



**Shri Vile Parle Kelavani Mandal's
MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF
SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF
COMMERCE AND ECONOMICS (AUTONOMOUS)**
*NAAC Reaccredited 'A' grade, CGPA: 3.57,
Granted under RUSA, FIST-DST & Star College Scheme of DBT, Government of
India, Best College (2016-17), University of Mumbai*

Affiliated to the
UNIVERSITY OF MUMBAI

**Program: Bachelor of Science (Honours)
Biochemistry**

S.Y. B.Sc.

Semester III & IV

**Choice Based Credit System (CBCS) with effect
from the Academic year 2022-23**

A.C. No: 13

Agenda No: 3(ix)

The courses are as follows:-

Semester III

| | |
|------------|--|
| USMABC301 | Pharmacology |
| USMABC302 | Physiology-I |
| USMABC303 | Enzymology and Membrane Biochemistry |
| USMABC304 | Biophysical Chemistry |
| USMABC305 | Research Methodology and Technical Writing |
| USMABC306 | Databases, IoT and AI |
| USMABC307 | Genetics-I |
| USMABCP312 | Practical-VII |
| USMABCP334 | Practical-VIII |
| USMABCP356 | Practical-IX |
| USMABCP37 | Internship |

Semester IV

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|------------|--|
| USMABC401 | Nutritional Biochemistry |
| USMABC402 | Analytical Biochemistry |
| USMABC403 | Applied Biotechnology-I |
| USMABC404 | Bioinformatics and IPR |
| USMABC405 | Entrepreneurship and Product Development |
| USMABC406 | Life Skills |
| USMABC407 | Physiology-II |
| USMABCP412 | Practical-X |
| USMABCP434 | Practical-XI |
| USMABCP456 | Practical-XII |
| USMABCP47 | Research Project |

N.B.

- (i) The duration of each theory lecture will be 60 minutes. A course consists of 3 modules. For each module the number of lecture hours allotted are 10. The total number of lecture hours for each course will thus be 30.
- (ii) There will be one practical for each course. The duration of each practical will be of 2 hours, i.e., 120 minutes
For practical component, the value of one credit is equal to 30 learning hours.
- (iii) Thus in a week, a student will study 2 hours of theory and 4 hours of practicals.

Evaluation Pattern for theory papers

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

| Continuous Assessment | Details | Marks |
|-----------------------|---|----------|
| Component 1 (CA-1) | Test (MCQ/Subjective) / Assignments/ Project/ Presentation | 15 marks |
| Component 2 (CA-2) | Test (MCQ/Subjective) / Assignments / Project/ Presentation | 10 marks |

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.


| Question Number | Description | Marks/Question | Total Marks |
|--------------------|---------------------------------|----------------|-------------|
| Q1 to Q3 | Answer any 3 out of 4 questions | 07 marks | 21 Marks |
| Q4 | Answer any 3 out of 4 questions | 04 marks | 12 Marks |
| Total Marks | | | 75 |

Evaluation Pattern for practical papers

In the Practical Exams, there will be 40% as continuous assessment and 60% as term end component to be conducted as a semester end exam per course. Two examiners will conduct the practical examination in each course. The average of marks awarded by both the examiners will be considered as final marks.

A learner has to appear for all the practical examinations failing which he/she will be marked absent.


Signature
HOD


Signature
Approved by Vice –Principal


Signature
Approved by Principal

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| Program: B.Sc. (Hons.) Biochemistry | Semester : III |
| Course: Pharmacology | Course Code: USMABC301 |

| Teaching Scheme | | | Evaluation Scheme | |
|--------------------------|---------------------------|--------|--|--------------------------------|
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | END Semester Examination (ESE) |
| 02 | - | 2 | 25% | 75% |

Learning Objectives:

In this course learners will be introduced to fundamental concepts pertaining to drug action. Historical development of pharmacology will be addressed. Learners will gain appreciation and understanding of the basic pharmacological terminology. They will enrich their knowledge on Pharmacokinetics, viz. administration, absorption, distribution, biotransformation and elimination of drugs. With an understanding of factors influencing drug dosage, forms of drugs and routes of drug administrations, the learner will be able to appreciate the development of new drug delivery forms. This will help in realization of clinical trials and its significance.

Course Outcomes:

After completion of the course, learners would be able to:

- CO1: Explain the concepts of pharmacology
- CO2: Distinguish between different drug forms and routes
- CO3: Apply the knowledge of pharmacokinetics for effective action of drugs
- CO4: Explain the process of drug design and development
- CO5: Inspect the new drug delivery routes and their advantages

Outline of Syllabus: (per session plan)

| Module | Description | No of hours |
|-------------------|----------------------|-------------|
| 1 | General Pharmacology | 10 |
| 2 | Pharmacokinetics | 10 |
| 3 | Pharmacology | 10 |
| | Total | 30 |
| PRACTICALS | | 30 |

| Module | Pharmacology | No. of Hours/Credits 30/2 |
|--------|--|------------------------------|
| 1 | General Pharmacology | 10 |
| | Fields in pharmacology and applied sciences: Introduction: definition, historical perspective, branches and scope of the subject of pharmacology and its relation with other medical disciplines; Pharmacopeias, | 2 |
| | Pharmacognosy Sources Classification and Nomenclature of drugs Dosage forms | 2 |
| | Routes of drug administration Factors affecting dosage and drug delivery how to prolong or shorten the drug action and effects | 1 |
| | General pharmacology Physicochemical properties of drugs-Chelation, Hydrogen bonding, Surface area, Redox potential, Ionization Combination of drugs- addition, synergism, antagonism and its types Concepts of Half Life, Loading dose, Maintenance dose, Therapeutic dose, Drug Tolerance Therapeutic drug monitoring | 5 |
| 2 | Pharmacokinetics | 10 |
| | Pharmacokinetics: Drug absorption: through-GIT, pulmonary, renal, placental and blood-brain barrier Drug Distribution and special compartments and barriers Drug Metabolism Drug Excretion via renal, biliary, pulmonary Bioavailability and Bioequivalence | 6 |
| | Pharmacokinetics: LD ₅₀ , ED ₅₀ , Drug plasma concentration, Volume of distribution, Clearance, Quantitative aspect of drug action: potency and efficacy, analysis of dose response curve and therapeutic index (safety index), | 4 |
| 3 | Pharmacology | 10 |
| | Bioassays: Principles and methods | 2 |
| | Drug Discovery and Development of new drugs Types of drug discovery Drug development: a) Preclinical evaluation: Hyperacute, Acute, and Chronic toxicity b) Clinical Evaluation-Clinical Trials | 3 |

| | | |
|--|--|---|
| | Drug Interactions- Factors predisposing drug interactions, Classification and mechanism, ADR and its prevention | 2 |
| | Novel Drug Delivery System [NDDS]- Transdermal Drug Delivery Systems Liposomes, Nanoparticles, Radiopharmaceuticals | 3 |

RECOMMENDED READING:

Essential Reading:

1. FSK Barar, Essentials of Pharmacotherapeutics, 1st Edition, .
2. M.N. Chatterjee & Ranashinde. Textbook of Medical Biochemistry, 6th Edition. Jaypee Brothers

Suggested Reading:

1. Karen Whalen, Richard S. Finkel. Pharmacology, 6th Edition, Lippincott Illustrated Reviess
2. N. Murugesh. Concise textbook of pharmacology, 7th edition Sathya publications

Any other reference sources as recommended by the course instructor.

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|---|------------------------------------|---------------|---|--|
| Program: B.Sc. (Hons.) Biochemistry | | | Semester : III | |
| Course: Physiology-I | | | Course Code: USMABC302 | |
| Teaching Scheme | | | Evaluation Scheme | |
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | - | 2 | 25% | 75% |
| <p>Learning Objectives: Digestion involves the breakdown of foods we eat and breaks them into smaller components that our bodies can use for energy, cell repair and growth. This lesson introduces learners to the main parts of the digestive system and how they interact. Also, the learners will be able to identify the locations and primary secretions involved in the chemical digestion of carbohydrates, proteins and lipids. The learner is made aware of the parts and functions of respiratory and excretory system. As an important part of a human body, circulatory system is also introduced at the basic level to learners. The course also gives insight into the body fluids and their functions played in the system.</p> | | | | |
| <p>Course Outcomes: At the end of the course learners will be able to CO1: Analyse and compare the parts and functions of digestive systems and role of enzymes in digestion CO2: Identify the factors that influence digestion, absorption and nutrient transport in the body and correlate them with the digestive disorders for their root causes CO3: Examine respiratory and excretory physiology to solve problems arising due to malfunctioning of the both CO4: Compare and contrast different blood cells and body fluids along with their roles in the body CO5: Comprehend the overall circulatory system</p> | | | | |
| Outline of Syllabus: (per session plan) | | | | |
| Module | Description | | | No of hours |
| 1 | Digestion and Absorption | | | 10 |
| 2 | Respiration and Excretion | | | 10 |
| 3 | Circulatory System and Body Fluids | | | 10 |
| | Total | | | 30 |
| PRACTICALS | | | | 30 |

| Module | Physiology-I | No. of Hours/Credits 30/2 |
|--------|--|------------------------------|
| 1 | Digestion and Absorption | 10 |
| | <i>Digestion</i> Parts and Functions of gastro intestinal tract (Cross section of GIT) Processes in digestion Swallowing, Mechanical and Chemical Digestion Organs and Glands associated with GIT Salivary gland, Liver, Pancreas, Gall Bladder Secretions and Juices of GIT Saliva, Gastric juice, Intestinal juice, pancreatic and Bile juice | 5 |
| | <i>Digestion and Absorption of:</i> Carbohydrates Lipids Proteins (including the role of the different organs involved) Hormonal regulations | 3 |
| | <i>Disorders</i> Peptic ulcer, Lactose Intolerance | 2 |
| 2 | Respiration and Excretion | 10 |
| | <i>Respiratory system</i> Breathing – inspiration and expiration Partial pressure of gases Blood Gases- CO ₂ and O ₂ - modes of transport, factors affecting the transport, O ₂ dissociation curves, Chloride shift. Respiratory disorders – respiratory acidosis and alkalosis Introduction to blood Gas Analysis (pH, pO ₂ , pCO ₂ , Bicarbonate) and its interpretation. | 5 |
| | <i>Excretion</i> Structure of the nephron: (ultrafiltration, pressures involved); GFR, regulation of GFR; Renal tubule -structure & function (proximal and distal convoluted tubules and Henle's loop) Formation of dilute and concentrated urine <i>Excretory disorder:</i> Nephritis | 5 |
| 3 | Circulatory System and Body Fluids | 10 |
| | <i>Circulatory system</i> Basic structure of the heart, heart valves and circulation of blood, the cardiac cycle Structure and functions of blood vessels, Starling's hypothesis capillary exchange Fluid compartments of the body – ICF and ECF | 3 |
| | <i>Blood:</i> Composition of blood, proteins in plasma & their functions, Coagulation of blood, blood clotting and factors involved [no pathway] Blood cells- RBCs, Platelets & WBCs (Neutrophil, Eosinophil, Basophil, Lymphocytes & Monocytes.) | 3 |

