

SEMESTERWISE MARKS DISTRIBUTION FOR 7TH AND 8TH SEMESTERS (FOR HONOURS AND HONOURS WITH RESEARCH)

YEAR	7 th SEM	Theory	Practical	Internship/ Dissertation	Seminar	Internal Assessment (20)		Attendance	TOTAL	Credit
						Project/ Assignment	CE			
4 th (With Hons.)	Major-13 Research Methodology, Scientific Ethics and Academic Skills	50	25			10	10	5	100	6
	Major- 14 Elective Related major disciplines 14-A-Exercise Physiology and Holistic Fitness Sciences 14-B-Fundamental Biochemistry 14-C - Hormonal and Reproductive Sciences 14-D- Environmental Physiology 14-E- Human Nutrition 14-F- Human Immunology and Microbiology	50	25			10	10	5	100	6
	Major- 15 Community Nutrition, Public Health and Seminar Presentation	50			Seminar -25		Review on Elective topic 20	5	100	6
	Major-16 Pharmacology and Therapeutics	50	25			10	10	5	100	6
4 th (With Resch.)	Major-13 Research Methodology, Scientific Ethics and Academic Skills	50	25			10	10	5	100	6
	Major- 14 Elective Related major disciplines 14-A-Exercise Physiology and Holistic Fitness Sciences 14-B-Fundamental Biochemistry 14-C – Hormonal and Reproductive Sciences 14-D- Environmental Physiology 14-E- Human Nutrition 14-F- Human Immunology and Microbiology	50	25			10	10	5	100	6
	Major- 15 Community Nutrition, Public Health and Seminar Presentation	50			Seminar -25		Review on Elective topic 20	5	100	6
	Major-16 Research Proposal submission and Presentation			50	25 (with viva)		20		100	6
YEAR	8 th SEM	Theory	Practical	Internship/ Dissertation	Seminar	CE (20)		Attendance	TOTAL	Credit
						Project/ Assignment	Midterm exam			
4 th (With Hons.)	Major-17 Statistics in Physiology	50	25			10	10	5	100	6
	Major- 18 Elective Related major disciplines 18-A-Exercise Physiology and Holistic Fitness Sciences 18-B-Fundamental Biochemistry 18-C Hormonal and Reproductive Sciences 18-D- Environmental Physiology 18-E- Human Nutrition 18-F- Human Immunology and Microbiology	50	25			10	10	5	100	6
	Major-19 Biotechnology and Bioinformatics	50	25			10	10	5	100	6
	Minor 6 Human Nutrition, Dietetics and Community Health	50	25			10	10	5		6
4 th (With Resch.)	Major-17 Statistics in Physiology	50	25			10	10	5	100	6
	Major- 18 Elective Related major disciplines 18-A- Exercise Physiology and Holistic Fitness Sciences 18-B-Fundamental Biochemistry 18-C - Hormonal and Reproductive Sciences 18-D- Environmental Physiology 18-E- Human Nutrition 18-F- Human Immunology and Microbiology	50	25			10	10	5	100	6
	Major-19 Submission of Research Dissertation			50	25 (with viva)		20		100	6
	Minor 6 Human Nutrition, Dietetics and Community Health	50	25			10	10		100	6

(Common for both 4 years Honours and Honours with research)

Course: Major-13

Paper Title: Research Methodology, Scientific Ethics and Academic Skills

Paper Code: PHY-MAJ13

Course Objectives: This course is designed to introduce undergraduate students to the fundamental concepts, principles of scientific research and their applications in physiology including allied life sciences. It aims to develop an understanding of the research process, including the identification of research problems, formulation of objectives and hypotheses, and selection of appropriate methods for data collection. The course also seeks to provide basic skills in data organization, analysis, interpretation, and scientific communication through report writing, presentations, and referencing. In addition, it emphasizes the importance of research ethics, academic integrity, biosafety, and responsible conduct of research while fostering the ability to apply elementary research skills in laboratory, field, and community-based studies.

Theory:

04 Credit

Unit I: Fundamentals of Scientific Research Planning and Working with data

1.1 Principles of Scientific Intervention: Science and scientific thinking, Research: meaning, objectives and importance, Types of research (basic, applied and observational), Steps in scientific research, Research in physiology and life sciences

1.2 Research Planning and Data Collection - Identifying a research problem, Research question, aim and objectives, Variables and simple hypothesis, Sampling methods (random and non-random), Methods of data collection: observation, questionnaire, interview and laboratory records

1.3 Basic Data Analysis and Presentation-Types of data (qualitative and quantitative), Tables, charts and graphs, Measures of central tendency (mean, median and mode), Simple interpretation of scientific data, Introduction to spreadsheet software for data entry and graph preparation

Unit II: Research Communication, Ethics and Applications

2.1 Scientific Communication - Structure of a scientific report, Abstract, introduction, methods, results and conclusion, Basics of literature search, Referencing styles (Vancouver and APA), Oral presentation and poster presentation, Preparation of PowerPoint presentations

2.2 Research Ethics and Good Scientific Practice - Research ethics and responsible conduct of research, Plagiarism and academic integrity, Authorship and acknowledgement, Ethical issues in research involving humans and animals (basic concepts), Biosafety and laboratory safety, Intellectual property rights: basic concepts

2.3 Research Applications in Physiology -Community-based and laboratory-based research, Survey methods in health and physiology, Health awareness and screening programmes, Case studies in physiology research, Mini research project: planning and presentation (concept only)

Practical:

2 Credit

1. Identification of a simple research problem.
2. Preparation of a questionnaire/survey schedule.
3. Collection and tabulation of simple data.
4. Preparation of tables, bar charts and pie charts using spreadsheet software.
5. Searching scientific articles using online databases (basic introduction).
6. Referencing using citation software or manual methods.
7. Preparation of a PowerPoint presentation.
8. Poster preparation on a physiological topic.

9. Seminar presentation.
10. Preparation of a short project report.

References:

1. Kothari CR, Garg G. Research Methodology: Methods and Techniques. 4th ed. New Delhi: New Age International Publishers; 2019.
2. Kumar R. Research Methodology: A Step-by-Step Guide for Beginners. 5th ed. New Delhi: SAGE Publications; 2019.
3. Mahajan BK. Methods in Biostatistics for Medical Students and Research Workers. 9th ed. New Delhi: Jaypee Brothers Medical Publishers; 2018.
4. Daniel WW, Cross CL. Biostatistics: A Foundation for Analysis in the Health Sciences. 11th ed. Hoboken: Wiley; 2018.
5. Day RA, Gastel B. How to Write and Publish a Scientific Paper. 9th ed. Cambridge: Cambridge University Press; 2022.
6. Shamoo AE, Resnik DB. Responsible Conduct of Research. 4th ed. New York: Oxford University Press; 2022.
7. Indian Council of Medical Research. National Ethical Guidelines for Biomedical and Health Research Involving Human Participants. New Delhi: ICMR; 2017.

(Common for both 4 years Honours and Honours with research)

Course: Major-14

Paper Title: Elective Related Major Disciplines

Students have to choose any *one* elective from the basket of allotted electives enlisted below

14-A-Exercise Physiology and Holistic Fitness Sciences

14-B- Fundamental Biochemistry

14-C - Hormonal and Reproductive Sciences

14-D- Environmental Physiology

14-E- Human Nutrition

14-F- Human Immunology and Microbiology

Course: Major-14A

Paper Title: Exercise Physiology and Holistic Fitness Sciences

Paper Code: PHY-MAJ14A

Course Objectives: This course aims to provide undergraduate students with a comprehensive understanding of the physiological principles underlying exercise and physical activity. It introduces the mechanisms of energy metabolism, skeletal muscle function, cardiovascular, respiratory, metabolic, endocrine, thermoregulatory, and neuro-immune responses to acute and chronic exercise. The course also develops an understanding of exercise testing, physical fitness assessment, body composition, and the role of exercise in promoting health, enhancing performance, preventing lifestyle-related diseases, and improving overall well-being.

