publishers. New Delhi.
4. David T Plummer (1988), An introduction to Practical Biochemistry, 3rd edition. Tata Mc Graw Hill Publishing Company Limited, ISBN: 978-0-07-099487-4.
5. Keith Wilson and John Walker, (2010), Principles and Techniques of Biochemistry and Molecular Biology. 7th edition. Cambridge University Press, UK, ISBN: 978-0-521-51635-8.

BCH 1436 Cell Biology, Genetics & Human Physiology Lab 4 Hrs/4Cr

In haematological analysis, students will be trained in collection of blood specimen, identifying blood groups, determination of RBC, WBC and ESR. Students will also be trained in exercise on cytological observation of different stages of cell division and isolation of cellular organelles.

1. Analysis of the various stages of mitosis and meiosis in the root tips of onion.
2. Observation of cell plasmolysis – onion peeling and notonia leaf peeling
3. Isolation of mitochondria from liver.
4. Isolation of chloroplast from leaves.
5. Visualization of lampbrush chromosome.
6. Solving problems on Mendelian ratios – monohybrid, dihybrid cross.
7. Test for Hardy Weinberg equilibrium.
8. Determination of blood pressure using Sphygmomanometer under normal, light exercise and heavy exercise.
9. Determination of ESR and blood grouping and Rh typing.
10. Estimation of hemoglobin by Sahli's method.
11. Determination of bleeding time and clotting time.
12. Preparation and examination of blood smear.
13. Enumeration of RBC - Hemocytometry.
14. Determination of differential WBC count – Hemocytometry.
15. Detecting the pathway of color vision using Ishihara chart.
16. Hearing test – Tuning Fork Test – Rinne's test & Weber's Test.

Learning Outcome:

Students will acquire and demonstrate competency in routine and specialized cell biology, genetics and basic human physiology skills.

References:

1. Geoffrey M. Cooper (1997), The Cell – A molecular Approach, ASM publications, Washington.
2. Santra S.C. Chatterjee T.P. Das A.P. (1989), College Botany Practical – Volume I, New Central Book Agency, Kolkata.
3. Jayaraman J. (2011), Laboratory Manual in Biochemistry, 5th edition, New Age International Publishers (P) Ltd., New Delhi. ISBN: 978-8122430493.
4. Pal G K, Pravathi Pal (2010), Text book of practical physiology, 3rd edition, Unversity press, Hyderabad, ISBN: 978-81-7371-671-3.
5. Jacques Wallach (2007), Interpretation of diagnostic tests, 8th edition, Lippincott William & Wilklins, Philadelphia, ISBN-13: 978-0-7817-3055-6.

BCH 2336 **Cancer Biology** **3 Hrs/3Cr**

The course outlines the biology of cancer. Students will study the type of cancers, their propagations and impact on the physiology. It also provides knowledge on regulatory networks involved in the growth control. The students can also have an idea on cancer prevention and treatment associated with stem cells.

Unit I – Biology of cancer

Cancer – history – epidemiology – classification – based on cell type – benign, malignant carcinomas, sarcomas, myeloma, leukemia, lymphomas – based on organ – oral, colon, breast, prostate, lungs, liver, pancreas, cervix, ovary – pathology – differences between normal cell and cancer cell.

Unit II – Metastasis and cancer genetics

Epigenetics – role of histone proteins – Intra cellular and extra cellular control of cell division – role of protein kinase – carcinogenesis types – chemical, radiation, viral – Cancer genetics – chromosomal abnormalities – hereditary neoplasma and familial cancer syndromes.

Unit III – Apoptosis regulators

Apoptosis – Caspases – IAP – Bcl2 family proteins – TNF and other death signals – proto-oncogenes – growth factors – tumor suppressor genes – role of free radicals and anti-oxidants.

Unit IV – Cancer detection and treatment

Early detection – urine – blood – tumor markers – lab diagnosis – biopsy – molecular diagnosis – BRCA1 and BRCA2 genes– chemotherapy – gene therapy – radiation treatment and surgical removal.

Unit V – Stem cells in cancer therapy

Introduction to stem cells – source – isolation – role of purging – growth – maintenance – treatment – immuno-reconstitution – stem cell transplantation.

BCH 2437 Metabolism, Enzymology and Nutritional Biochemistry Lab

4 Hrs/4Cr

The lab course aims at giving a practical knowledge on the activity of important enzymes and their effect on various parameters. This course also gives a practical knowledge and hands on experience in cellular studies and the various metabolic products present in fruits.