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| Bile: Bile salt and pigments- Composition, characteristics and function; storage | 1 |
| Urine: Composition – normal and abnormal constituents; | 1 |
| Lymph: Composition, Formation and Circulation | 1 |
| Cerebrospinal Fluid: Composition | 1 |
| Applications of body fluids in diagnostics | |

RECOMMENDED READING:

Essential Reading:

1. Gerard J. Tortora, Bryan H. Derrickson Tortora's Principles of Anatomy and Physiology 15th Edition Macmillan Education
2. Peter Raven, George Johnson and Kenneth Mason and Jonathan Losos and Tod Dunca Biochemistry 12th Edition Mc Graw Hill
3. S N Pandey, B K Sinha Plant Physiology 4th Edition Vikas Publishing House Pvt Ltd

Suggested Reading:

1. Voet D. and Voet, J.G. Principles of Biochemistry 3rd Edition John Wiley & Sons
2. Zubay, Geoffrey L Principles of Biochemistry 5th Edition McGraw-Hill Education - Europe
3. Jeremy M. Berg, John L Tymoczko, Lubert Stryer Biochemistry 5th Edition Freeman publishers
4. Victor Rodwell, David Bender, Kathleen Botham, Peter Kennelly, P. Anthony Weil Harpers illustrated biochemistry 3rd Edition Mc Graw Hill, Lange
5. Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach 5th edition ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA
6. Plummer, David T Introduction to practical biochemistry 3rd Edition Tata Mc. Graw and Hill publishers
7. Sawhney, S.K. and Singh, Randhir Introductory practical biochemistry 1st Edition Narosa Publishing House

Any other reference sources as recommended by the course instructor.

| Practical USMABCP312 includes Practical of USMABC301 and USMABC302 | |
|---|---|
| Practical (Hours per week) | Credit |
| 4 | 2 |
| Practical USMABC301 | |
| 1 | Monograph of sucrose |
| 2 | Monograph of Vitamin C |
| 3 | Monograph of Acetyl salicylate |
| 4 | Estimation of Sodium benzoate by non-aqueous titration |
| 5 | Sodium Chloride by precipitation titration |
| 6 | Limit Test of the following: i. Chloride ii. Sulphate iii. Iron iv. Arsenic |
| Practical USMABC302 | |
| 1 | Gastric Function Tests: Gastric Juice- Total and Free Acidity |
| 2 | Determination of the Achromic point of Salivary Amylase. |
| 3 | Arterial blood gas analysis |
| 4 | Lung volume determination |
| 5 | Urine Analysis: i. Normal constituents - Urea, Uric acid, Chloride ii. Abnormal constituents –Glucose, Protein iii. Titratable acidity [using neutral red or phenol red] |
| 6 | Bile: i. Detection of Bilirubin [Iodine test / Gmelin's Nitric acid test / Fouchet's test] ii. Detection of Bile salt [Pettenkofer's test. Hays sulphur test] |
| 7 | Blood Experiments: i. Determination of total RBC count ii. Determination of total WBC count iii. Differential staining of WBC cells iv. Bleeding time and Clotting time |

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

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|--|----------------------------------|---------------|---|--|
| Program: B.Sc. (Hons.) Biochemistry | | | Semester: III | |
| Course: Enzymology and Membrane Biochemistry | | | Course Code: USMABC303 | |
| Teaching Scheme | | | Evaluation Scheme | |
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | - | 2 | 25% | 75% |
| <p>Learning Objectives: This course will provide fundamental knowledge on enzymes and their importance in biological reactions. Students will understand the difference between a chemical catalyst and biocatalyst and understand activation energy. They will study non-protein enzymes such as ribozymes and will be exposed to the Industrial and biomedical applications of enzymes. The objective of the course is also to provide students with a detailed knowledge regarding membrane composition, structure-function relationship and properties and the various membrane transport mechanism. The course also aims to provide insights into operation of classical cellular signal transduction pathways in the physiological system.</p> | | | | |
| <p>Course Outcomes: After completion of the course, learners would be able to:</p> <p>CO1: Explain fundamental properties of enzymes and differentiate between a chemical catalyst and biocatalyst.</p> <p>CO2: Analyze the concept of activation energy and evaluate the different theories proposed to explain the mechanism of action of enzymes.</p> <p>CO3: Derive the equations of enzyme kinetics and calculate the value of kinetic parameters, like K_m, V_{max}, V_o, $[S]$</p> <p>CO4: Discuss enzyme inhibition and application of enzymes in various fields</p> <p>CO5: Review the general composition and structure of biomembranes and analyse basic membrane characteristics, such as membrane fluidity.</p> <p>CO6: Compare the different types of membrane transport</p> <p>CO7: Integrate the processes of cellular communication and signal transduction.</p> | | | | |
| Outline of Syllabus: (per session plan) | | | | |
| Module | Description | | | No of hours |
| 1 | Enzymology-I | | | 10 |
| 2 | Enzymology-II | | | 10 |
| 3 | Membrane Biochemistry | | | 10 |
| | Total | | | 30 |
| PRACTICALS | | | | 30 |

| Module | Enzymology and Membrane Biochemistry | No. of Hours/Credits 30/2 |
|--------|--|------------------------------|
| 1 | Enzymology-I | 10 |
| | Enzymes Definition, historical perspective, general characteristics, co-factors – coenzymes and prosthetic group. | 1 |
| | Classification and units of enzymes: Based on IUB with examples. Unit of enzyme activity – definition of IU, enzyme turn over number and nature of non-enzymatic and enzymatic catalysis. Specific activity. | 2 |
| | Enzyme specificity Concept of active site, ES complex, specificity, transition stage | 1 |
| | Theories of enzyme catalysis: Lock and key model, Koshland's induced fit theory. | 1 |
| | Basic thermodynamic principles of enzymatic reactions: Standard free energy, entropy and enthalpy change in a reaction. Transition state, activation energy of both in non-enzymatic and enzymatic reaction, reaction rate, rate constant, rate limiting step, rate equation, binding energy, association and dissociation constants | 2 |
| | Enzyme kinetics: Factors affecting rate of enzyme catalyzed reactions. Concept of pre steady state and steady state kinetics, initial rate, maximum velocity, Michaelis constant, Michaelis- Menten equation (derivation), graphical representation, double reciprocal plot | 3 |
| 2 | Enzymology-II | 10 |
| | Inhibition of enzyme catalyzed reaction Competitive, noncompetitive (mixed), uncompetitive, irreversible inhibition, one example in each case. Effect of metal ions (Zn^{2+} , Cu^{2+} , As^{3+} , Hg^{2+}) on enzyme activity (with examples) | 2 |
| | Allosteric enzymes: Sigmoidal curve, positive and negative modulators, | |
| | Isoenzymes: Detection, nature, importance-Lactate dehydrogenase as an example. | 2 |
| | Multi enzyme complex Pyruvate dehydrogenase complex – Composition, subunits, assembly, enzymatic reaction functions | 4 |
| | RNA as an enzyme-Ribozymes | |
| | Applications of Enzymes: Enzymes as reagents, Marker enzymes in diagnostics, Industrial applications of enzymes. | 2 |

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| 3 | Membrane Biochemistry | 10 |
| | <i>Overview of Passive and Active transport</i> | 2 |
| | Types of transporters: Channel and Carrier protein, symport, antiport with examples (Passive transport glucose transporter and anion transporter) | |
| | <i>Primary active transporters</i> | 3 |
| | P type ATPases, V type ATPases, F type ATPases. Action of Antibiotics on cellular transport (Ionophores: valinomycin, gramicidin, vanadate, ouabain) | |
| | Secondary active transporters: Na ⁺ glucose symporter Overview of ABC family of transporters | |
| | <i>Ion channels:</i> | 3 |
| | Voltage-gated ion channels (Na ⁺ /K ⁺ voltage-gated channel) and ligand-gated ion channels (acetyl choline receptor) and aquaporins Relationship of membrane transport and diseases | |
| | <i>Cell Signaling</i> | 2 |
| | Cascade of Adenylate Cyclase (epinephrine as an example) G protein, Coupled receptor (GPCR) Serine Tyrosine kinase receptor-Insulin receptor | |

RECOMMENDED READING:

Essential Reading:

1. Nelson, D. L. and Cox, M.M, (2008). Lehninger, Principles of Biochemistry 5th Edition
2. Stryer, Lubert; W.H.; Biochemistry 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA

Suggested Reading:

1. Nicholas C.P. and Lewis S. Fundamentals of Enzymology (1999) 3rd ed., Oxford University Press Inc. (New York), ISBN:019 850229X.
2. R.K.Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's Biochemistry, 22nd edn. (1990), Prentice-Hall, International, USA.
3. P.K. Stumpf, Outlines of Biochemistry, 4th edn. (1994), Wiley Eastern, New Delhi, (Chapters 7 & 8).
4. G.L. Zubay Biochemistry 4th Ed. (1998) W.C. Brown Publishers, USA.
5. U. Satyanarayanan, Biochemistry, Books & allied (P) Ltd., Kolkata, 3rd edition

Any other reference sources as recommended by the course instructor.