Theory:

04 Credit

Unit I: Fundamentals of Exercise Physiology

1.1 Introduction to Exercise Physiology- Scope and significance, Physical activity, exercise, and fitness, Concepts of physical fitness, health-related fitness, and performance-related fitness

1.2 Energy Metabolism During Exercise - ATP as the energy source, Aerobic and anaerobic energy systems, Energy expenditure during exercise, Oxygen consumption and oxygen debt, EPOC, lactate and exercise, Concept of MET

1.3 Skeletal Muscle and Exercise - Structure and function of skeletal muscle, Types of muscle fibers, motor unit recruitment, Muscle contraction during exercise, Muscle fatigue and recovery, neuromuscular adaptation to exercise,

1.4 Exercise and Body Composition - Body mass index (BMI) , Body composition and fitness, Obesity and physical inactivity

1.5 Exercise Testing and Assessment-Principles of exercise testing, Assessment of aerobic and anaerobic fitness, Determination of maximal oxygen uptake (VO_2max), Physical fitness evaluation and interpretation

Unit II: Physiological Responses to Exercise

2.1 Cardiovascular Responses - Heart rate and stroke volume, Cardiac output during exercise, Blood pressure changes during exercise, Training-induced cardiovascular adaptations

2.2 Respiratory Responses - Pulmonary ventilation during exercise, Oxygen transport and utilization, VO_2max and its significance, Effects of training on respiratory function

2.3 Metabolic and Endocrine Responses - Carbohydrate, fat, and protein metabolism, Hormonal regulation during exercise, Blood glucose regulation during physical activity

2.4 Thermoregulation - Physiologic responses to heat and cold stress, Heat production during exercise, Mechanisms of heat loss, Dehydration and exercise performance

2.5 Neuro-Immune Interactions in Exercise -Neuroendocrine regulation during acute and chronic exercise. Exercise-induced modulation of innate and adaptive immune responses, Cytokines, myokines, and neuroimmune communication, Role of exercise in inflammation, immune surveillance, and recovery, Effects of overtraining on neuroimmune function and susceptibility to infection, Clinical applications of exercise in immune-mediated and neurological disorders.

Practical:

2 Credit

1. Assessment of Heart Rate variability
2. Measurement of VO_2max (direct or indirect methods).
3. Determination of haemoglobin concentration before and after exercise.

4. Estimation of Blood Glucose (fasting, post-exercise) – Glucometer/Colorimetric method before and after exercise
5. Serum Lactate Measurement – indicator of anaerobic metabolism
6. Protein Estimation – serum/plasma proteins (Biuret or Lowry method)
7. Exercise-Tolerance test to determine cardiac efficiency.
8. Determination of static and dynamic lung functions.
9. Body composition analysis (BMI, waist-hip ratio, skinfold measurements).
10. Blood pressure and heart rate responses to graded exercise.

References:

1. Kenney WL, Wilmore JH, Costill DL. Physiology of Sport and Exercise. 8th ed. Champaign (IL): Human Kinetics; 2023.
2. Powers SK, Howley ET. Exercise Physiology: Theory and Application to Fitness and Performance. 12th ed. New York: McGraw-Hill Education; 2024.
3. McArdle WD, Katch FI, Katch VL. Exercise Physiology: Nutrition, Energy, and Human Performance. 10th ed. Philadelphia: Wolters Kluwer; 2022.
4. Sharkey BJ, Gaskill SE. Fitness and Health. 8th ed. Champaign (IL): Human Kinetics; 2021.
5. ACSM. ACSM's Guidelines for Exercise Testing and Prescription. 12th ed. Philadelphia: Wolters Kluwer; 2025.
6. Fahey TD, Insel PM, Roth WT. Fit and Well: Core Concepts and Labs in Physical Fitness and Wellness. 16th ed. New York: McGraw-Hill Education; 2023.
7. Nieman DC. Exercise Testing and Prescription: A Health-Related Approach. 8th ed. New York: McGraw-Hill Education; 2021.
8. Iyengar BKS. Light on Yoga. Revised ed. New Delhi: HarperCollins Publishers India; 2005.
9. Nagendra HR, Nagarathna R. New Perspectives in Stress Management. Bengaluru: Swami Vivekananda Yoga Prakashana; 2018.
10. Sembulingam K, Sembulingam P. Essentials of Medical Physiology. 9th ed. New Delhi: Jaypee Brothers Medical Publishers; 2024.
11. Guyton AC, Hall JE. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2024.
12. Garber CE, editor. ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription. 9th ed. Philadelphia: Wolters Kluwer; 2023.

Course: Major-14B

Paper Title: Fundamental Biochemistry

Paper Code: PHY-MAJ14B

Course Objectives: This course aims to introduce students to the chemistry of biologically important molecules and the structure, properties, and functions of enzymes. It is designed to develop a fundamental understanding of the major metabolic pathways and their regulation, while enabling students to appreciate the relationship between biochemical processes and normal human physiology, thereby providing a strong foundation for the study of physiology and allied biomedical sciences.

Theory:

04 Credit

Unit I: Chemistry of biomolecules and enzymes

1.1 Fundamental concepts on Biomolecules: Water and pH; acids, bases, electrolytes and biological buffers, Carbohydrates: classification, structure and biological importance, Lipids: fatty acids, triglycerides, phospholipids and cholesterol, Proteins: amino acids, peptide bond, levels of protein structure, Nucleic acids: DNA and RNA—structure and functions

1.2 Enzymes: Definition, nomenclature and classification, Properties of enzymes, Mechanism of enzyme action, Factors affecting enzyme activity, Enzyme inhibition, Clinical and industrial applications of enzymes

Unit II: Bioenergetics and Metabolism

2.1 Bioenergetics: ATP and high-energy compounds, Glycolysis, Citric acid (TCA) cycle, Electron transport chain and oxidative phosphorylation, Glycogenesis and glycogenolysis (overview)

2.2 Lipid and Protein Metabolism: Digestion and absorption of lipids, β -oxidation of fatty acids, Ketone bodies, Protein digestion and amino acid metabolism, Urea cycle (overview)

2.3 Nucleic acid Metabolism: Synthesis and metabolism of purines and pyrimidines

2.4 Vitamins and Coenzymes: Fat soluble and water-soluble vitamins, introduction to coenzymes, NAD⁺ and NADP⁺, FMN and FAD, Pyridoxal Phosphate, Tetrahydrofolic Acid and one carbon metabolism, Cobamides, Coenzyme A, Ubiquinone (Coenzyme Q or CoQ), Thiamin Pyrophosphate (TPP) and Lipoic Acid, Other Coenzymes

2.5 Integration of Metabolism: Integration of carbohydrate, lipid and protein metabolism, Metabolism during fed and fasting states, Vitamins as coenzymes, Basic concept of metabolic disorders (diabetes mellitus, obesity, hyperlipidaemia)

Practical:

2 Credit

1. Serum total protein estimation
2. Blood glucose estimation
3. Estimation of total cholesterol of serum
4. Estimation of serum amylase activity
5. Study on the effect of temperature and pH on enzyme activity

References:

1. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 9th ed. New York: W.H. Freeman; 2025.
2. Berg JM, Tymoczko JL, Gatto GJ Jr, Stryer L. Biochemistry. 10th ed. New York: W.H. Freeman; 2023.
3. Voet D, Voet JG, Pratt CW. Fundamentals of Biochemistry: Life at the Molecular Level. 6th ed. Hoboken (NJ): John Wiley & Sons; 2024.
4. Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. Harper's Illustrated Biochemistry. 32nd ed. New York: McGraw-Hill Education; 2021.
5. Devlin TM. Textbook of Biochemistry with Clinical Correlations. 8th ed. Hoboken (NJ): John Wiley & Sons; 2017.
6. Satyanarayana U, Chakrapani U. Biochemistry. 7th ed. Kolkata: Elsevier India; 2021.
7. Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of Biochemistry for Medical Students. 10th ed. New Delhi: Jaypee Brothers Medical Publishers; 2023.
8. Ferrier DR. Lippincott Illustrated Reviews: Biochemistry. 8th ed. Philadelphia: Wolters Kluwer; 2023.
9. Murray RK, Bender DA, Botham KM, Kennelly PJ, Rodwell VW, Weil PA. Harper's Illustrated Biochemistry. 31st ed. New York: McGraw-Hill Education; 2018.
10. Campbell MK, Farrell SO. Biochemistry. 10th ed. Boston: Cengage Learning; 2023.