1) Assay of salivary amylase activity.
2) Study of effect of pH on enzyme activity.
3) Study of effect of temperature on enzyme activity.
4) Estimation of amino acid by ninhydrin method.
5) Assay of urease activity.
6) Assay of catalase activity.
7) Titration curve of glycine and determination of pKa value.
8) Estimation of iron from apple juice by phenanthrone method.
9) Estimation of ascorbic acid by 2,4-dichlorophenol indophenol method.
10) Determination of SGOT/SGPT activity.
11) Estimation of phenolic compounds from fruits.
12) Estimation of inorganic phosphate – Fiske Subbarow method.
13) Calculation of BMI
14) Estimation of ash content, moisture content, fibre content.
15) Assay of vitamin A – Spectrophotometric method.

Learning outcome:

The students know to determine the enzyme activity, estimate the major food components from food sources.

References:

1. Jayaraman J. – Laboratory Manual in Biochemistry (2011). 5th edition. New Age International Publishers P Ltd., New Delhi. ISBN: 978-8122430493.
2. Sadasivam S, Manickam A – Biochemical Methods (1996). Revised 2nd edition. New Age International Publishers, P Ltd. New Delhi. ISBN: 81-224-0976-8.
3. Keith Wilson and John Walker (editors) – Principles and Techniques of Biochemistry and Molecular Biology. (2010) 7th edition. Cambridge University Press. ISBN 978-0-521-51635-8.
4. David T Plummer – An introduction to practical Biochemistry. (1988) 3rd edition. Tata Mc Graw Hill Publishing Company Limited. ISBN:978-0-07-099487-4.
5. Harold Varley. Practical Clinical Biochemistry (2006) 6th edition. CBS Publishers. New Delhi.

BCH 2438 **Medical Microbiology & Clinical Biochemistry Lab** **4 Hrs/4Cr**

This lab course a collaborative outcome of both microbial and biochemical analysis in the clinical field, where the students will be trained to do certain microbial techniques, to identify disease causing microorganisms and to inculcate basic aseptic techniques to grow the microorganisms. They will also be exposed in collection and processing of various clinical specimens and analyzing biochemical parameters in blood and urine. The students will be explored to the methods followed in estimating the essential components of blood and urine.

1. General laboratory safety rules and regulations - basic instrumentation in microbiology lab - cleaning of glass wares - sterilization – moist heat, dry heat & filtration methods.
2. Media Preparation – liquid & solid media – basal, enriched & selective media preparation – quality testing.
3. Pure culture techniques – pour plate and streak plate methods – maintenance of pure culture – paraffin method – cultural characteristics.
4. Microscopy - smear preparation – staining techniques - Gram staining – acid fast staining - LPCB staining (fungi) -Leishman staining (malarial parasites) – wet mount examination(eggs & cysts of parasites) - motility demonstration.
5. Antibacterial sensitivity assay – Kirby Bauer's Method – MBC & MIC.
6. Enumeration of microbes – quantitative methods – hemocytometry – colony counting.
7. Collection, transport & processing of clinical specimens – Blood, Urine, Stool, Sputum, Pus, Throat swabs & Skin scrapings.
8. Urine qualitative analysis – normal and abnormal constituents
9. Estimation of blood sugar – OT method
10. Estimation of serum cholesterol. – Zak's method
11. Estimation of serum creatinine – Jaffe's method
12. Estimation of urea from blood/urine – DAM/TSC Method
13. Estimation of uric acid from urine/blood – Caraway Method
14. Estimation of titrable acidity in urine.
15. Estimation of calcium from urine – Clark & Collip method

BCH 2632 **Medical Microbiology** **6 Hrs/6Cr**

The objective of the course is to provide students with an understanding of the basic concepts and skills relating to infectious diseases and the etiological agents contributing to the diseases. The students will be introduced to medically important bacteria, viruses, parasites and fungi and its disease causing capabilities and prevention. The relationship between vectors and pathogens in causing diseases will be explored. The core concepts of integrated disease management and newer techniques and biological standardization in the field of medical microbiology will inculcate the students with advanced knowledge.

Unit I – Basic Microbiology

Definition – history and scope – contributions of eminent microbiologists – nomenclature - classification of microorganism – physical and chemical methods of sterilization – nutrition & growth curve – microscopy – cultural and morphological characteristics – normal flora of human body – pathogens - host-parasite relationship.