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|---|--|---------------|---|--|
| Program: B.Sc. (Hons.) Biochemistry | | | Semester : III | |
| Course: Biophysical Chemistry | | | Course Code: USMABC304 | |
| Teaching Scheme | | | Evaluation Scheme | |
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | - | 2 | 25% | 75% |
| Learning Objectives: | | | | |
| <p>Biophysics deals with the application of physics to biological systems, from the first picture of the structure of DNA, to the treatment of cancer, and the understanding of allergic reactions. The concepts and techniques of biophysics find applications in bioelectronics, medicine/health, and population dynamics and are closely related to statistical mechanics and transport processes. Therefore, this course gives an insight into instrumentation part of laser, optics, magnetism, heat and sound. Analytical techniques help reveal different methods of separation and isolation of macro and micro molecules along with their estimation. Enzymes have great importance in diagnosis which leads to promote the study of such enzymes of clinical importance in details.</p> | | | | |
| Course Outcomes: | | | | |
| After completion of the course, learners would be able to: | | | | |
| CO1: Develop a firm foundation in the fundamentals and applications of current biophysical theories. | | | | |
| CO2: Analyze fundamental principles of instruments based on theories of optics, heat, sound, magnetism and fluid dynamics | | | | |
| CO3: Relate principles of physics to applications and techniques in the field of biology such as microscopy, spectroscopy and fluid dynamics | | | | |
| CO4: Demonstrate and apply the operation of spectrophotometer in determination of biomolecules | | | | |
| Outline of Syllabus: (per session plan) | | | | |
| Module | Description | | | No of hours |
| 1 | Lasers, Optics, Microscope | | | 10 |
| 2 | Heat, Sound, Magnetism | | | 10 |
| 3 | Spectroscopy and Clinical Enzymology | | | 10 |
| | Total | | | 30 |
| PRACTICALS | | | | 30 |

| Module | Biophysical Chemistry | No. of Hours/Credits 30/2 |
|---------------|---|--------------------------------------|
| 1 | Lasers, Optics, Microscope | 10 |
| | <i>Introduction to Optics and Lasers:</i> | 2 |
| | <i>Optics:</i> Properties of Light - Reflection, Refraction, Dispersion, Interference. Rhodopsin | 2 |
| | <i>Lasers:</i> Properties of Lasers, Stimulated Emissions, Laser Action; Applications, | 2 |
| | <i>Electromagnetic Radiations:</i> Introduction to Electromagnetic Radiation. | 4 |
| | <i>Microscopy:</i> Types of Microscopy; Electron Optics; Electron Microscopy; Preparation of Specimen, SEM, TEM and Imuno-Electron Microscopy | |
| | Fluorescence Microscopy. applications of the above physical properties in biological studies/life sciences | |
| 2 | Heat, Sound, Magnetism | 10 |
| | <i>Heat:</i> Concept of Temperature; Modes of Heat Transfer; Measuring Temperature; Platinum Resistance Thermometer; Thermocouple and Thermistors. Application in life sciences. | 3 |
| | <i>Sound:</i> Types of Sound Waves - Audible, Ultrasonic and Infrasonic Waves; Doppler Effect, Principles of superposition, Applications in life sciences Applications of Ultrasonic Waves. | 3 |
| | <i>Magnetism:</i> Magnetic Field; Magnetism of Earth; Paramagnetism, Diamagnetism, Ferromagnetism. Nuclear Magnetism and Biomagnetism Elasticity – stress and strain in solids, Hook's law, Relevance of elasticity to life science Stress and strain in solids | 4 |
| 3 | Spectroscopy and Clinical Enzymology | 10 |
| | <i>Spectroscopy</i> | 5 |
| | Introduction to Electromagnetic spectrum and concept of Lambda max Determination of molar extinction coefficient | |
| | Beer-Lambert law: derivation and limitations | |
| | Construction, working and applications of a simple colorimeter and Spectrophotometer | |
| | Applications of Beer-Lambert law in the estimation of biomolecules (carbohydrates, proteins and lipids) and evaluating the sensitivity of methods. | |
| | Numericals based on the above concept | 2 |
| | <i>Clinical Enzymology</i> | |
| | Principles of diagnostic enzymology | 3 |
| | <i>Enzymes in diagnostics</i> | |
| | Enzyme and isozyme patterns in health and diseases with special mention of: CPK and LDH | |

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| | Enzyme in health and diseases with special mention of alkaline and acid phosphatase, SGOT and SGPT Case studies | |
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RECOMMENDED READING:

Essential Reading:

1. Robert K. Murray, Harper's Illustrated Biochemistry, 32nd edition, Mc Graw Hill Professionals
2. Avinash Upadhyay, Biophysical Chemistry, Revised, Himalaya Publications
3. S.K Sawhney, Randhir Singh, Introductory Practical Biochemistry, 2nd edition, Alpha Science International
4. Igor N S, N Zaccai & J Zaccai, Methods in Molecular Biophysics (2007), Cambridge
5. Witmann, Advanced Methods in Protein Microsequencing
6. Narayanan, Essential Biophysics, New Age Publication
7. HG Bohr Handbook of Molecular Biophysics (Methods & Application), 2009, Wiley Publications

Suggested Reading:

1. Jeremy M. Berg, Lubert Stryer, John Tymoczko, Biochemistry, 9th edition, Macmillan Learning
2. David E. Metzler, Biochemistry: The Chemical Reactions of Living Cells, Volume 1 and 2 (2nd edition), Academic press
3. Rodney F. Boyer, Basic Concepts in Biochemistry: A Student's Survival Guide, 3rd edition, Brooks/Cole Publishing
4. Rodney F. Boyer, Modern Experimental Biochemistry, 3rd edition, Pearsons
5. David Holme, Analytical Biochemistry, Longman
6. David Plummer, Practical Biochemistry, 3rd edition, Tata McGraw Hill
7. David L. Nelson, Lehninger's Principles of Biochemistry, 5th edition, W.H. Freeman
8. Donald Voet, Biochemistry, 2nd revised, John Willey and Sons. Inc

Any other reference sources as recommended by the course instructor.

| Practical USMABCP334 includes Practicals of USMABC303 and USMABC304 | |
|--|---|
| Practical (Hours per week) | Credit |
| 4 | 2 |
| Practicals USMABC303 | |
| 1 | Estimation of Calcium by Collip's method |
| 2 | Estimation of Calcium by EDTA method |
| 3 | Preparation of beta Amylase extract and demonstration of the activity qualitatively |
| 4 | Preparation of Urease extract and demonstration of the activity qualitatively |
| 5 | Preparation of Invertase extract and demonstration of the activity qualitatively |
| 6 | Qualitative assay for inhibition of enzyme activity |
| 7 | Effect of pH and temperature on the rate of enzyme reaction |
| 8 | Membrane permeability of beetroot a) Effect of temperature b) Effect of alcohol |
| 9 | Assignment on industrial applications of enzymes |
| 10 | Preparation of bio cleaner |
| Practicals USMABC304 | |
| 1 | Principle and working of Colorimeter |
| 2 | Principle of spectrophotometer |
| 3 | Determination of lambda max |
| 4 | Verification of Beer Lamberts Law |
| 5 | Estimation of glucose by DNSA method |
| 6 | Isolation of DNA from Moong |
| 7 | Estimation of fluoride in water by the Alizarin red method |
| 8 | UV absorption of DNA and Protein |

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

| | | | | |
|---|--|---------------|---|--|
| Program: B.Sc. (Hons.) Biochemistry | | | Semester : III | |
| Course: Research Methodology and Scientific Writing | | | Course Code: USMABC305 | |
| Teaching Scheme | | | Evaluation Scheme | |
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | - | 2 | 25% | 75% |
| Learning Objectives: Research unlocks the unknowns, lets us explore the world from different perspectives, and fuels a deeper understanding. Thus, research is an integral for success. For conducting research it is mandatory to understand the underlying principles of research. The outlining of details like the formulation of research statement, method of data collection, the research design as well as the analysis of results need to be well understood. This course is aimed at proving the foundation for proceeding to execute a scientific research project. Students will also acquire the knowledge to present via power point presentations at various scientific congregations and they will enrich skills for writing reviews and research reports. | | | | |
| Course Outcomes: After completion of the course, learners would be able to: CO1: Explain the concepts of research methodology CO2: Describe the research processes (reading, evaluating, and developing) CO3: Formulate research problems CO4: Create a literature reviews using print and online databases CO5: Identify, explain, compare, and prepare the key elements of a research report CO6: Design a plan, conduct, evaluate and present a research projects | | | | |
| Outline of Syllabus: (per session plan) | | | | |
| Module | Description | | | No of hours |
| 1 | Research Methodology | | | 10 |
| 2 | Research Design | | | 10 |
| 3 | Scientific Writing | | | 10 |
| | Total | | | 30 |
| PRACTICALS | | | | 30 |

| Module | Research Methodology and Scientific Writing | No. of Hours/Credits 30/2 |
|---------------|--|--|
| 1 | Research Methodology | 10 |
| | Research Concept, Objectives and Motivation, Significance of Research Significance of Research Types of Research and Research Approaches Research Methods versus Methodology Research and Scientific Method Importance of Knowing How Research is Done Research Process Criteria of Good Research Problems Encountered by Researchers in India | 1 3 3 2 1 |
| 2 | Research Design | 10 |
| | Research Problem Concept Selecting the Problem Necessity of Defining the Problem Technique Involved in Defining a Problem Research Design Concept Need for Research Design Features of a Good Design Important Concepts Relating to Research Design Research Designs Types | 3 4 3 |
| 3 | Scientific Writing | 10 |
| | Report Writing Significance , Different Steps in Writing Report Layout of the Research Report Reports Types Mechanics of Writing a Research Report Precautions for Writing Research Reports Interpretation Conclusions Oral Presentation Types Plagiarism Types , Para typing, and Plagiarism check softwares | 3 4 2 1 |

RECOMMENDED READING:

Essential Reading:

1. Research methodology, Methods and techniques – CR Kothari Willey Eastern Ltd, Mumbai
2. Research methods – Ram Ahuja, Rawat Publications, New Delhi

Suggested Reading:

1. Bhattacharya, D. K. (2003): Research Methodology, Excel Books, New Delhi
2. Cenise F. Polit, J.B. Bemadette, P. Hungler (1984) Essential of Nursing Research Methods Lippinott Company, U.K.