Course: Major-14C

Paper Title: Hormonal and Reproductive Sciences

Paper Code: PHY-MAJ14C

Course Objectives: The course introduces students to the endocrine system and its role in maintaining homeostasis. It explains the synthesis, secretion, regulation and physiological functions of major hormones, their mechanisms of action, endocrine control of growth, metabolism, stress, reproduction and calcium balance, and provides an overview of common endocrine disorders and their physiological basis.

Theory:

04 Credit

Unit I: General Endocrinology

1.1 Introduction to Endocrinology: Organization of the endocrine system, Endocrine, paracrine and autocrine signalling, Classification of hormones, Hormone synthesis, secretion, transport and metabolism, Mechanism of hormone action, Hormone receptors and second messengers, Feedback regulation of hormone secretion

1.2 Hypothalamus and Pituitary Gland: Hypothalamus as the neuroendocrine control centre, Hypothalamo-pituitary axis, Anterior pituitary hormones: Growth hormone, TSH, ACTH, FSH, LH and Prolactin, Posterior pituitary hormones: ADH and Oxytocin, Physiological functions and regulation, Disorders: Dwarfism, Gigantism, Acromegaly, Diabetes insipidus

1.3 Thyroid Gland: Synthesis and secretion of thyroid hormones, Physiological functions, Regulation of thyroid secretion, Hyperthyroidism and hypothyroidism

1.4 Parathyroid Gland: Parathyroid hormone, Calcium and phosphate homeostasis, Calcitonin and Vitamin D (basic concept), Osteoporosis (introduction)

1.5 Endocrine Pancreas: Islets of Langerhans, Insulin and glucagon, Regulation of blood glucose, Diabetes mellitus: causes, symptoms and complications (basic concept)

1.6 Adrenal Gland: Cortisol, Aldosterone, Physiological functions, Adrenal Medulla: Adrenaline and noradrenaline, Role in stress response

1.7 Endocrine functions of kidney and Heart: Hormones and their physiological roles in blood pressure regulation, erythropoiesis and calcium homeostasis, n regulation of blood volume and sodium balance

Unit II: Applied Endocrinology

2.1 Hormones in Growth, Exercise and Stress Physiology: Hormonal regulation of growth and metabolism, Hormonal regulation during exercise, Hormones and stress, Hormones regulating appetite (Leptin and Ghrelin)

2.2 Biological rhythms and melatonin: Biological rhythms: circadian, ultradian and infradian rhythms; biological clock and regulation of circadian rhythms; pineal gland and biosynthesis of melatonin; physiological functions of melatonin; role of melatonin in sleep–wake cycle, seasonal rhythms, and regulation of metabolism; effects of light exposure and circadian disruption on human health.

2.3 Common endocrine disorders: Diabetes mellitus, Thyroid disorders, Cushing's syndrome, Addison's disease. Osteoporosis

2.4 Immuno endocrinology: Structure and endocrine functions, Thymic hormones (Thymosin, Thymopoietin and Thymulin), Role in T-lymphocyte maturation and immune regulation, Age-related involution of thymus

2.5 Hormonal control of gut and the gut endocrine axis

2.6 Introduction to hormone estimation: (ELISA, immunoassay—principle only), RIA

2.7 Basics of artificial intelligence in endocrinology: AI applications in diabetes monitoring, hormone data interpretation and endocrine disease prediction (introductory level)

Practical:

2 Credit

1. Identification of endocrine glands using histological slides.
2. Routine HE staining of thyroid, adrenal and pancreas
3. Study of endocrine gland models and charts.
4. Interpretation of normal hormone laboratory reports (TSH, T3, T4, insulin and cortisol).
5. Demonstration of blood glucose estimation.
6. Interpretation of endocrine case studies.
7. Visit to a clinical biochemistry/endocrinology laboratory (optional).
8. Seminar on a common endocrine disorder.

References:

1. Hadley ME, Levine JE. Endocrinology. 7th ed. Boston: Pearson Education.
2. Gardner DG, Shoback D, editors. Greenspan's Basic and Clinical Endocrinology. 11th ed. New York: McGraw-Hill Education; 2023.
3. Hall JE. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2024.
4. Barrett KE, Barman SM, Brooks HL, Yuan JXJ. Ganong's Review of Medical Physiology. 27th ed. New York: McGraw-Hill Education; 2023.
5. Silverthorn DU. Human Physiology: An Integrated Approach. 9th ed. Harlow: Pearson; 2024.
6. Vander AJ, Widmaier EP, Raff H, Strang KT. Vander's Human Physiology: The Mechanisms of Body Function. 16th ed. New York: McGraw-Hill Education; 2024.
7. Abbas AK, Lichtman AH, Pillai S. Basic Immunology: Functions and Disorders of the Immune System. 7th ed. Philadelphia: Elsevier; 2024.
8. Boron WF, Boulpaep EL. Medical Physiology. 4th ed. Philadelphia: Elsevier; 2022.
9. Johnson LR. Gastrointestinal Physiology. 9th ed. Philadelphia: Elsevier.
10. Tietz NW. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St. Louis: Elsevier; 2019.
11. Topol E. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. New York: Basic Books; 2019.
12. Melmed S, Auchus RJ, Goldfine AB, Koenig RJ, Rosen CJ, editors. *Williams Textbook of Endocrinology*. 15th ed. Philadelphia: Elsevier; 2024.

Course: Major-14D

Paper Title: Environmental Physiology

Paper Code: PHY-MAJ14D

Course Objectives: This course is designed to introduce undergraduate students to the fundamental concepts of environmental physiology and the mechanisms by which the human body adapts to changing environmental conditions. It aims to develop an understanding of the interactions between physical environmental factors and physiological processes, including thermoregulation, water and electrolyte balance, responses to heat, cold, humidity and high altitude. The course also seeks to provide knowledge of environmental biophysics and the principles governing human adaptation and homeostasis under environmental stress.

Theory:

04 Credit

Unit I: Environmental Biophysics

1.1 Introduction to Environmental Physiology: Scope and significance of environmental physiology, Interaction between organisms and the environment, Components of the environment: atmosphere, hydrosphere, lithosphere and biosphere, Internal and external environment, Homeostasis and allostasis

1.2 Physical Environment: Weather and climate, Environmental temperature, Atmospheric pressure, Wind velocity, Solar radiation, Environmental energy balance

1.3 Heat and Temperature: Heat versus temperature, Sources of body heat, Heat production and heat conservation, Modes of heat transfer: conduction, convection, radiation and evaporation, Thermal conductivity of air and water, Thermal insulation of the human body

1.4 Humidity and Water Balance: Absolute humidity, Relative humidity, Vapour pressure, Dew point, Physiological importance of humidity, Heat index, Sweating and evaporative cooling, Water intake and water loss, Dehydration and rehydration, Regulation of body fluid volume, Electrolyte balance during environmental stress

Unit II: Human Adaptation:

2.1 Thermoregulation: Normal body temperature, Core and shell temperature, Neural control of thermoregulation, Role of hypothalamus, Behavioural thermoregulation, Vasodilatation and vasoconstriction, Sweating and shivering, Brown adipose tissue, Fever versus hyperthermia, Heat acclimatization, Heat cramps, Heat exhaustion, Heat stroke, Hypothermia

2.2 High Altitude Physiology: Characteristics of high-altitude environment, Hypobaric hypoxia, Acute physiological responses, Acclimatization, Acute Mountain sickness, High altitude pulmonary oedema, High altitude cerebral oedema

2.3 Cold Environment: Physiological responses to cold, Cold acclimatization, Frostbite, Hypothermia

Practical:

2 Credit

1. Measurement of relative humidity using hygrometer.
2. Measurement of wet bulb and dry bulb temperature.
3. Determination of Heat Index.
4. Recording oral and skin temperature under different environmental conditions.