Unit II – Bacteriology

General properties – structure – classification - epidemiology – pathogenesis - diseases – laboratory diagnosis – prevention and control measures of medically important bacteria – Staphylococcus, Streptococcus, Neisseria, Clostridium, Bacillus, Vibrio, Escherichia, Salmonella, Shigella ,Mycobacteria, Spirochetes.

Unit III – Virology

General properties – structure – classification – epidemiology, pathogenesis and cytopathology – disease - laboratory diagnosis – treatment - prevention and control of DNA viruses – pox, herpes, adeno, hepatitis, papilloma - RNA viruses - polio, influenza , rabies, HIV, virioids & prions.

Unit IV – Parasitology and Mycology

General properties- structure and classification – pathogenesis - clinical features – diagnosis – treatment - prevention and control - Entamoeba, Leishmania, Trypanosoma, Plasmodia - Taenia, - Schistosoma, - Trichuris, Ascaris, filarial worms.

Fungi - general properties – structure – classification - reproduction - pathogenesis – clinical features – diagnosis – treatment – prevention and control – dermatophytes, Candida, Aspergillus, Rhizopus, Mucor, dimorphic fungi, mycetoma, mycotoxicosis.

Unit V – Integrated Disease Management

Epidemiology of infectious disease - nosocomial infections – vectors & zoonotic diseases - Infections of organs and systems of human body – disease cycle – infectious disease management - chemoprophylaxis – immunoprophylaxis - animal and human ethics in microbiological work - automation in microbiology - biological standardization - quality control – Role of ICMR –WHO.

Learning Outcome:

The students are able to describe the diversity of microorganisms, bacterial cell structure and function and microbial growth. Students gain the knowledge of the various pathogenic bacteria, virus, parasites and fungus and their disease management.

BCH 2634 **Clinical Biochemistry** **6 Hrs/6Cr**

This course discusses on the fundamental principles of clinical chemistry and will provide an appreciation of the biochemical and physiological factors involved in the maintenance and alteration of organ and tissue function. The primary goal of the course is to teach certain common metabolic disorders. It also amalgamates disorders of carbohydrates, amino acids, lipids and nucleic acid metabolisms and their biochemistry. Special emphasis is given on the conventional biochemical tests carried out for the diagnosis of the disorders.

Unit 1- Concepts of Clinical Biochemistry

Basic concepts of clinical biochemistry – scope – historical perspectives and discoveries – units and measurements – normal ranges – clinical samples – collection – handling – transport – testing – preservation - blood, urine, CSF - organ function test – liver, kidney.

Unit II – Disorders of Carbohydrate metabolism and Hematological Disorders

Glucose homeostasis - diabetes mellitus – glycosuria – obesity – GTT – inborn errors – galactosuria – pentosuria – glycogen storage diseases – abnormal hemolytic states – anemia – thalassemia - haemophilia – thrombosis – thrombocytopenia – jaundice.

Unit III – Disorders of Lipid metabolism

Triglyceride, phospholipid and cholesterol metabolic disorders – Fatty liver – atherosclerosis - myocardial infarction - lipoprotenemias – inborn errors – Tay-Sach's disease, Niemann-Pick's Diseases, Faber's disease and Gaucher's disease - diagnosis - lipid profile – biosensors.

Unit IV – Disorders of Protein, amino acids and Nucleic acid metabolism

Disorders of plasma proteins – disorders of urea cycle- disorders of creatinine – ammonia and porphyrins – inborn errors- phenylalanemia – tyrosinemia, maple syrup disease, phenylketonuria, alkaptonuria, albinism, Hartnup's disease.

Disorders of nucleic acid metabolism- disorders of purine and pyrimidine metabolism – gout – orotic aciduria – xanthinuria – Lesch Nyhan syndrome.

Unit V- Advancements of Clinical Biochemistry

Automations in clinical biochemistry – use of diagnostic kits – master health check up - quality control and safety measures in clinical biochemistry lab – introduction to recent diagnostic tools.

BCH 3239 **Forensic Science** **3 Hrs/2Cr**

The course will give the students to the basic of forensic science. The relation between the law and medicine. The topic includes the discussion of basics of forensic science, regulation of Indian and state medical councils, medical ethics and euthanasia. It also provides the informations on various divisions of forensic laboratories. The course also deals with application of biology in the field of forensic science such as blotting techniques, RFLP, PCR, DNA finger printing technologies. There is also the discussion on management of poisoning, criminal laws and poison acts, types and causes of crimes, interaction of criminals with society.