Any other reference sources as recommended by the course instructor

| | | | | |
|---|--|---------------|---|--|
| Program: B.Sc. (Hons.) Biochemistry | | | Semester : III | |
| Course: Databases, IoT and AI | | | Course Code: USMABC306 | |
| Teaching Scheme | | | Evaluation Scheme | |
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | - | 2 | 25% | 75% |
| <p>Learning Objectives: Biochemistry integrates principles from biology and chemistry and is multidisciplinary in its approach. The presence of the latest digital technologies has made research and development in biochemistry break all boundaries of discipline. In recent years, IoT has gotten actively involved especially in healthcare and pharmaceuticals. The connectivity-driven technology as IoT and AI is facilitating various types of biochemical research and applications in the field of biochemistry This course is designed to enrich students with the use of information technology for biochemists.</p> | | | | |
| <p>Course Outcomes: After completion of the course, learners would be able to: CO1: Discuss the fundamentals of information technology and importance of database system CO2: Design database and apply queries on database. CO3: Describe system on- chip architecture. CO4: Evaluate application of artificial intelligence in biological sciences.</p> | | | | |
| Outline of Syllabus: (per session plan) | | | | |
| Module | Description | | | No of hours |
| 1 | Database systems | | | 10 |
| 2 | Internet of Things | | | 10 |
| 3 | Artificial Intelligence (AI) | | | 10 |
| | Total | | | 30 |
| PRACTICALS | | | | 30 |

| Module | Databases, IoT and AI | No. of Hours/Credits |
|---------------|---|------------------------------|
| | | 30/2 |
| 1 | Database systems | 10 |
| | <p>Database systems Concepts: Introduction to DBMS – Database, DBMS – Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture</p> <p>Relational data model Domains, attributes, Tuples and Relations, Relational Model Notation, Characteristics of Relations, Relational Constraints - primary key, referential integrity, unique constraint, Null constraint</p> <p>DDL Statements Creating Databases, Using Databases, datatypes, Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables</p> <p>DML Statements Viewing the structure of a table insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate functions (count, min, max, avg, sum)</p> | 2 3 2 3 |
| 2 | Internet of Things | 10 |
| | <p>Internet of things Evolution Definition and Characteristics Architecture Technologies for IoT Developing IoT Applications</p> <p>Applications Industrial IoT Security in IoT Biological applications Machine to Machine communication vs IoT</p> | 6 4 |
| 3 | Artificial Intelligence (AI) | 10 |
| | <p>Introduction Fundamentals Need for AI Foundations of AI AI environment</p> <p>Application domains of AI AI tools Applications of AI in biological sciences- Design of biochemical pathways; Cancer Genomics; Finding the link between genes and diseases ; Prediction of protein structures</p> | 4 6 |

| | | |
|--|---|--|
| | Diagnosis of diseases as diabetes Challenges and Future of AI. | |
|--|---|--|

RECOMMENDED READING:

Essential Reading:

1. Joel Murach, Murach’s MySQL, Murach, 2012
2. Learning Internet of Things, Peter Waher, Packt Publishing(2015)
3. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009

Suggested Reading:

1. Ramakrishnam, Gehrke, Database Management Systems, McGraw-Hill, 2007
2. Abusing the Internet of Things, Nitesh Dhanjani, O’Reilly
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010

Any other reference sources as recommended by the course instructor

| Practical USMABCP356 includes Practicals of USMABC305 and USMABC306 | |
|--|--|
| Practical (Hours per week) | Credit |
| 4 | 2 |
| Practicals USMABC305 | |
| 1 | Comparison of:- a) General and technical writing b) Formal and informal writing; |
| 2 | Writings and presentations for different scientific discussion forums- seminars, symposia, conferences and workshops- Power point presentation |
| 3 | Writing for scientific journals, popular magazines, manuals; handbooks; scientific journals, |
| 4 | Research paper reading |
| 5 | Abstract writing |
| 6 | Literature Survey: Print: Sources of information: Primary, secondary, tertiary sources; Journals: Research articles, review articles, monographs, Author Index, Formula Index, and other Indices with examples. Digital: Web resources, E-journals, Journal access, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, Science Direct, SciFinder, Thomson Reuter, Scopus. |
| 7 | Citation index, Impact factor, H-index |
| 8 | Review of literature writing on any topic of interest-5 page |
| 9 | Elsevier certificate courses online |
| Practicals USMABC306 | |
| 1 | Perform the following using mysql: Viewing all databases Creating a Database Viewing all Tables in a Database Creating Tables (With and Without Constraints) Inserting/Updating/Deleting Records in a Table |
| 2 | Perform the following using mysql: a) Altering a Table b) Dropping/Truncating/Renaming Tables |
| 3 | Perform the following using mysql: Simple DML Queries Simple Queries with Aggregate functions |
| 4 | IoT Case Study on Smart Education / Smart Building / smart car/ smart college/ smart office etc. |
| 5 | Case study on Usage of IoT in Medical Science and Pharmaceutical industries. |
| 6 | Python program to visualize protein structure |
| 7 | Python program for DNA matching. |
| 8 | Convert a given sequence of DNA into its Protein equivalent. |

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

| | | | | |
|--|--------------------------------------|---------------|---|--|
| Program: B.Sc. (Hons.) Biochemistry | | | Semester : III | |
| Course: Genetics | | | Course Code: USMABC307 | |
| Teaching Scheme | | | Evaluation Scheme | |
| Lecture (Hours per week) | Tutorial (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | - | 2 | 25% | 75% |
| <p>Learning Objectives: The aim of the course is to provide an understanding of both classical and modern concepts in the areas of transmission, molecular and population Genetics. The objective of the course is to familiarize learners with the concepts and processes that evolve in and around central dogma of molecular biology. The course content is aimed at encouraging learners to cultivate keen observational skills and to develop the ability to analyze and interpret experimental data, making them suitable for future careers in higher education and employment in industry and research institutes. The course seeks to be diverse and yet presents the essence of the subject in a very elegant and focused manner that will build competitive edge not only for professional development in a related area but prepare learners for academic pursuits like research and teaching.</p> | | | | |
| <p>Course Outcomes: After completion of the course, students would be able to: CO1: Summarize the contributions of various scientists in the field of genetics. CO2: Discuss the sub-disciplines of genetics CO3: Interpret nucleic acid structure, its organization in chromosomes and sequences present in it. CO4: Get insight into Mendelian and non-Mendelian genetics CO5: Examine the experimental design and laws of inheritance given by Mendel. CO6: Illustrate Mendelian genetics in humans, practice pedigree analysis. familiarize with prokaryotic recombinations CO7: Compare prokaryotic and eukaryotic chromosomal structure, CO8: Assess karyotypes and solve case studies and numericals based on the above concepts</p> | | | | |
| Outline of Syllabus: (per session plan) | | | | |
| Module | Description | | | No of hours |
| 1 | Genetics I | | | 10 |
| 2 | Mendelian and Non-Mendelian Genetics | | | 10 |
| 3 | Genetics II | | | 10 |
| | Total | | | 30 |
| PRACTICALS | | | | 30 |

| Module | Genetics | No. of Hours/Credits |
|---------------|--|-----------------------------|
| 1 | Genetics I | 10 |
| | <i>History and Development of Genetics</i> History and development of Genetics as a discipline | 2 |
| | <i>History</i> Contributions of Mendel, Bateson, Hardy- Weinberg, Garrod, Morgan, Beadle and Tatum, Tatum, Barbara Mclintock, Hershey & Chase; Watson & Crick. | |
| | <i>Subdisciplines of genetics</i> Transmission genetics, Molecular genetics, Population genetics | 2 |
| | <i>DNA: The genetic material</i> Experiments by Griffith, Avery and Hershey, Chase | 4 |
| | <i>Prokaryotic Genome</i> Circularity; Single origin | |
| | <i>Eukaryotic chromosomes</i> Centromere, kinetochome, telomere, Chromatin structure, Euchromatin, Heterochromatin, polytene chromosomes, lamp brush chromosome, DNA supercoiling | 2 |
| | Centromeric and telomeric DNA | |
| | <i>Genetics in human society</i> Application of genetics in various fields, for improvement of plant and animal species | |
| | <i>The universality of genetic principles</i> | |
| 2 | <i>Mendelian and non-Mendelian Genetics</i> | 10 |
| | <i>Mendelian Genetics:</i> Genotypes and phenotypes, | 2 |
| | <i>Mendel's experimental design,</i> Laws of inheritance- Monohybrid crosses and Mendel's principle of segregation, Dihybrid crosses and Mendel's principle of Independent assortment | 3 |
| | <i>Non-Mendelian Genetics-</i> Chloroplast, Mitochondrial and Maternal Inheritance, Incomplete dominance Co-dominance; Epistasis, Maternal effects, Multiple Alleles | 2 |
| | <i>Introduction to Mutations-</i> Point mutation, Deletion; Inversion and Duplication | |
| | <i>Chromosomal alterations</i> | |
| | <i>Karyotyping and Pedigree</i> | 3 |
| | <i>Numericals on above concepts and Case studies</i> on the same. | |

| 3 | Genetics II | 10 |
|---|--|----|
| | Organization of DNA into chromosomes (upto Solenoid structure) | 2 |
| | Structure of condensed chromatin, Nucleosomes, Topoisomerase | |
| | DNA re-association kinetics (Cot curve analysis); Repetitive and unique sequences; Satellite DNA Introduction to Overlapping genes and Split genes; Comparison of chromosomal structure in prokaryotes and eukaryotes | 3 |
| | Recombination in prokaryotes Transformation: Definition and transformation in <i>Bacillus subtilis</i> Transduction: Definition; Explain general features with one example, bacteriophage, Lytic and lysogenic pathway Conjugation: in <i>E. coli</i> Mechanism, F ⁺ , F ⁻ and Hfr strain | 5 |

RECOMMENDED READING:

Essential Reading

1. Genetics- the continuity of life-Daniel J Fairbanks and W. Ralph Andersen
2. iGenetics-Peter J. Russel, Pearson

Suggested Reading:

1. Genetics (2012) by Gardner, Simons and Snustad. Sixth edition, John Wiley.
2. Genetics - A Conceptual Approach (2016) by BA Pierce. Sixth edition, WH Freeman & Co. (New York)
3. Tropp, B.E. Molecular Biology. Genes to Proteins.2011 (4th Ed.) Jones and Bartlett publications
4. Molecular Cell Biology by James Dernell, Harvey Lodish and David Baltimore, W.H. Freeman & Co., 2007 (6th Ed.).

Any other reference sources as recommended by the course instructor.