References:

1. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 9th ed. New York: W.H. Freeman; 2025.
2. Berg JM, Tymoczko JL, Gatto GJ Jr, Stryer L. Biochemistry. 10th ed. New York: W.H. Freeman; 2023.
3. Voet D, Voet JG, Pratt CW. Fundamentals of Biochemistry: Life at the Molecular Level. 6th ed. Hoboken (NJ): John Wiley & Sons; 2024.
4. Campbell NA, Urry LA, Cain ML, Wasserman SA, Minorsky PV, Orr RB. Campbell Biology. 12th ed. New York: Pearson; 2021.
5. Manahan SE. Environmental Chemistry. 11th ed. Boca Raton (FL): CRC Press; 2017.
6. Bharucha E. Textbook of Environmental Studies for Undergraduate Courses. 3rd ed. Hyderabad: Universities Press; 2020.
7. Sharma PD. Ecology and Environment. 14th ed. Meerut: Rastogi Publications; 2022.
8. Halliwell B, Gutteridge JMC. Free Radicals in Biology and Medicine. 6th ed. Oxford: Oxford University Press; 2022.
9. Klaassen CD, editor. Casarett and Doull's Toxicology: The Basic Science of Poisons. 10th ed. New York: McGraw-Hill Education; 2024.
10. De AK. Environmental Chemistry. 8th ed. New Delhi: New Age International Publishers; 2018.

Course: Major-14E

Paper Title: Human Nutrition

Paper Code: PHY-MAJ14E

Course Objectives: From this course students will gather the knowledge about the role different nutrients and food on health management and disease prevention. The course would fortify to the students to acquire the knowledge about hygiene and health maintenance. From this course students will gather the knowledge about the study of health by studying malnutrition and undernutrition from this course students will gather the knowledge about vitamin deficiency.

Theory:

04 Credit

Unit I: Food Science

1.1 Food Science: Food groups and classification, Water and Ice in Foods - Structure and properties of water, Water activity (aw) and its effect on microbial growth and shelf life, Free water vs. bound water in foods. Carbohydrates in Foods-Structure and properties of sugars, starches, cellulose, pectins, gums. Proteins in Foods - Structure and classification of food proteins. Fats and Lipids - Structure and classification. Vitamins, Minerals, and Pigments - Effect of cooking and processing on vitamins and Pigments

1.2 Food guide and dietary guidelines: Food Pyramid and Food Plate: Structure and concept of the Food Pyramid Concept and need for food guides. Balanced diet principles (ICMR/NIN), Indian Dietary Guidelines (ICMR-NIN), WHO/FAO food-based dietary guidelines

1.3 Portion Size and Serving Standards: Concept of portion size vs. serving size, Household measurements vs. standard measurements

1.4 Food processing: Effect of processing on nutrients – chemical and radiation hazards. Food additives, food colour and preservatives.

1.5 Energy needs and energy balance: Components of energy expenditure – Macronutrients and micronutrients: functions, requirements, and imbalances. BMR, physical activity, SDA of food, daily energy need. Weight control programs – dietary management, modification of physical activity and behaviour

Unit II Human Nutrition and Metabolism

2.1 Nutritional biochemistry: Glycolysis, gluconeogenesis, glycogen metabolism, TCA cycle, oxidative phosphorylation, Blood glucose regulation, insulin and glucagon. Fatty acid metabolism, Protein metabolism and nitrogen balance, Biochemical roles of water- and fat-soluble vitamins, Coenzymes and co-factors, Deficiency disorders. Mineral metabolism: calcium, iron, zinc, iodine, selenium.

2.2 Metabolic disorders: Diabetes mellitus, lactose intolerance, obesity atherosclerosis, fatty liver disease.

2.3 Nutrition, hormones and integrated metabolism: Integration of metabolism (fed state, fasting, starvation, exercise), Hormonal regulation of metabolism.

2.4 Nutrition through Different Stages of Life: Assessment of nutritional status: anthropometric, clinical, biochemical methods. Nutrition through the life cycle: infancy, childhood, adolescence, pregnancy, lactation, elderly.

2.5 Therapeutic nutrition: Nutrition in Stress (fever burn survey), Cancer, HIV, Osteoporosis and neurodegenerative diseases.

Practical:**2 Credit**

1. Adulteration of food: (i) Metanil yellow in sweets, ice-cream and beverages. (ii) Aluminium foil in sweet. (iii) Margarin in Ghee. (iv) Water in Milk. (v) Chalk powder in sugar. (vi) Khesari flower in Besan.
2. Blood Constituents: Serum constituents: a. protein (Folin Ciocalteu method/ Biuret method). b. glucose, c. cholesterol.
3. Nutritional assessment and Diet survey.

References:

1. Mahan LK, Raymond JL. Krause's Food & the Nutrition Care Process. 16th ed. St. Louis (MO): Elsevier; 2023.
2. Gropper SS, Smith JL, Carr TP. Advanced Nutrition and Human Metabolism. 8th ed. Boston: Cengage Learning; 2021.
3. Wardlaw GM, Smith AM. Contemporary Nutrition. 11th ed. New York: McGraw-Hill Education; 2019.
4. Srilakshmi B. Nutrition Science. 7th ed. New Delhi: New Age International Publishers; 2022.
5. Srilakshmi B. Dietetics. 8th ed. New Delhi: New Age International Publishers; 2019.
6. Swaminathan M. Essentials of Food and Nutrition. Vol. I: Fundamental Aspects. 2nd ed. Bengaluru: The Bangalore Printing and Publishing Co. Ltd.; 1993.
7. Swaminathan M. Essentials of Food and Nutrition. Vol. II: Applied Aspects. 2nd ed. Bengaluru: The Bangalore Printing and Publishing Co. Ltd.; 1993.
8. Bamji MS, Krishnaswamy K, Brahmam GNV, editors. Textbook of Human Nutrition. 4th ed. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.; 2017.
9. Gibney MJ, Lanham-New SA, Cassidy A, Vorster HH, editors. Introduction to Human Nutrition. 3rd ed. Oxford: Wiley-Blackwell; 2023.
10. Whitney E, Rolfes SR. Understanding Nutrition. 16th ed. Boston: Cengage Learning; 2022.
11. Ross AC, Caballero B, Cousins RJ, Tucker KL, Ziegler TR, editors. Modern Nutrition in Health and Disease. 12th ed. Philadelphia: Wolters Kluwer; 2020.
12. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 9th ed. New York: W.H. Freeman; 2025.
13. Ferrier DR. Lippincott Illustrated Reviews: Biochemistry. 8th ed. Philadelphia: Wolters Kluwer; 2023.
14. Fellows PJ. Food Processing Technology: Principles and Practice. 5th ed. Cambridge: Woodhead Publishing; 2022.
15. Potter NN, Hotchkiss JH. Food Science. 5th ed. New York: Springer; 1998.

Course: Major-14F**Paper Title: Human Immunology and Microbiology****Paper Code: PHY-MAJ14F**

Course Objectives: This course introduces students to the diversity of microorganisms, their structure, growth, importance in health and disease, and basic laboratory methods. It emphasizes medically important microorganisms and their applications in biotechnology, food, agriculture, and environmental sciences.