Unit I – Basics of forensic science

Definition – branches, legal procedures – medical jurisprudence – Indian medical council and state medical council regulations – medical ethics – euthanasia – forensic Science Laboratories in India – Central and State level laboratories – various divisions – ballistics, biology, chemistry, serology.

Unit II – Investigative techniques

Collection of evidences – identification – collection – comparison – preservation – body fluids – hair – finger prints – foot prints – types of injuries, wounds – sign and symptoms of death – time of death – autopsy – post mortem.

Unit III – Biological techniques in forensic science

Blood grouping – microscopy – principles and types – introduction to molecular biology – Blotting techniques, RFLP, PCR, STR and DNA finger technology.

Unit IV – Toxicology

Toxicant – definition – classification – types of poisoning – management – signs and symptoms – mode of action – excretion – detection – criminal laws – Indian status on drugs and poison.

Unit V – Crime Scenario in India

Introduction to crime – history – sociological aspects – types of crime – causes – society - criminal interaction – behaviour – responsible factors – genetic predisposition – statistics.

Learning Outcome:

The students develop an understanding and appreciation for the scope of forensic science and understanding of the scientific method in the context of the law for each forensic sub-discipline.

References:

1. B. J. Fisher, W.J. Tilstone, C. Woytowicz, Introduction to Criminalistics: The foundation of Forensic Science, *ISBN*-13: 978-0120885916

BCH 3240 **Clinical Diagnostics** **3 Hrs/2Cr**

The course deals with the clinical procedures commonly used in a clinical lab. Students will be exposed to the tests performed in the areas of pathology, biochemistry and microbiology. The course also explicit the cross matching of blood and processes of the blood banking procedures.

Unit I – Biological Samples

Clinical sample – definition – blood – urine – feaces – synovial fluid – amniotic fluid – saliva – solid tissue – collection – preservation – handling – storage.

Unit II – Pathology

Blood functions - cell morphology – blood cell counting – anticoagulants – serum – plasma – changes in blood on keeping – ESR, bleeding time, clotting time – blood grouping and Rh typing.

Urine – normal and abnormal constituents – clinical significance.

CSF – lumbar puncture – appearance – chemical constituents – pressure – Lange colloidal gold reaction – biochemical changes – clinical significance.

Biopsy – Fine Needle Aspiration Cytology – Staining.

Unit III – Biochemical Tests

Biochemistry - principles – blood glucose level – Diabetes mellitus – GTT – HbA1c – obesity – lipid profile – atherosclerosis – myocardial infarction –liver function test – total protein – bilirubin – SGOT/SGPT – alkaline phosphatase – renal function test – urea – creatinine hormones – hCG – thyroid hormones – sex hormones.

Unit IV – Microbial Diagnosis

Introduction – microscopy – morphology – bacteria – fungi – virus – parasites – sterilization and disinfectants – growth and maintenance of microbes – culture media – staining techniques – biochemical characterization – antimicrobial study – diagnostic test – WIDAL test – VDRL – CRP – ASO – HIV – HBsAg – disposal of biomedical waste.

Unit V – Blood Transfusion and Blood Banking

Blood cross matching – blood transfusion – testing donor blood - storage – transport - maintenance of blood bank records.

Learning Outcome:

The students will have a clear idea on the basics and principles of clinical chemistry, general microbiology, clinical hematology, histopathology, blood banking and blood transfusion techniques.

References:

1. Praful B. Godkar & Darshan P. Godkar, (2014), Textbook of Medical Laboratory Technology- set of 2 volumes. Clinical Laboratory sciences and Molecular Diagnosis, 3rd edition, Bhalani publishing House, Mumbai. ISBN: 9789381496190.

BCH 3537 **Molecular Biology and Analytical Techniques Lab** **5 Hrs/5Cr**

The lab course aims the students have hands on training in isolation of DNA, RNA. Separation techniques like electrophoretic method of separating nucleic acids and proteins. Centrifugation, chromatography for the separation of sugars, amino acids and plant pigments. The students are able to learn the immunological techniques for antigen – antibody assay.