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| Program: B.Sc. (Hons.) Biochemistry | Semester : III |
| Course: Internship | Course Code: USMABCP37 |
| Teaching Scheme | Evaluation Scheme |
| Credit | End Semester Examinations (ESE) (Marks-200) |
| 04 | 200 |

GUIDELINES TO CARRY OUT INTERNSHIP IN SEMESTER III

| | |
|----|---|
| 1. | The goal of the internship course is to be supplement the national education policy mission to enrich skills set in learners during their graduation. The current course is an opportunity to connect the learners to the community, develop their social quotient and contribute to a better understanding of the society and its needs. |
| 2. | Duration of Internship: Depending on the nature of internship, the duration of internship is recommended as 120 hours during the summer vacation lasting between semester II and semester III. |
| 3. | Nature of Research Project: The internship should ideally be associated with an NGO/ Charitable trust / Organizations associated with upliftment of children/ women/ less privileged / Orphanage/ Organizations associated with societal commitment/ Organizations associated with environmental protection/ Any other proposal deemed fit by the mentor |

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|--|---|---|--|
| Program: B.Sc. (Honours) Biochemistry | | Semester : IV | |
| Course: Nutritional Biochemistry | | Course Code: USMABC401 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| <p>Learning Objectives: Like molecular biology, biochemistry, and genetics, nutrition has become more focused on metabolism and metabolic pathways. Nutrition also focuses on how diseases, conditions, and problems can be prevented or reduced with a healthy diet. Due to increasing lifestyle related morbidity, people are becoming more sensitive to the issue of healthy gut and diet and the topic of nutrition is in the public interest. This course helps the learner appreciate the significance of different macro and micronutrients in normal physiology. There is an invisible kingdom of thousands of species and trillions of inhabitants' microbes present within the body and make up the diverse human microbiome. These microbiomes support and maintain our health but also, when the its biome is disturbed, have been linked to hundreds of ailments. Therefore, this course gives an understanding of these good and bad species of microbiota and the remedial actions against the diseases caused by them.</p> | | | |
| <p>Course Outcomes: At the end of the course learners will be able to CO1: Classify and explain the nutrients as macro and micro. CO2: Analyze the interrelationship between energy units CO3: Translate the functions of nutrients and deficiency disorders CO4: Compare beneficial and pathogenic microorganisms, their mechanisms of actions CO5: Gage different types of vaccines and their importance in disease control</p> | | | |
| Outline of Syllabus: (per session plan) | | | |
| Module | Description | No of hours | |
| 1 | Nutrition-I | 10 | |
| 2 | Nutrition-II | 10 | |
| 3 | Microbiology in Human Health and Diseases | 10 | |
| | Total | 30 | |
| PRACTICALS | | 30 | |

| Module | Nutritional Biochemistry | No. of Hours/Credits 30/2 |
|--------|---|-------------------------------------|
| 1 | Nutrition-I | 10 |
| | <p><i>Introduction to Nutrition and Energy metabolism</i> Concept of – Nutrition, Proximate principles, RDA, Reference man and woman Unit of energy- calorie, joule, Interconversion BMR and RMR – definition, factors affecting BMR, Significance of BMR in clinical diagnosis BMI SDA/DIT - General concept and significance Measurement of energy expenditure- Food calorimetry - calorific value determination by Bomb calorimeter Calorific value of proximate principle- Numericals</p> <p><i>Macronutrients:</i> <i>Sources, Functions, EAR, Excess and Deficiency diseases of Carbohydrates, Fats and Proteins</i> <i>Carbohydrates:</i> Glycemic index and glycemic load. Dietary fiber and its role in health; <i>Fatty acid-</i> Essential Fatty Acids; Excess and deficiency of EFA Combination ratios of n6 and n3 Importance of the following: a) Omega fatty acids. Omega 3/ omega 6 ratio b) Phospholipids c) Cholesterol d) Mono, Polyunsaturated and Saturated Fatty Acids in the body Deficiency- Phrynoderma (Toads skin)</p> <p><i>Proteins:</i> Complete and complementary protein Amino acid pool Concept of BV, PER, NPU, Nitrogen balance, PDCAAS and Amino acid Score. Deficiency- Marasmus, Kwashiorkor</p> <p><i>Balanced Diet:</i> Concept, constituents and significance Steps involved in meal planning</p> | <p>4</p> <p>2</p> <p>2</p> <p>2</p> |
| 2 | Nutrition-II | 10 |
| | <p><i>Micronutrients:</i> <i>Dietary sources Functions, EAR, Excess and Deficiency diseases of-</i></p> | |

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|----------|---|----------------------------|
| | <p>Water soluble vitamins – Vitamin B complex- Thiamin Riboflavin, Niacin Pyridoxine Biotin Lipoic acid: [Chemistry of the above vitamin and its coenzyme form [structure not to be done, only group involved in its activity] Vitamin C: Fat soluble vitamins: Vitamin A – Chemistry Wald’s Visual cycle Role of Rhodopsin (with structure), Transducin, cGMP in vision, dermatology and immunology; Vitamin D – Chemistry Role in Ca absorption and mobilization, Hypervitaminosis; Vitamin E and Vitamin K Micro Minerals and trace elements: Dietary sources, Functions, EAR, excess and deficiency diseases of- Macrominerals: Calcium, Potassium, Sodium Microminerals: Iron, Phosphorus, Manganese, Copper, Zinc Trace: Iodine, Selenium, Chromium, Molybdenum</p> | <p>4</p> <p>3</p> <p>3</p> |
| 3 | Microbiology in Human Health and Diseases | 10 |
| | <p>Beneficial Microorganism: Lactobacillus Normal flora of human gut Probiotics Yeast Nitrogen fixing bacteria (Rhizobium and Azotobacter) Food borne microorganism: Staphylococcus aureus, Clostridium botulinum (Botulism) Viruses: Classification based on genetic material with examples. Plant viruses – TMV, morphology, general characteristics and its replication. Bacteriophages: Morphology, general characteristics, life cycle (lysogeny and lytic cycle) of T-even bacteriophage.</p> | <p>1</p> <p>1</p> <p>3</p> |

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|---|--------------------|---|--|
| Program: B.Sc. (Honours) Biochemistry | | | Semester : IV |
| Course: Biochemical Techniques | | | Course Code: USMABC402 |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| <p>Learning Objectives: In continuation with the Biophysical chemistry-I in semester III, this course deals with the analytical techniques in biochemistry needed for separation, isolation of macro and micro molecules. The course is designed to make learner aware of these techniques for analysis of properties and characteristics of such molecules of biological systems</p> | | | |
| <p>Course Outcomes: After completion of the course, learners would be able to: CO1: Explain the principle and working of bioanalytical instruments CO2: Compare different types of centrifuges and analyse their significance in the biological field CO3: Translate the mechanism of electrophoretic and chromatographic technique in research work</p> | | | |
| Outline of Syllabus: (per session plan) | | | |
| Module | Description | No of hours | |
| 1 | Centrifugation | 10 | |
| 2 | Electrophoresis | 10 | |
| 3 | Chromatography | 10 | |
| | Total | 30 | |
| PRACTICALS | | | 30 |

| Module | Biochemical Techniques | No. of Hours/Credits |
|---------------|---|-----------------------------|
| 1 | Centrifugation and Radioactivity | 10 |
| | Centrifugation | 2 |
| | RCF, RPM and derivation of an equation relating the two; Nomogram; Derivation of rate of sedimentation Factors affecting sedimentation velocity Sedimentation coefficient Wall effect Types of rotors | |
| | Principle, Types, Instrumentation and applications of centrifuges: | 1 |
| | Clinical High speed Ultra-centrifuges | |
| | Preparative centrifuge:- | 2 |
| | Differential, Rate-zonal and Isopycnic Types and characteristics of density gradient materials | |
| | Analytical centrifuge: Construction, working and Applications | |
| | Radioactivity: | 1 |
| | Radioactive and Stable isotopes Types, pattern and rate of radioactive decay Concept of Decay Constant, Half-life Units of radioactivity (Curie, Becquerel) | |
| | Measurement of radioactivity: Principle of working | 2 |
| | Geiger-Muller Counter Basic Scintillation counter, Concept of Quenching | |
| | Applications of radioactivity: | 2 |
| 2 | Electrophoresis | 10 |
| | Principle of electrophoresis: | 1 |
| | Experimental set up Factors affecting the rate of migration of sample in an electric field | |
| | Moving boundary and zone electrophoresis | |
| | Components of electrophoresis unit/apparatus | 3 |
| | Various Support media – paper, cellulose acetate, agar, agarose and polyacrylamide Solubilizers: SDS, Urea, β -mercaptoethanol | |

| | | |
|---|---|----|
| | <p><i>Technique of electrophoresis with staining or visualization method:</i></p> <p>Agarose electrophoresis for separation of DNA Native PAGE for separation of proteins SDS PAGE: determination of subunit stoichiometry and molecular weight of protein Discontinuous electrophoresis</p> <p><i>Principles and Applications of electrophoresis:</i></p> <p>Blotting techniques: Southern, Northern and Western Isoelectric focusing Capillary electrophoresis 2D electrophoresis</p> <p><i>Case studies on above concepts</i></p> | 3 |
| 3 | Chromatography | 10 |
| | <p><i>Principle, Technique and Industrial Applications of the following kinds of chromatography:</i></p> <p>Partition chromatography (Paper), Adsorption Chromatography (TLC and column); Gel filtration- Properties, characteristics and types of gels Ion exchange Chromatography-Properties, characteristics and types of exchangers</p> <p><i>Principles and industrial applications of:</i></p> <p>GLC HPLC Affinity chromatography</p> <p><i>Case studies and Numericals based on the above concepts</i></p> | 6 |
| | | 4 |

RECOMMENDED READING:

Essential Reading:

1. Avinash Upadhyay, Biophysical Chemistry, Revised, Himalaya Publications
2. S.K Sawhney, Randhir Singh, Introductory Practical Biochemistry, 2nd edition, Alpha Science International

Suggested Reading:

9. Jeremy M. Berg, Lubert Stryer, John Tymoczko, Biochemistry, 9th edition, Macmillan Learning
10. David E. Metzler, Biochemistry: The Chemical Reactions of Living Cells, Volume 1 and 2 (2nd edition), Academic press
11. Rodney F. Boyer, Basic Concepts in Biochemistry: A Student's Survival Guide, 3rd edition, Brooks/Cole Publishing
12. Rodney F. Boyer, Modern Experimental Biochemistry, 3rd edition, Pearsons
13. David Holme, Analytical Biochemistry, Longman
14. David Plummer, Practical Biochemistry, 3rd edition, Tata McGraw Hill
15. David L. Nelson, Lehninger's Principles of Biochemistry, 5th edition, W.H. Freeman
16. Donald Voet, Biochemistry, 2nd revised, John Willey and Sons. Inc
17. Robert K. Murray, Harper's Illustrated Biochemistry, 32nd edition, Mc Graw Hill Professionals

Any other reference sources as recommended by the course instructor.