Theory:**04 Credit****Unit I. Microbiology**

1.1 Introduction to Microbiology: History and scope of microbiology, Classification of microorganisms, Types of microorganisms, Beneficial and harmful microorganisms, Normal human microbiota, microbial evolution and systematic phylogenetic trees, Methods of studying microbial diversity (Conventional and molecular tools)

1.2 Bacteria: Structure of bacterial cell, Shapes and arrangements, Growth and nutrition, Bacterial growth curve, Culture media, Sterilization and disinfection, Staining methods (Gram stain and Acid-fast stain), Bacterial genetics, Mechanisms of bacterial resistance to host cellular (phagocytosis) and humoral defences, Immune escape mechanisms,

1.3 Viruses, Fungi and Protozoa: General characteristics of viruses, Structure and replication of viruses, Introduction to bacteriophages and their use in study of molecular genetics, Fungi: morphology and importance, Protozoa of medical importance, Emerging viral diseases

Unit II. Applied Microbiology

2.1 Environmental Microbiology: Food microbiology, Water microbiology, Industrial microbiology, Fermentation, Probiotics and prebiotics, Gut microbiome and human health, Biofertilizers and biopesticides

2.2 Microbial Diseases and Control: Common bacterial, viral and fungal infections, Modes of transmission, Prevention and control, Antibiotics and antimicrobial resistance, Vaccination, Biosafety and biohazard concepts

Practical:

2 Credit

1. Laboratory safety and aseptic techniques
2. Preparation of culture media
3. Gram staining
4. Observation of bacteria and fungi
5. Isolation of microorganisms by streak plate
6. Colony morphology
7. Measurement of microbial growth
8. Visit to microbiology laboratory/industry and report submission

References:

1. Paniker CKJ, Ananthanarayan and Paniker's Textbook of Microbiology. 11th ed. Hyderabad: Universities Press; 2022.
2. Willey JM, Sherwood LM, Woolverton CJ. Prescott's Microbiology. 11th ed. New York: McGraw-Hill Education; 2020.
3. Madigan MT, Bender KS, Buckley DH, Sattley WM, Stahl DA. Brock Biology of Microorganisms. 16th ed. New York: Pearson; 2021.
4. Tortora GJ, Funke BR, Case CL. Microbiology: An Introduction. 13th ed. New York: Pearson; 2019.
5. Pelczar MJ Jr, Chan ECS, Krieg NR. Microbiology. 5th ed. New Delhi: Tata McGraw-Hill; 2001.
6. Carroll KC, Pfaller MA, Landry ML, McAdam AJ, Patel R, Richter SS, et al. Jawetz, Melnick & Adelberg's Medical Microbiology. 29th ed. New York: McGraw-Hill Education; 2023.
7. Cappuccino JG, Welsh C. Microbiology: A Laboratory Manual. 12th ed. New York: Pearson; 2020.
8. Pepper IL, Gerba CP, Gentry TJ, editors. Environmental Microbiology. 4th ed. London: Academic Press; 2022.
9. Frazier WC, Westhoff DC. Food Microbiology. 5th ed. New Delhi: Tata McGraw-Hill; 2008.
10. Casida LE Jr. Industrial Microbiology. New Delhi: New Age International Publishers; 2007.

(Common for both 4 years Honours and Honours with research)

Course: Major-15

Paper Title: Community Nutrition, Public Health and Seminar Presentation

Paper Code: PHY-MAJ15

Course Objectives: This course aims to provide undergraduate students with a fundamental understanding of community nutrition and public health, emphasizing nutritional requirements across the life cycle, common nutritional disorders, food safety, environmental health, and national health programmes. The course enables students to appreciate the role of nutrition and public health measures in disease prevention, health promotion, and community well-being.

Theory:

4 Credit

Unit I: Fundamentals of Community Nutrition

1.1 Introduction to Community Nutrition: Concept and scope of community nutrition and public health, Determinants of health and nutritional status, Nutritional assessment: Anthropometric, clinical, biochemical and dietary methods (basic concepts)

1.2 Nutritional Requirements: Food groups and balanced diet, Recommended Dietary Allowances (RDA), Energy and nutrient requirements during childhood, adolescence, adulthood, pregnancy and lactation, Adult Consumption Unit (ACU)

1.3 Food Composition and Nutritional Assessment: Nutritional value of common Indian foods, Diet survey methods (basic concepts), Dietary guidelines for Indians, Nutrition education and behaviour change communication

Unit II: Public Health Nutrition

2.1 Community Nutritional Problems: Protein-energy malnutrition (PEM), Marasmus and Kwashiorkor, Micronutrient deficiency disorders, Iron deficiency anaemia, Iodine deficiency disorders, Vitamin A deficiency, Overnutrition and obesity, Lifestyle disorders and nutrition

2.2 Therapeutic Nutrition: Principles of therapeutic diets, Dietary management of, Obesity Diabetes mellitus, Hypertension, Nutrition for sports and physical activity (basic concepts)

2.3 National Nutrition Programmes: Integrated Child Development Services (ICDS), Mid-Day Meal (PM POSHAN), Anaemia Mukh Bharat, POSHAN Abhiyaan, Food Fortification Programme, Public Distribution System (PDS)

Unit III: Public Health and Environmental Health

3.1 Food Hygiene and Food Safety: Food hygiene, Food contamination and food adulteration, Food-borne diseases, Food preservation (basic principles), Personal hygiene and sanitation

3.2 Environmental Health: Safe drinking water, Water sanitation, Waste disposal, Air pollution, Noise pollution and its health effects

3.3 Health Promotion: Health education, Lifestyle modification, Role of nutrition in prevention of non-communicable diseases, Community participation in health promotion

Seminar:

2Credit

Seminar on review topic based on elective one

References:

1. Park K. Park's Textbook of Preventive and Social Medicine. 27th ed. Jabalpur: Banarsidas Bhanot Publishers; 2023.

2. Srilakshmi B. Nutrition Science. 7th ed. New Delhi: New Age International (P) Ltd.; 2018.
3. Mudambi SR, Rajagopal MV. Fundamentals of Foods, Nutrition and Diet Therapy. 7th ed. New Delhi: New Age International (P) Ltd.; 2017.
4. Gopalan C, Rama Sastri BV, Balasubramanian SC. Nutritive Value of Indian Foods. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research; 2017.
5. Indian Council of Medical Research–National Institute of Nutrition. Dietary Guidelines for Indians. 2nd ed. Hyderabad: ICMR-NIN; 2024.
6. Indian Council of Medical Research–National Institute of Nutrition. Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR) for Indians. Hyderabad: ICMR-NIN; 2024.
7. World Health Organization. Basic Methods for Assessing Nutritional Status. Geneva: WHO; 2021.
8. Hall JE. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2024.

(Course Specific for 4 years Honours)

Course: Major-16

Paper Title: Pharmacology and Therapeutics

Paper Code: PHY-MAJ16

Course Objectives This course introduces undergraduate students to the fundamental principles of pharmacology and therapeutics with emphasis on the safe, effective, and rational use of medicines. It provides an understanding of the basic mechanisms of drug action, pharmacokinetic principles, commonly used therapeutic agents, and their clinical applications. The course also develops awareness of adverse drug reactions, drug safety, antimicrobial therapy, toxicology, and pharmacovigilance while promoting responsible and ethical use of medicines in healthcare.

Theory:

04 Credit

Unit I: General and Systemic Pharmacology

1.1 Fundamental concepts - Introduction to Pharmacology: definition, scope and branches, Sources and classification of drugs, Routes of drug administration, Drug absorption, distribution, metabolism and excretion (ADME), Drug dosage forms and factors affecting drug action, Adverse drug reactions, drug allergy, drug interactions and drug dependence, Essential medicines and rational use of drugs

1.2 Drugs Acting on the Nervous System - Autonomic nervous system: sympathetic and parasympathetic drugs (basic concepts), Local anaesthetics and general anaesthetics, Analgesics: opioid and non-opioid drugs, Antipyretic and anti-inflammatory drugs (NSAIDs), Drugs used in anxiety and insomnia (basic concepts)

1.3 Cardiovascular and Respiratory Pharmacology - Drugs used in hypertension, Drugs used in heart failure and angina (basic principles), Anticoagulants and antiplatelet drugs, Drugs used in bronchial asthma, Drugs for cough and allergic disorders

1.4 Endocrine and Gastrointestinal Pharmacology - Insulin and oral antidiabetic drugs, Thyroid hormones and antithyroid drugs, Corticosteroids: therapeutic uses and adverse effects, Drugs used in peptic ulcer disease and gastroesophageal reflux, Laxatives and anti diarrhoeal drugs

Unit II: Toxicology and Clinical Pharmacology

2.1 Toxicology and Chemotherapy- Introduction to toxicology, Food poisoning, pesticide poisoning and heavy metal poisoning, Principles of poisoning management and antidotes, Principles of antimicrobial chemotherapy, Antibiotics: penicillins, cephalosporins and macrolides (basic concepts), Antifungal and antiviral drugs (overview), Antimalarial and antihelminthic drugs, Cancer (concepts) and therapy

2.2 Clinical Pharmacology and Drug Safety - Drug prescription: essential components, Pharmacovigilance and adverse drug reaction reporting, Over-the-counter (OTC) drugs and self-medication, Drug abuse and substance misuse, Role of the pharmacist and healthcare professional in rational drug use, Recent advances in drug delivery systems (overview)

2.3 AI in Pharmacology - Introduction to Artificial Intelligence (AI) in healthcare and pharmacology, Applications of AI in drug discovery and drug repurposing, AI-assisted prediction of drug efficacy and adverse drug reactions, AI in personalized medicine and precision therapeutics (basic concepts), Ethical considerations and limitations of AI in pharmacology.