1) Isolation of genomic DNA from liver cells.
2) Isolation of plasmid DNA from E.coli.
3) Estimation of DNA – Diphenyl amine method.
4) Estimation of RNA – Orcinol method.
5) Separation of DNA – Agarose Gel Electrophoresis.
6) Separation of proteins – SDS-PAGE.
7) Density gradient centrifugation – CsCl method.
8) Separation of amino acids – paper chromatography.
9) Separation of sugars – thin layer chromatography.
10) Separation of lipids – thin layer chromatography.
11) Separation of amino acids/plant pigments/algal pigments – column chromatography.
12) Immunological techniques- Antigen-Antibody interactions - Radial immuno diffusion. Double immuno diffusion - Rocket electrophoresis.
13) Spectrophotometer – demo.
14) Photo Fluorometer – demo.
15) Field visit.

Learning Outcome:

The students understand and perform isolation, estimation and separation of nucleic acids, sugars and amino acids using various techniques in molecular biology.

References:

1. Sadasivam S, Manickam A (1996), Biochemical Methods, 2nd edition. New Age International Publishers, P Ltd.New Delhi. ISBN: 81-224-0976-8.
2. David Sheehan (2009), Physical Biochemistry 2nd edition. John Wiley & Sons Ltd, London. ISBN: 9780470856024.
3. Rajamanickam C. (2002), Experimental protocols in Basic Molecular Biology, Osho scientific publication, Madurai.

BCH 3538 **PROJECT** **5 Hrs/5Cr**

This course incorporates project mode of learning and is offered to final year students to promote research aptitude. At the final semester every biochemistry student is given an opportunity to take up a project to develop skills and exposure to research. Each student has to work with a team of students. All the faculty members of the department will equally participate in this teaching and learning activity. They are expected to guide and supervise minimum one or maximum two teams depending on the class strength and they will be the internal examiners of this paper, The HOD/Coordinator will assign the guide for each student. The course will be evaluated by the internal project panel members (HOD/Coordinator and the faculty members) using a standard format developed by the Coordinator. Each team is expected to present their findings. A viva-voce will be conducted to evaluate final outcome of the project.

BCH 3633 **Analytical Techniques** **6 Hrs/6Cr**

This course outlines the basic principles of various techniques employed in the field of biochemistry. This course is aimed at developing quantitative skills in estimating various constituents using specified instruments. Students will acquire a broad knowledge in basic mechanism of instrumentations employed in the fields of biology in clinical settings.

Unit I – Methods of Cell Separation and Microscopy

Microfiltration, centrifugation, ultrasonication, high pressure homogenisation, ultrafiltration, diafiltration and their applications, reverse osmosis, lyophilisation.

Microscopy: principle, instrumentation, specimen preparation – light microscopy, bright field, phase contrast, fluorescence, SEM, TEM, STEM and their applications.

Unit II – Spectroscopy and Centrifugation

Spectroscopy – principle – Beer – Lambert's law , colorimetry, UV – visible spectroscopy, turbidometry, luminometry, fluorimetry, fluorescence, X-ray diffraction, – instrumentation – applications.

Centrifugation – principles of sedimentation, types of centrifuges - high speed, analytical – types of rotors – types of centrifugation - preparative, differential centrifugation, density gradient, zonal - analytical ultracentrifugation – Svedberg unit – instrumentation – applications.

Unit III - Chromatography

Principles – paper, thin layer, gel-filtration, ion-exchange, affinity chromatography, gas liquid chromatography, gas solid chromatography, high pressure liquid chromatography (HPLC); reversed phase chromatography, Hydrophobic interaction chromatography – instrumentation -applications.

Unit IV – Electrophoresis

Principle, concept of electrophoresis, factors affecting electrophoresis, moving boundary electrophoresis, zone electrophoresis, - paper, agarose gel electrophoresis, pulse field gel electrophoresis, naitve PAGE, SDS-PAGE, isoelectrofoccusing, 2-Dimensional electrophoresis, immunoelectrophoresis – instrumentation – applications.

Unit V – Radioisotope Techniques

Principle – radioactivity - units, radioactive decay - rate – measurement - Geiger Muller counter, scintillation counter, effect of radiations on biological system, Cerenkov radiations, Tracer technique- Principle autoradiography – RIA – ELISA - safety measures in handling of radioisotopes - Dosimetry – instrumentation – applications.

Learning Outcome:

Appreciable knowledge will be gained by the students in the modern analytical techniques. The students will also be in a position to apply their knowledge in developing new methods for determination and validate procedures.