| Practical USMABCP412 includes Practical of USMABC401 and USMABC402 | |
|---|--|
| Practical (Hours per week) | Credit |
| 4 | 2 |
| Practical USMABC401 | |
| 1 | Estimation of glucose by Iodometry method |
| 2 | Estimation of Protein by biuret method |
| 3 | Preparation of Ash |
| 4 | Study of moisture content in food |
| 5 | Enhancing the traditional recipes with specific nutrients (protein, carbohydrate, fat, vitamin A, vitamin C, calcium and iron) |
| 6 | Nutritional survey |
| 7 | Planning Recipes <ul style="list-style-type: none"> i. Dry ii. Moist iii. Frying iv. Microwave |
| 8 | Standardization of portions for cooked food |
| 9 | Preparation and serving the planned menu for men and women of different occupations |
| 10 | Assignment on beneficial microorganisms |
| 11 | Workshop on Nutrition |
| Practical USMABC402 | |
| 1. | Preparation of tissue homogenate |
| 2. | Preparative differential centrifugation of plant / animal tissue |
| 3. | Density gradient centrifugation |
| 4. | Estimation of water hardness |
| 5. | Separation of serum proteins by agarose gel electrophoresis |
| 6. | Separation of proteins using polyacrylamide gel |
| 7. | Separation of amino acid acids by paper chromatography |
| 8. | Separation of sugars by paper chromatography |
| 9. | Separation of plant pigments by thin-layer chromatography |
| 10. | Separation of carotenoids by TLC |

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

| | | | |
|---|---|---|--|
| Program: B.Sc. (Honours) Biochemistry | | Semester : IV | |
| Course: Applied Biotechnology | | Course Code: USMABC403 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| Learning Objectives: | | | |
| <p>The course examines the relationship between applied biochemistry and the field of biotechnology from various perspectives. The main objectives of this course are to provide a basic foundation and understanding of biotechnology from a biochemical perspective. By the end of this course, the students will have a better understanding of the applications of biochemistry in the field of biotechnology for the production of commercially-important specialty chemicals and medically-related biochemical molecules. Students will be able to assess the physico-chemical characteristics and energy content of coal, petroleum and natural gas and take an objective view of the nature of Earth's resources and impact of human activities on earth's environment.</p> | | | |
| Course Outcomes: | | | |
| <p>After completion of this course, a learner would be able to:</p> <p>CO1: Describe the different methods of enzyme immobilization and their applicability.</p> <p>CO2: Explain and categorize biosensors and single cell proteins based on their principle of working, features, construction, types and applications.</p> <p>CO3: Discuss the need, importance and scope of non-conventional and alternate energy resources and the biogas and biomass energy conversion systems.</p> <p>CO4: Apply the knowledge on sources, generation, storage, types, collection, transport, processing for management of solid waste and waste water.</p> <p>CO5: Evaluate and assess the current practices available for waste management.</p> | | | |
| Outline of Syllabus: (per session plan) | | | |
| Module | Description | No of hours | |
| 1 | Immobilization and Biosensors | 10 | |
| 2 | Energy | 10 | |
| 3 | Resource Management and Industrial Pollutants | 10 | |
| | Total | 30 | |
| PRACTICALS | | 30 | |

| Module | Biotechnology | No. of Hours/Credits 30/2 |
|---------------|---|--------------------------------------|
| 1 | Immobilization and Biosensor | 10 |
| | <i>Immobilized enzymes</i> Introduction; Methods of immobilization (entrapment, adsorption, covalent binding, microencapsulation, cross-linking) | 3 |
| | <i>Stabilization of soluble enzymes</i> Solvent and substrate stabilization, Enzyme stabilization by polymer, salts, and Chemical modification; Applications and Problems | 4 |
| | <i>Biosensors</i> Features of biosensors; Types: Electrochemical, Thermometric, Optical, Piezoelectric, Whole cell, Immuno-biosensor; Construction and development, Applications in bioscience | 3 |
| | <i>Single cell proteins</i> Introduction; Bacterial proteins; Yeast proteins; fungal proteins; algal proteins; Economic aspect; Applications in food science | 3 |
| 2 | Energy | 10 |
| | Environmental impact of conventional Sources of energy: Coal Coke Natural gas (CNG) | 4 |
| | <i>Biomass and Bioenergy production</i> Biofuel and Biomass: Fossil fuel; Energy rich crops (sugar and starch; wood-rich; petroleum plants); Animal energy; Sources of biofuel, its cultivation and extraction process Biogas: Production, Composition, Applications. Gobar gas [MSW and LFG, Renewable natural gas, NG vehicle] | 4 |
| | <i>Emerging eco-friendly alternatives for chemical industry</i> Green Chemistry and Green Technology Concept of 5R's | 2 |
| 3 | Resource management and Industrial Pollutants | 10 |
| | <i>Solid waste</i> Types of waste, treatment, recycling | 2 |
| | <i>Waste water</i> Sewage, Composition of sewage, types of sewage, detection of pathogenic organism of sewage; preliminary treatment, primary treatment Secondary treatment; tertiary treatment, disinfectant Sludge treatment and disposal; waste water collection vs sewage treatment in developing countries | 4 |
| | <i>Sources, Environmental implications and abatement strategies for</i> | 4 |

| | | |
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| | Polymers and Plastics pollution Asbestos pollution Poly Chlorinated Biphenyls pollution Mining (Acid mine drainage) | |
|--|--|--|

RECOMMENDED READING:

Essential Reading:

1. U. Satyanarayan; Biotechnology, Books & allied (P) Ltd., Kolkata.
2. Environmental Chemistry by Anil Kumar De, Arnab Kumar De 7th Eds, New Age International Publisher.

Suggested Reading:

1. A.H. Patel, Industrial microbiology, Macmillan India Ltd.
2. L. E. Casida, Industrial microbiology, New age international publishers.
3. Sawhney, S.K. and Singh, Randhir; Introductory practical biochemistry; Narosa Publishing House.
4. Dr. A.C. Deb, Fundamentals of Biochemistry, New central book agency (P) Ltd., 8th edition.
5. U. Satyanarayanan, Biochemistry, Books & allied (P) Ltd., Kolkata, 3rd edition

Any other reference sources as recommended by the course instructor.

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|--|--------------------|---|--|
| Program: B.Sc. (Honours) Biochemistry | | | Semester : IV |
| Course: Bioinformatics and IPR | | | Course Code: USMABC404 |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| Learning Objectives: The objective of this course is to impart basic understanding of bioinformatics and computational biology. The course will introduce the broad scope of bioinformatics by discussions on the theory and practices of computational methods in biology. This course also aims to provide learners with a practical hands-on experience with common bioinformatics tools and databases. Learners will be trained in the basic theory and application of programs used for database searching, protein and DNA sequence analysis, and prediction of protein structures. The course seeks to be diverse and yet presents the essence of the subject in a very elegant and focused manner that will build competitive edge not only for professional development in a related area but prepare learners for academic pursuits like research, innovation and teaching. The learner will be in a position to understand the innovation and understand the ways and means to protect the innovation legally | | | |
| Course Outcomes: After completion of the course, students would be able to: CO1: Understand the basics of bioinformatics and computational biology and develop awareness of the interdisciplinary nature of this field. CO2: Demonstrate the use of several soft wares/tools in biology. CO3: Discuss, access and use biological databases in public domain. CO4: Practice of protein structure visualization using soft wares. CO5: Gain understanding of sequence alignments. CO6: Analyze phylogeny using alignment tools. CO7: Get acquainted with nature of various intellectual properties and identify the exact kind of intellectual property protection to be secured. CO8: Delineate the steps involved in securing the appropriate form of protection. CO9: Construct application for filing a patent of intellectual creation or invention. | | | |
| Outline of Syllabus: (per session plan) | | | |
| Module | Description | No of hours | |
| 1 | Bioinformatics-I | 10 | |
| 2 | Bioinformatics-II | 10 | |
| 3 | IPR | 10 | |
| | Total | 30 | |
| PRACTICALS | | | 30 |

| Module | Bioinformatics and IPR | No. of Hours/Credits 30/2 |
|----------|--|--|
| 1 | Bioinformatics-I | 10 |
| | <p><i>Bioinformatics</i> Definition, Goals and Branches of Bioinformatics, Bioinformatics for biologists, World wide web and bioinformatics</p> <p><i>Algorithm</i> Definition, Deterministic, non-deterministic, heuristic</p> <p><i>Applications of Bioinformatics in</i> Sequence analysis, Molecular modeling and drug designing, Phylogeny/ evolution, Ecology & population studies, Medical sciences, forensic analysis and agriculture.</p> <p><i>Database Management system</i> Properties and advantages of DBMS</p> <p><i>Databases- Definition, Classification</i> Primary, secondary and derived databases with examples, Public domain database, Nucleotide and protein Sequence databases, Structural database, Motif database, Genome database, Gene expression database, Annotated sequence database.</p> <p><i>Full form & function in brief of</i> GenBank, EMBL, PIR, SWISS PROT, PDB,GDB</p> | <p>2</p> <p>2</p> <p>4</p> <p>2</p> |
| 2 | Bioinformatics-II | 10 |
| | <p><i>Sequence alignment: Pairwise and multiple</i> Global and local alignment, Methods of aligning two sequences- Dot plot method, heuristic method, dynamic programming</p> <p><i>Phylogenetic analysis</i> Phylogenetic trees, terminology related to it, steps to construct phylogenetic trees, distance based tree construction, clustering algorithm, hierarchical clustering</p> <p><i>Sequence analysis Tools</i> Explain the following terms in brief - BLAST, FASTA, L-ALIGN, CLUSTAL- X & W, RASMOL, PYMOL Software for protein sequencing - PROPECT, AMMP, COPIA</p> <p><i>Introduction to Genomics & Proteomics</i> Sub-disciplines of genomics- functional, nutritional, comparative, structural</p> <p><i>Transcriptomics-Micro-array analysis-concept and applications</i> Hybridization, types of microarrays-cDNA and oligonucleotide microarray</p> | <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> |

| 3 | IPR | 10 |
|---|---|----|
| | IPR | 1 |
| | Introduction to Intellectual property: types | |
| | Patent | 2 |
| | Objectives; Criteria for grant of patents, Non-patentable inventions, Patent filing procedures and its infringement, Rights and obligations of patent holder, Terms of patent, Maintenance of patent, Patent Act 1970 and its amendment | |
| | Copy rights | 2 |
| | Introduction, works protected under copyright law, registration of copyright, copyright society; Term of copyright, transfer of copy right and its infringement | |
| | Trade mark | 2 |
| | Introduction, types, functions, selection, registration, protection of good will and infringement, Term of a trademark | |
| | Protection of | 3 |
| | Plant varieties and farmers' rights | |
| | Geographical indications | |
| | Biological Diversity | |