Practical:

2 Credit

1. Demonstration of effects of drugs on heartbeat of amphibians

2. Demonstration of drug induced alterations of mammalian intestinal movement
3. Bioassay of drugs on mammalian uterine and intestinal movement
3. MTT assay
4. Knowledge on drug isolation, purification of drug and biological activity testing in both animal model lines
9. Lethality: MLD, LD₅₀, IC₅₀ of drugs.
10. Toxicity assessment in serum, blood and tissue /organ toxicity by specific markers

References:

1. Tripathi KD. Essentials of Medical Pharmacology. 9th ed. New Delhi: Jaypee Brothers Medical Publishers; 2024.
2. Shanbhag TV, Shenoy S. Pharmacology for Medical Graduates. 5th ed. New Delhi: Elsevier; 2022.
3. Katzung BG, Trevor AJ. Basic and Clinical Pharmacology. 16th ed. New York: McGraw-Hill Education; 2023.
4. Bennett PN, Brown MJ, Sharma P. Clinical Pharmacology. 12th ed. Edinburgh: Elsevier; 2019.
5. Goodman LS, Brunton LL, Hilal-Dandan R, Knollmann BC, editors. Goodman & Gilman's The Pharmacological Basis of Therapeutics. 14th ed. New York: McGraw-Hill; 2023.
6. World Health Organization. WHO Model List of Essential Medicines. Geneva: WHO; Latest edition.
7. Ministry of Health and Family Welfare, Government of India. National List of Essential Medicines (NLEM). New Delhi: Government of India; Latest edition.
8. Topol E. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. New York: Basic Books; 2019.

(Course Specific for 4 years Honours with Research)

Course: Major-16

Paper Title: Research Proposal and Progress Report submission

Paper Code: PHY-MAJ16

Course Objectives Upon successful completion of this course, students will be able to identify and formulate a research problem in physiology or allied life sciences, develop appropriate research questions, aims, objectives, and simple hypotheses, conduct a basic literature review using scientific resources, design a feasible research proposal with suitable methodology and data analysis plans, apply the principles of research ethics, biosafety, and responsible conduct of research, prepare a scientifically structured proposal using appropriate referencing styles, and effectively communicate and defend their research ideas through oral presentation using suitable audio-visual aids and scientific reasoning.

Research Proposal submission and Progress report Components-

50 marks

Written Research Proposal Submission-

Evaluation based on - Selection and relevance of research topic – significance, originality, and suitability for physiology/life sciences; Research problem, aim, and objectives – clarity of problem statement, objectives, and research question/hypothesis; Review of literature – use of relevant sources, understanding of previous work, and identification of knowledge gaps; Methodology – study design, sampling, variables, data collection methods, and feasibility of the study; Data analysis plan – appropriateness of basic statistical methods, tables, charts, and interpretation plan; Ethical considerations and safety – informed consent, confidentiality, biosafety, and responsible conduct of research; Scientific writing and referencing – organization, language, formatting, APA/Vancouver style, and plagiarism-free submission.

Research Proposal Presentation-

Evaluation based on - Content and understanding – knowledge of topic, objectives, literature background, and proposed methodology; Organization and logical flow – clear introduction, objectives, methods, expected outcomes, and conclusion; Presentation skills – clarity of speech, confidence, communication, and time management; Quality of visual aids – PowerPoint/poster design, readability, diagrams, tables, and graphs; Response to questions – ability to answer questions, justify the proposal, and demonstrate critical thinking.

Interim (Progress) Report Submission-

Component of evaluation- Coherence between the research problem, objectives, hypothesis and study design, Literature review in alignment with the proposed work hypothesis, Research methodology adopted and its relevance with the study design, Progress of work/preliminary findings, Report writing and formatting

Research Proposal Presentation: Components-

25 marks

Interim Report Presentation-

Evaluation based on - Content - objectives, literature background, and proposed methodology; Organization and logical flow including the timeline of work progress; Presentation skills – clarity of speech, confidence, communication, and time management; Quality of visual aids – PowerPoint/poster design, readability, diagrams, tables, and graphs; Response to questions – ability to answer questions, justify the proposal, and demonstrate critical thinking.

Viva Voce-

(Common for both 4 years Honours and Honours with research)

Course: Major-17

Paper Title: Statistics in Physiology

Paper Code: PHY-MAJ17

Course Objectives This course aims to provide undergraduate students with a fundamental understanding of biostatistical principles and their applications in physiology and biomedical sciences. It introduces methods of data collection, organization, presentation, and analysis while developing the ability to interpret biological and physiological data using basic statistical techniques. The course also familiarizes students with hypothesis testing, correlation, and simple statistical inference, enabling them to apply statistical reasoning in laboratory experiments, research, and healthcare. Emphasis is placed on accurate data interpretation, ethical reporting, and the use of spreadsheet software for basic statistical analysis.

Theory:

04 Credit

Unit I: Fundamentals of Biostatistics

1.1 Introduction- Definition, scope and importance of biostatistics, Role of biostatistics in physiology and biomedical sciences, Types of data: qualitative and quantitative, Variables and scales of measurement (nominal, ordinal, interval and ratio), Population and sample, Sampling methods: probability and non-probability sampling, Sources of error and bias in biological studies

1.2 Collection and Presentation of Data- Methods of data collection, Classification and tabulation of data, Frequency distribution, Graphical presentation of data: Bar diagram, Histogram, Pie chart, Line graph, Frequency polygon, Scatter diagram, Interpretation of graphical data

Unit II: Descriptive Statistics

2.1 Measures of central tendency - Properties of mean, computation of mean from data, Median-properties, computation of median, Mode-properties and computation from data

2.2 Measures of dispersion (Properties and computation) - Range, Variance, Standard deviation, coefficient of mean deviation, Coefficient of variation, Percentiles and quartiles,

2.3 Moments, Skewness and Kurtosis-Moments about mean and about any point, Derivation of their relationships, Effect of change of origin and scale on moments, Coefficients of Skewness and Kurtosis with their interpretations.

Unit III: Probability Distribution and Tests of Significance

3.1 Basic concepts- Probability, Sampling distribution, Probability distributions: Normal distribution, Bernoulli distribution, Binomial distribution, Poisson distribution, Introduction to Z-score

3.2 Statistical Inference - Sampling distribution (basic concept), Standard error, Confidence interval (basic concept), Hypothesis: null and alternative, Type I and Type II errors, Level of significance (p-value)

3.3 Tests of Significance and Correlation-Parametric and non-parametric tests (overview), Student's t-test (paired and unpaired), Chi-square test, Correlation: Pearson's and Spearman's correlation, Simple linear regression (basic concept)

3.4 Applications of Biostatistics in Physiology-Biostatistics in experimental physiology, Clinical and epidemiological data analysis, Anthropometric data analysis, Analysis of physiological parameters (blood pressure, heart rate, lung function, blood glucose, etc.)