Reference:

1. Avinash Upadhyay, Kakoli Upadhyay, Nirmalendranath, (2003) Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Delhi.
2. Simon Roe, (2004) Protein Purification Techniques 2nd edition, oxford University Press, New Delhi

BCH 3634 **Protein Chemistry and Proteomics** **6 Hrs/6Cr**

The objective of the course is to appreciate the organization of proteins and its classification in living systems. Students develop knowledge on the sequencing of proteins and understand its complex structure that helps them in applying the concepts in the development of protein models. Special emphasis is given to identification of proteins using spectrometry and microarrays. Application of protein in various fields of medicine will indulge in the thrust of the students.

Unit I – Organization of Proteins

Introduction , definition, biological role, building blocks of proteins – aminoacids- peptides – peptide bond - polypeptides – classification of amino acids - classification of proteins – based on solubility - shape - composition and functions of proteins.

Unit II - Sequencing of amino acids

Importance – determination - protein sequencing – end group analysis, Dansyl chloride reaction – Sanger's reagent – use of exopeptidase, endopepditase, determination of the aminoacid sequence - small peptide - large protein – specific chemical and enzymatic cleavage – separation of peptides - cyanogen bromide – Edmann degradation – Chemical synthesis – Merrifield solid – phase peptide synthesis.

Unit III - Structure of proteins

Protein structure – Levels – primary and secondary structure– α-helix and β-pleated sheet- Ramachandran plot, irregular structures – random coil, variations in standard secondary structures, turns and loops – Protein folding – thermodynamics of folding, role of disulphide bonds, chaperonins – structure-function relationship.

Unit IV - Complex architecture of protein

Tertiary structure – stabilizing forces – motifs and domains – variations in side chain location with polarity – combining helices and sheets in various ways, behaviour of proteins in solution – salting in, salting out – quaternary structure – stabilizing forces – biological functions – fibrous proteins – keratin, collagen, elastin – globular proteins – hemoglobin, myoglobin, chymotrypsin – denaturation and renaturation.

Unit V - Proteomics

Definition – identification and analysis of proteins – 2- D analysis, tryptic digestion of protein and peptide fingerprinting, mass spectrometry, MALDI, Tandem Mass Spectrometry for protein identification, techniques to study protein – protein interactions, antigen and antibody microarrays, protein microarrays, protein biomarkers, protein sorting – Protein Data Bank.

Learning Outcome:

The students have an in depth knowledge on various levels in organization of proteins, sequencing of amino acids and techniques of proteomics.

BCH 3635 **Pharmacology & Toxicology** **6 Hrs/6Cr**

The course will provide the basic knowledge to understand the general principles of drug action and metabolism of drugs by the body. The course also deals with chemotherapy and their application on vulnerable diseases. Understanding the basic concepts of The students are introduced to the adverse effects of drugs, heavy metal toxicity.

Unit I – General Pharmacology

Introduction - drug - dosage forms – mechanism of action - combined effect factors modifying drug action - Pharmacokinetics: absorption, distribution, biotransformation of drugs – drug metabolism – liver, kidney, intestine – excretion – bioassay.

Unit II – Pharmacodynamics

Receptor – general aspects - structural – functional aspects - regulation - classification and characterization– drug -receptor interactions – free radicals – impact – antioxidants.

Unit III – Chemotherapy

General principles of chemotherapy, antibiotics – norflaxacin, ciprofloxacin, erythromycin - chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases – chemotherapy of malignancy.

Unit IV – Principles of Toxicology

Definition – toxicants – classification – occurrence, sources, evaluation of toxicity – threshold dose– lethal dose – sublethal dose – infectious dose – detoxification – adverse drug reactions – abnormal action of drugs – tolerance, addiction, habituation, idiosyncracy, allergy, hypersensitivity, antagonism, synergism, potentiation, tachyphylaxis.

Unit V – Organ toxicity

Overview of hepatotoxicity – nephrotoxicity – neurotoxicity – respiratory toxicity – cardiotoxicity – immunotoxicity – causes – types – mechanism – effects.

Learning Outcome:

The students will acquire the knowledge on drug metabolism, chemotherapy, principles of toxicology and organ toxicity.

References:

1. K.D. Tripathi (2013), Essentials of Medical Pharmacology 6th edition, Jaypee Brothers Medical publishers(P) Ltd., New Delhi, ISBN No: 81-8448-085-7.