RECOMMENDED READING:

Essential Reading:

1. Bioinformatics-Basics, Algorithms, and Applications-Ruchi Singh, Richa Sharma, University Press (India), Pvt. Ltd. (2010)
2. Practical approach to Intellectual Property Rights-Rachna Singh Puri, Arvind Viswanathan, IK International Publishing House Pvt. Ltd.(2009)

Suggested Reading:

1. Bioinformatics – Principles and Applications (2008), 1st ed. Ghosh, Z. and Mallick, B., Oxford University Press (India), ISBN: 9780195692303.
2. Bioinformatics: Sequence and Genome Analysis (2001), 1st ed., Mount, D.W. Cold Spring Harbor Laborator Press (New York), ISBN: 0-87969-608-7
3. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (2005), 3rd ed., Baxevanis, A.D. and Ouellette, B.F., John Wiley & Sons, Inc. (New Jersey), ISBN: 0-47147878-4.
4. Text Book of Intellectual Property Rights (7th Ed), N.K. Acharya, Asia Law House, Hyderabad.
5. Intellectual Property Law by P. Narayanan Published by Eastern Law House.
6. Shiv Sahai Singh, The Law of Intellectual Property Rights, Deep & Deep

| Practical USMABCP434 includes Practicals of USMABC403 and USMABC404 | |
|--|--|
| Practical (Hours per week) | Credit |
| 4 | 2 |
| Practical USMABC403 | |
| 1. | Determination of the Chemical Oxygen demand of an effluent / sewage. |
| 2. | Preparation of Biofertilizer. |
| 3. | Preparation of immobilized yeast and its use in determination of invertase activity. |
| 4. | Study of bioremediation. |
| 5. | Extraction of Biopolymer (Azetobactr) |
| 6. | Case Study on Swachh Bharat Abhiyan-Indore as an example |
| 7. | Awareness campaign through poster/ documentary / poster or any other modality to create awareness on waste management. |
| Practical USMABC404 | |
| 1. | Sequence retrieval (protein and gene) from NCBI and Molecular file formats - FASTA, GenBank/Genpept. |
| 2. | Structure download (protein and DNA) from PDB and Molecular viewer by visualization software (Pymol / Rasmol) |
| 3. | BLAST suite of tools for pairwise alignment. |
| 4. | Multiple sequence alignment (CLUSTALW) and construction of guide trees |
| 5. | Primary sequence analyses and Secondary structure prediction. |
| 6. | Write an application for filing of a patent |

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

| | | | |
|---|----------------------|---|--|
| Program: B.Sc. (Honours) Biochemistry | | | Semester : IV |
| Course: Entrepreneurship and Product Development | | | Course Code: USMABC405 |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| <p>Learning Objectives: Entrepreneurs are people who manage a business with the intention of expanding business by applying some form of innovation and with the leadership and managerial capacity for achieving their goals, generally in the face of strong competition from other firms, large and small. The overall aim of this course, therefore, is to provide opportunities to consider and reflect on the personal aspects involved in transforming an innovative idea into an entrepreneurial product.</p> | | | |
| <p>Course Outcomes: After completion of the course, learners would be able to:</p> <ul style="list-style-type: none"> ● Explain the nature of entrepreneurship ● Demonstrate function of the entrepreneur in the successful, commercial application of innovations ● Formulate entrepreneurial ideas ● Explore entrepreneurial leadership and management style ● Evaluate feasibility of business ventures | | | |
| Outline of Syllabus: (per session plan) | | | |
| Module | Description | No of hours | |
| 1 | Entrepreneurship | 10 | |
| 2 | Business modeling | 10 | |
| 3 | Proposal Preparation | 10 | |
| | Total | 30 | |
| PRACTICALS | | | 30 |

| Module | Entrepreneurship and Product Development | No. of Hours/Credits 30/2 |
|---------------|---|--------------------------------------|
| 1 | Entrepreneurship | 10 |
| | <i>Entrepreneurship, Start-Ups and Intrapreneurship</i> Concept ; Need and Importance | 1 |
| | <i>Entrepreneurship</i> Factors Attributes/Traits of a Successful Entrepreneur Mitigating failure | 2 |
| | <i>Entrepreneurial Lifecycle/Process</i> Ideation Creative thinking | 2 |
| | <i>Scouting for Business Ideas</i> Various sources Generation Business Ideas- Various tools Idea Vs Opportunity Opportunity Evaluation Importance of Opportunity Evaluation Different parameters for Opportunity Evaluation | 5 |
| 2 | Business modeling | 10 |
| | <i>Business Modeling</i> Meaning, Need and Nature Relationship between Business Model & Business Plan | 2 |
| | <i>Market Research</i> Market Plan and advertising | 2 |
| | <i>Financial Planning</i> Role of Government and Financial Institutions in Entrepreneurship Devel Sources of Funding -examples | 3 |
| | <i>Business Planning</i> Project Feasibility Assessment Elements of Business Plan Entrepreneur Vs Manager | 3 |
| 3 | Financials of Proposal | 10 |
| | <i>Maintenance of Books of Accounts and other records</i> Accounting Process and Financial Statements Importance of Costing techniques Management Accounting tools for Decisions Requirement of Audit | 4 |
| | <i>Objectives of Financial Management</i> Time Value of Money Sources of Finance | 1 |
| | <i>Introduction to Income Tax</i> | 3 |

| | | |
|--|--|---|
| | TDS and Advance Tax Tax Planning Professional Tax Basics of GST <i>Preparing an elementary Business Plan</i> | 2 |
|--|--|---|

RECOMMENDED READING:

Essential Reading:

1. Entrepreneurship: Robert D Hirsch, Michael P Peters, Dean A Shepherd. McGraw Hill
2. Entrepreneurship: Theory, Process and Practice. Donald F Kurtako
3. New Business Road Test: Prof. John Mullins
4. How to write a great Business Plan: William Sahlman
5. Financial Accounting- R L Gupta
6. Cost Accounting- Jawaharlal
7. Management Accounting- Khan and Jain
8. Financial Management- Prassanchandra
9. Auditing-Kamal Gupta
10. Income Tax- Singhanian
11. GST- V S Datey

Suggested Reading:

1. Corporate Entrepreneurship – Paul Burns
2. The Oxford Handbook of Entrepreneurship
3. Entrepreneurship in the New Millenium – Kutatko Hodgetts.
4. J. Collins and Lazier W, —Beyond entrepreneurship, Prentice Hall, New Jersey, 1992
5. Hisrich Peters Shephard, —Entrepreneurship, Tata McGraw Hill.

Any other reference sources as recommended by the course instructor.

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|---|--|---|--|
| Program: B.Sc. (Honours) Biochemistry | | Semester: IV | |
| Course: Life Skills | | Course Code: USMABC406 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| Learning Objectives: | | | |
| <p>The rapid pace of change and increasing complexities of the present times demand that individuals should be equipped with the skills needed to adapt and flourish in an uncertain world. Life Skills are the psychosocial skills required to deal with the challenges of daily life through adopting positive behaviors to deal with change. This course aims to equip learners with the skills needed for personal growth as well as for a positive contribution to the society. The outcomes of this course would lead to capacity building in life skills for development of self. Also, the learner will be able to set appropriate goals, manage stress and time effectively.</p> | | | |
| Course Outcomes: | | | |
| <p>After completion of this course, a learner would be able to:</p> <p>CO1: Develop understanding into the fundamentals of life skills.</p> <p>CO2: Experience self-awareness and develops ways to face demands and challenges of life.</p> <p>CO3: Understand the concept of rights and appreciate the rights assured to the citizens of India</p> <p>CO4: Analyse the issues faced by the Indian society in present times</p> | | | |
| Outline of Syllabus: (per session plan) | | | |
| Unit | Description | Duration | |
| 1 | Concept of Life Skills | 10 | |
| 2 | Human Rights and Constitution of India | 10 | |
| 3 | Understanding Stress and Conflict | 10 | |
| | Total | 30 | |
| PRACTICALS | | 30 | |

| Module | Life Skills | 30 Lecture hours/2 Credits |
|----------|--|----------------------------|
| 1 | Concept of Life Skills | 10 |
| | <p>Concept of Life Skills</p> <p>Survival Skills and Livelihood Skills, The WHO Model</p> <p>Applying Psychology to everyday life: Thinking critically about Critical thinking,</p> <p>Maslow's theory of self-actualisation</p> <p>Intelligence and Emotional Intelligence</p> <p>Approaches to Understanding-Motivation, Culture and Emotions</p> <p>Introduction to the Principles of Pleasure – Affect, emotion, happiness and subjective well-being</p> <p>Introduction to self-efficacy, self-awareness, optimism and hope</p> <p>Introduction to Altruism, Gratitude and Forgiveness</p> <p>How People Think Paying attention to Attention- Deficit/Hyperactivity Disorder</p> | <p>3</p> <p>2</p> <p>5</p> |
| 2 | Human Rights and Constitution of India | 10 |
| | <p>Concept of Human Rights</p> <p>Origin and evolution of the concept</p> <p>The Universal Declaration of Human Rights</p> <p>Constitution of India</p> <p>The structure of the Constitution-the Preamble, Main Body and Schedules</p> <p>Basic features of the Constitution</p> <p>Human Rights constituents with special reference to Fundamental Rights stated in the Constitution</p> <p>Fundamental Duties of the Indian Citizen</p> <p>Contemporary Social Issues in India:</p> <p>Substance abuse- impact on youth & challenges for the future</p> <p>Issue of child labour- magnitude, causes, effects and response</p> <p>Child abuse- effects and ways to prevent</p> | <p>2</p> <p>5</p> <p>3</p> |
| 3 | Understanding Stress and Conflict | 10 |
| | <p>Causes of stress and conflict in individuals and society</p> <p>Agents of socialization and the role played by them in developing the individual</p> <p>Significance of values, ethics and prejudices in developing the individual</p> <p>Stereotyping and prejudice as significant factors in causing conflicts in society</p> <p>Aggression and violence as the public expression of conflict</p> <p>Types of conflicts and use of coping mechanisms for managing individual stress</p> <p>Different methods of responding to conflicts in society</p> | <p>4</p> <p>3</p> |

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| | Conflict-resolution and efforts towards building peace and harmony in society | |
| | Yoga as a means of conflict resolution and mental health | |
| | Yoga it's Definition & Objectives | |
| | Concept and alignment of Pancakosa | |
| | Relevance of Yoga in Modern age | 3 |
| | Spiritual Energy -Kundalini Shakti, Chakras | |

RECOMMENDED READING

Essential Reading

1. Clapham, Andrew (2015). Human Rights (Oxford-A Very Short Introduction), OUP.
2. Khosla, Madhav (2012). The Indian Constitution (Oxford India Short Introduction Series), Oxford.
3. Brian Luke Seaward. Managing Stress-Principles and Strategies for Health and Well Being 9th Edition Jones and Bartlett Learning

Suggested Reading:

1. Shivananda, J., Human Rights. Alfa Publications, New Delhi,. 2006
2. Rajawat, M., Human Rights and Dalits. Anmol Publications, New Delhi, 2005
3. Kaushal, R., Women & Human Rights in India; Kaveri Books, New Delhi, 2000
4. Ciccarelli, S. K., & White, J. N. (2018). Psychology. 5th edition. New Jersey: Pearson education.
5. Synder, C.R., & Lopez, S.J. (2014). Handbook of Positive Psychology. London: Oxford University Press.
6. United Nations (2015), The Universal Declaration of Human Rights, Aegitas.
7. Kashyap, Subhash (2021). Our Constitution. National Book Trust.
8. Ahuja, Ram (2021). Social Problems in India (Fourth Edition), Rawat Publications.