1. Preparation of frequency distribution tables.
2. Graphical presentation of data using bar charts, histograms, pie charts and line graphs.
3. Calculation of mean, median and mode.
4. Calculation of range, variance and standard deviation.
5. Calculation and interpretation of coefficient of variation.
6. Simple probability problems.
7. Calculation of Pearson's correlation coefficient.
8. Demonstration of Student's t-test using physiological data.
9. Data entry and graph preparation using spreadsheet software (MS Excel/LibreOffice Calc).
10. Interpretation of statistical results from physiological experiments.

References:

1. Mahajan BK. Methods in Biostatistics for Medical Students and Research Workers. 9th ed. New Delhi: Jaypee Brothers Medical Publishers; 2018.
2. Daniel WW, Cross CL. Biostatistics: A Foundation for Analysis in the Health Sciences. 11th ed. Hoboken: John Wiley & Sons; 2018.
3. Pagano M, Gauvreau K. Principles of Biostatistics. 2nd ed. Boca Raton: CRC Press; 2018.
4. Rosner B. Fundamentals of Biostatistics. 8th ed. Boston: Cengage Learning; 2016.
5. Gupta SC, Kapoor VK. Fundamentals of Mathematical Statistics. 12th ed. New Delhi: Sultan Chand & Sons; 2020.
6. Gupta SP. Statistical Methods. 46th ed. New Delhi: Sultan Chand & Sons; 2021.
7. Sundar Rao PSS, Richard J. An Introduction to Biostatistics: A Manual for Students in Health Sciences. 4th ed. New Delhi: Prentice Hall India; 2012.
8. Motulsky H. Intuitive Biostatistics. 4th ed. New York: Oxford University Press; 2018.
9. Das D and Das A. Statistics for Biology and Psychology. Academic Press Publishers, 2015.

(Common for both 4 years Honours and Honours with research)

Course: Major-18

Paper Title: Elective Related Major Disciplines

Students have to choose any *one* elective from the basket of allotted electives enlisted below

18-A-Exercise Physiology and Holistic Fitness Sciences

18-B- Fundamental Biochemistry

18-C - Hormonal and Reproductive Sciences

18-D- Environmental Physiology

18-E- Human Nutrition

18-F- Human Immunology and Microbiology

Course: Major-18A

Paper Title: Exercise Physiology and Holistic Fitness Sciences

Paper Code: PHY-MAJ18A

Course Objectives: This course aims to provide an advanced understanding of physiological responses and adaptations to exercise, mechanisms underlying physical fitness and athletic performance, and the role of holistic approaches including yoga, lifestyle modification, and wellness interventions in health promotion and disease prevention.

Theory:

04 Credit

Unit I: Physical Fitness, Training and Human Performance

1.1 Components of Physical Fitness - Cardiorespiratory endurance, Muscular strength and endurance, Flexibility, Body composition, Balance, coordination, agility, speed, and power

1.2 Principles of Exercise Training - Overload, specificity, progression, reversibility, and periodization, Resistance training, Aerobic and anaerobic training, Functional fitness training

1.3 Sports Performance and Ergogenic Aids - Physiological determinants of athletic performance, Performance enhancement strategies, Nutritional ergogenic aids, Ethical and health concerns associated with performance-enhancing substances

1.4 Exercise Prescription-Exercise prescription for different age groups, Exercise prescription for sedentary individuals, Exercise guidelines for healthy populations, Monitoring exercise intensity and training load

Unit II: Holistic Fitness Sciences and Yogic Physiology

2.1 Concept of Holistic Health and Wellness -Dimensions of wellness, Lifestyle and health, Physical activity and quality of life, Wellness promotion strategies

2.2 Yogic Physiology - Historical and scientific basis of yoga, Physiological effects of yogic practices, Pranayama and respiratory physiology, Meditation and neurophysiological mechanisms

2.3 Exercise, Yoga and Lifestyle Disorders-Obesity and metabolic syndrome, Type 2 diabetes mellitus, Hypertension and cardiovascular diseases, Role of exercise and yoga in prevention and management

2.4 Mind-Body Interactions-Exercise and mental health, Stress physiology and stress management, Neuroendocrine effects of exercise and yoga, Exercise, cognition and healthy ageing

Practical:

2 Credit

1. Assessment of resting physiological parameters.
2. Harvard Step Test and Physical Fitness Index.
3. Determination of aerobic capacity.
4. Handgrip strength and muscular endurance tests.
5. Oxidative Stress Markers – Malondialdehyde (MDA) / TBARS assay
6. Body composition analysis (BMI, waist-hip ratio, skinfold measurements).
7. Blood pressure and heart rate responses to graded exercise.
8. Determination of cholesterol, lipid profile in human

References:

1. Kenney WL, Wilmore JH, Costill DL. Physiology of Sport and Exercise. 8th ed. Champaign (IL): Human Kinetics; 2023.
2. Powers SK, Howley ET. Exercise Physiology: Theory and Application to Fitness and Performance. 12th ed. New York: McGraw-Hill Education; 2024.
3. McArdle WD, Katch FI, Katch VL. Exercise Physiology: Nutrition, Energy, and Human Performance. 10th ed. Philadelphia: Wolters Kluwer; 2022.
4. Sharkey BJ, Gaskill SE. Fitness and Health. 8th ed. Champaign (IL): Human Kinetics; 2021.
5. ACSM. ACSM's Guidelines for Exercise Testing and Prescription. 12th ed. Philadelphia: Wolters Kluwer; 2025.
6. Fahey TD, Insel PM, Roth WT. Fit and Well: Core Concepts and Labs in Physical Fitness and Wellness. 16th ed. New York: McGraw-Hill Education; 2023.
7. Nieman DC. Exercise Testing and Prescription: A Health-Related Approach. 8th ed. New York: McGraw-Hill Education; 2021.
8. Iyengar BKS. Light on Yoga. Revised ed. New Delhi: HarperCollins Publishers India; 2005.
9. Nagendra HR, Nagarathna R. New Perspectives in Stress Management. Bengaluru: Swami Vivekananda Yoga Prakashana; 2018.
10. Sembulingam K, Sembulingam P. Essentials of Medical Physiology. 9th ed. New Delhi: Jaypee Brothers Medical Publishers; 2024.
11. Guyton AC, Hall JE. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2024.
12. Garber CE, editor. ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription. 9th ed. Philadelphia: Wolters Kluwer; 2023.

Course: Major-18B

Paper Title: Fundamental Biochemistry

Paper Code: PHY-MAJ18B

Course Objectives: This course aims to provide students with an understanding of the biochemical mechanisms involved in maintaining health and the alterations associated with disease. It introduces the fundamental concepts of molecular biology and cell biochemistry at the undergraduate level, familiarizes students with commonly used biochemical laboratory techniques, and enables them to appreciate the clinical significance of biochemical investigations in the diagnosis, monitoring, and management of human diseases.

Theory:

04 Credit

Unit I: Applied biochemistry

1.1 Cell Biochemistry: Structure and function of the cell membrane, Transport across biological membranes, Cell organelles and their biochemical functions, Cell signalling (basic concepts) Cell cycle and apoptosis (introductory)

1.2 Molecular Biology Basics: DNA replication (overview), Repair of DNA, Transcription and translation, Regulation of gene expression (basic concepts), Mutations and their significance, Heridity and the gene, Introduction to recombinant DNA technology and PCR

1.3 Porphyrins and Hemoglobin: Basic concepts, Synthesis and degradation of haemoglobin, Problems and adaptations at high altitudes, Myoglobin

1.4 Biochemical Techniques and Applications: Colorimetry and spectrophotometry, Chromatography, Electrophoresis, ELISA (principle and types), Biosensors and diagnostic kits, Introduction to bioinformatics and AI applications in biochemistry

1.5 Antimetabolites: General considerations, Sulphonamides, Antibiotics, Therapeutic significance of antimetabolites

Unit II: Clinical Biochemistry

2.1 Inborn errors of metabolism: Errors in carbohydrate, lipid, amino acid, porphyrin, nucleic acid metabolism, Lipoproteins and disorders