Any other reference sources as recommended by the course instructor.

| Practical USMABCP456 includes Practical of USMABC405 and USMABC406 | |
|---|---|
| Practical (Hours per week) | Credit |
| 4 | 2 |
| Practical- USMABC405 | |
| 1 | Presentation on a successful entrepreneurial idea |
| 2 | Presentation on an unsuccessful entrepreneurial idea |
| 3 | Case studies |
| 4 | Ideation of an entrepreneurial venture |
| 5 | Financial feasibility of a venture- Case study |
| 6 | Pitching a business plan |
| Practical- USMABC406 | |
| <i>Extension / Field / Experimental work/ Open book tests / Written Assignments / Case study / Action Research Project / Posters / Class presentations etc.</i> | |
| 1. | <p>Field Work/Survey</p> <p>a) Conduct a semi-structured interview on 2 sets of parents (Mother and Father) exploring the challenges of parenting and life skills needed for effective parenting. Compare the gender difference of parenting.</p> <p>b) Create scenarios/case studies of life skills required for Peace Keeping and Civic Responsibility and conduct a Focused Group Discussion amongst peers in the classroom.</p> <p>c) Make instructional modules for effective transaction of life skills needed for Disaster Management. Conduct a session on it.</p> <p>d) Conduct street play or role-play on Life Skills Interventions for handling emotions based on Broaden and Build Theory of Emotions.</p> <p>e) Survey one nuclear and one joint family in your surroundings. Write the importance of each family type in context of life skills development.</p> <p>f) Presentations on Rights and their dimensions</p> <p>g) Group discussions on the contemporary issues</p> <p>h) Role Play/ Posters/ Short Video Making</p> |
| 2. | <p>Seminar / Poster Presentation:</p> <p>a) Strategies for enhancing core life skills for self.</p> <p>b) Evaluation of life skills training.</p> <p>c) Any one life skill – Meaning and Importance</p> <p>d) Media and Life skill development</p> <p>e) Life skills for Social Inclusion or Women Empowerment or Corporate Sector</p> <p>f) Make a collage of stressful situations in your daily life, how you have faced them and now after studying this course what would you have done differently to handle that situation.</p> |
| 3. | <p>Practicals on:</p> <p>Types of Yoga: its brief introduction</p> <p>a) Hatha Yoga</p> <p>b) Raja Yoga</p> <p>c) Karma Yoga</p> |

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|----|-------------|
| d) | Gyana Yoga |
| e) | Bhakti Yoga |
| f) | Dhyana Yoga |
| g) | Mantra Yog |

To develop scientific temper and interest by exposure through industrial visits (eg. Kevalyadham Yoga Institute) and study/educational tours is recommended in each semester

| Program: B.Sc. (Hons.) Biochemistry | | Semester : IV | |
|---|-------------------------|---|--|
| Course: Physiology-II | | Course Code: USMABC407 | |
| Teaching Scheme | | Evaluation Scheme | |
| Lecture (Hours per week) | Credit | Continuous Assessment and Evaluation (CAE) | End Semester Examinations (ESE) |
| 02 | 02 | 25% | 75% |
| <p>Learning Objectives: As an extension into the subject of physiology, the learner in this paper is educated about the different aspects of neurophysiology, movement, locomotion and body fluids. Central nervous system is a complex of nerve tissues that is responsible for control and regulation of all the activities of the body. The learner is educated about the classification and components of the CNS in addition to concepts of transmission and its regulators. Locomotion and movement has played a crucial role in evolution of species – both animals and plants, thus learning about them is also crucial for the understanding of the physiology for the learner.</p> | | | |
| <p>Course Outcomes: After completion of the course, learners would be able to:</p> <p>CO1: Appreciate the complexity of the nervous system – including its classification, components and different membrane potentials</p> <p>CO2: Summarize the steps of generation and propagation of action potential and correlate with the action of neurotransmitters.</p> <p>CO3: Differentiate between types of movement and locomotion</p> <p>CO4: Compare different types of bones and joints</p> <p>CO5: Correlate the homeostasis in bones and joints with the disorders</p> <p>CO6: Explain the concepts of various types of movement in plants</p> <p>CO7: Analyze different mechanisms of muscle contraction and relaxation in human body</p> | | | |
| Outline of Syllabus: (per session plan) | | | |
| Module | Description | No of hours | |
| 1 | Neurobiology | 10 | |
| 2 | Skeletal system | 10 | |
| 3 | Movement and Locomotion | 10 | |
| | Total | 30 | |
| PRACTICALS | | 30 | |

| Module | Physiology-II | No. of Hours/Credits 30/2 |
|---------------|--|--|
| 1 | Neurobiology | 10 |
| | <i>Nervous System:</i> Classification: CNS, PNS, ANS; Components: Neurons (3 types) and Neuroglia (6 types) – structure and function, Axonal transport Resting Membrane Potential Ion channels [voltage and ligand gated] Action Potential (depolarization, repolarization and refraction period), Propagation of action potential (saltatory & continuous conduction) Physiological anatomy of a synapse Transmission at synapses – Electrical & Chemical synapses, Excitatory & Inhibitory post synaptic potentials, Agonists & Antagonists, Removal of Neurotransmitters <i>Neurotransmitters-</i> acetylcholine and Catecholamines, GABA, Glutamate & Aspartate – structure and function | 8 2 |
| 2 | Skeletal system | 10 |
| | <i>Bones and Homeostasis</i> Functions of Bone and the skeletal system Structure of Bone- Osteoprogenitor cells, Osteoblasts, Osteocytes, Osteoclasts Histology of compact and spongy bone. Types of Bone: On the basis of shape and location Bone's Role in Calcium Homeostasis Disorders: Osteoporosis, Osteomalacia <i>Joints and Homeostasis</i> Classification of joints- Structural and functional Synovial fluid Types of movements at synovial joints- Gliding, angular movements, Rotation Disorders- Osteoarthritis, Rheumatoid arthritis | 6 5 |
| 3 | Movement and Locomotion | 10 |
| | Movements in Plants: <i>Movements of Locomotion</i> Spontaneous: Ciliary, Amoeboid, Cyclosis (Rotation, Circulation) Induced: Chemotaxis, Phototaxis, Thermotaxis <i>Movements of Curvature:</i> Mechanical: hygroscopic movements Vital: i) Spontaneous- Movements of growth-(nutantion, circumnutantion, Hyponasty, | 6 |

| | | |
|--|---|---|
| | epinasty Movements of variation ii) Induced: Tropic - Hapto/ Geo / Hydro/Thermo/Chemo tropism Nastic – Seismonasty, Nyctynasty, Photonasty Contraction and Relaxation of Muscles Mechanism Other types of contractions – eg. twitch, tetanus, Isotonic, Isometric Regulation of Muscle contraction Neuromuscular junction | 4 |
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To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential Reading:

1. Gerard J. Tortora, Bryan H. Derrickson Tortora's Principles of Anatomy and Physiology 15th Edition Macmillan Education
2. Peter Raven, George Johnson and Kenneth Mason and Jonathan Losos and Tod Dunca Biochemistry 12th Edition Mc Graw Hill
3. S N Pandey, B K Sinha Plant Physiology 4th Edition Vikas Publishing House Pvt Ltd

Suggested Reading:

1. Voet D. and Voet, J.G. Principles of Biochemistry 3rd Edition John Wiley & Sons
2. Zubay, Geoffrey L Principles of Biochemistry 5th Edition McGraw-Hill Education - Europe
3. Jeremy M. Berg, John L Tymoczko, Lubert Stryer Biochemistry 5th Edition Freeman publishers
4. Victor Rodwell, David Bender, Kathleen Botham, Peter Kennelly, P. Anthony Weil Harpers illustrated biochemistry 3rd Edition Mc Graw Hill, Lange
5. Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach 5th edition ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA
6. Plummer, David T Introduction to practical biochemistry 3rd Edition Tata Mc. Graw and Hill publishers
7. Sawhney, S.K. and Singh, Randhir Introductory practical biochemistry 1st Edition Narosa Publishing House

Any other reference sources as recommended by the course instructor.

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|---|--|--|--|
| Program: B.Sc. (Hons.) Biochemistry | | Semester : IV | |
| Course: Research Project | | Course Code: USMABCP47 | |
| Teaching Scheme | | Evaluation Scheme | |
| Credit | | End Semester Examinations (ESE) | |
| 04 | | 200% | |
| GUIDELINE TO CARRY OUT PROJECT WORK IN SEMESTER IV | | | |
| 1. | The main purpose of introduction of research project Work at S.Y.B.Sc. is to make the learners familiar with research methodology i.e. reference work, experimental work, statistical analysis of experimental data, interpretation of results obtained, writing of project work and bibliography. This will not only help train the inquisitive minds of the learners, but also inspire them to take up research- oriented higher studies and career. | | |
| 2. | Duration of Project work: Depending on the nature of the research problem and the infrastructure available in the department of Biochemistry, the duration of project work is recommended as 120 hours in semester IV | | |
| 3. | Nature of Research Project: The following will be considered as the Research Project. a) Experimental based research involving laboratory work b) Survey based Field work with statistical analysis of data collect c) Any other proposal deemed fit by the mentor | | |