2.2 Organ functions and their tests: Introduction, Blood glucose regulation- role of hormones and disorders, Liver function tests, Kidney function tests, plasma proteins functions and clinical significance

2.3 Nutrition and Biochemistry: Balanced diet and energy requirements, Macronutrients and micronutrients, minerals, Antioxidants and free radicals, Functional foods and nutraceuticals, Malnutrition and obesity

2.4 Basics of Human immune system: Protective Processes of the Body Against External Infection, Immunity and Antigens, Humoral System of Immunity: Development and Role of Complements, Cellular System of Immunity: Development, Histocompatibility Antigens, Autoimmunity, Sensitivity (Allergy), Disorders of immune system

2.5 Hormones: Steroid hormones and peptide hormones, mechanism of hormone action, Tropic hormones and their action, local hormones and their actions, hypothalamic hormones, endocrine glands and their functions, Hormonal disorders - concept of hypo and hyper secretion of hormones and related diseases

Practical:

2 Credit

1. Estimation of haemoglobin
2. Estimation of calcium in biological fluid
3. Estimation of serum ascorbate
4. Chromatographic separation of amino acids and sugars
5. Demonstration of agarose gel electrophoresis
6. Hemagglutination test

References:

1. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 9th ed. New York: W.H. Freeman; 2025.
2. Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. Harper's Illustrated Biochemistry. 32nd ed. New York: McGraw-Hill Education; 2021.
3. Ferrier DR. Lippincott Illustrated Reviews: Biochemistry. 8th ed. Philadelphia: Wolters Kluwer; 2023.
4. Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of Biochemistry for Medical Students. 10th ed. New Delhi: Jaypee Brothers Medical Publishers; 2023.
5. Satyanarayana U, Chakrapani U. Biochemistry. 7th ed. New Delhi: Elsevier; 2021.
6. Devlin TM. Textbook of Biochemistry with Clinical Correlations. 8th ed. Hoboken (NJ): John Wiley & Sons; 2017.
7. Wilson K, Walker J, editors. Principles and Techniques of Biochemistry and Molecular Biology. 8th ed. Cambridge: Cambridge University Press; 2018.
8. Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, et al. Molecular Biology of the Cell. 7th ed. New York: Garland Science; 2022.
9. Abbas AK, Lichtman AH, Pillai S. Basic Immunology: Functions and Disorders of the Immune System. 7th ed. Philadelphia: Elsevier; 2023.
10. Guyton AC, Hall JE. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2024.
11. Burtis CA, Brunz DE, editors. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics. 9th ed. St. Louis (MO): Elsevier; 2023.
12. Glick BR, Pasternak JJ, Patten CL. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 6th ed. Washington (DC): ASM Press; 2022.

Course: Major-18C

Paper Title: Hormonal and Reproductive Sciences

Paper Code: PHY-MAJ18C

Course Objectives: This course provides students with a comprehensive understanding of the physiology of human reproduction. It covers the structure and functions of the male and female reproductive systems, endocrine regulation of reproduction, reproductive cycles, pregnancy, lactation, fertility regulation, reproductive health, and recent advances in reproductive medicine.

Theory:

04 Credit

Unit I: Gonads- structure, function and regulation

1.1 Fundamentals: Organization and functions of the male and female reproductive systems, Puberty and sexual maturation, Primary and secondary sexual characteristics, Hormonal regulation of reproduction, Hypothalamic–pituitary–gonadal (HPG) axis

1.2 Male Reproductive Physiology: Structure and functions of the testes, Spermatogenesis, Functions of Sertoli and Leydig cells, Testosterone: synthesis, regulation and physiological actions, Semen: composition and functions, Physiology of erection and ejaculation, Male infertility (basic concepts)

1.3 Female Reproductive Physiology: Structure and functions of the ovary and uterus, Oogenesis and follicular development, Ovarian hormones: estrogen and progesterone, Menstrual cycle and its hormonal regulation, Ovulation and corpus luteum, Menopause and physiological changes

Unit II: Reproductive Events and Early Human Development

2.1 Fertilization, Pregnancy and Lactation: Fertilization and implantation, early embryonic development (basic concepts), Placenta: structure and endocrine functions, Physiological changes during pregnancy, Parturition and hormonal regulation, Lactation and milk ejection reflex. Neonatal adaptation (overview)

2.2 Human embryology and developmental biology: Introduction to embryology and human developmental biology, cleavage, blastulation, implantation, and gastrulation; embryonic germ layers and their derivatives, neurulation and organogenesis, development of placenta and fetal membranes, fetal growth and development, circulation, congenital anomalies and teratogens.

2.3 Reproductive Health and Applied Reproductive Physiology: Family planning and contraceptive methods, ART (assisted reproductive technologies), Infertility: causes and basic evaluation, sexually transmitted infections (overview), Reproductive health and hygiene, Basic concepts of Polycystic ovary syndrome (PCOS), Benign prostatic hyperplasia (BPH) and erectile dysfunction

Practical:

2 Credit

1. Histology of testis, ovary, uterus and placenta- staining and identification.
2. Identification of different stages of spermatogenesis and ovarian follicles using charts/slides.
3. Study of the estrous cycle of rats.
4. Interpretation of hormone profiles (FSH, LH, estrogen, progesterone, testosterone, hCG).
5. Semen analysis and sperm count (demonstration/data interpretation).
6. Pregnancy diagnosis and urinary immunological test for pregnancy (principle of hCG test).
7. Case studies and seminar on infertility, menstrual disorders and reproductive health.

References:

1. Hall JE. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2024.
2. Barrett KE, Barman SM, Brooks HL, Yuan JXJ. Ganong's Review of Medical Physiology. 27th ed. New York: McGraw-Hill Education; 2023.
3. Silverthorn DU. Human Physiology: An Integrated Approach. 9th ed. Harlow: Pearson; 2024.
4. Vander AJ, Widmaier EP, Raff H, Strang KT. Vander's Human Physiology: The Mechanisms of Body Function. 16th ed. New York: McGraw-Hill Education; 2024.
5. Sadler TW. Langman's Medical Embryology. 15th ed. Philadelphia: Wolters Kluwer; 2024.
6. Moore KL, Persaud TVN, Torchia MG. The Developing Human: Clinically Oriented Embryology. 12th ed. Philadelphia: Elsevier; 2023.
7. Carlson BM. Human Embryology and Developmental Biology. 7th ed. Philadelphia: Elsevier; 2023.
8. Dutta DC. Textbook of Obstetrics. 10th ed. New Delhi: Jaypee Brothers Medical Publishers.
9. Dutta DC. Textbook of Gynecology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers.
10. Speroff L, Fritz MA. Clinical Gynecologic Endocrinology and Infertility. 9th ed. Philadelphia: Wolters Kluwer.
11. Plant TM, Zeleznik AJ, editors. *Knobil and Neill's Physiology of Reproduction*. 4th ed. Cambridge, MA: Academic Press (Elsevier); 2015.
12. Jameson JL, De Groot LJ, de Kretser DM, Giudice LC, Grossman AB, Melmed S, et al., editors. *Endocrinology: Adult and Pediatric*. 7th ed. Philadelphia: Elsevier Saunders; 2016.

Course: Major-18D

Paper Title: Environmental Physiology

Paper Code: PHY-MAJ18D

Course Objectives: This course is designed to introduce undergraduate students to the biochemical basis of environmental interactions and the impact of environmental pollutants on human health. It aims to develop an understanding of ecosystem energetics, biogeochemical cycles, energy metabolism, oxidative stress, antioxidant defense mechanisms, and biochemical adaptations to environmental stress. The course also seeks to provide knowledge of the sources, health effects, and preventive measures related to air, water, soil, noise, and radionuclide pollution, with emphasis on environmental monitoring and sustainable environmental management.

Theory:

04 Credit

Unit I: Environmental Biochemistry

1.1 Biochemical Basis of Environmental Interactions: Scope and importance of environmental biochemistry, Biochemical basis of organism–environment interactions, Biomarkers of environmental exposure and effect, Human impacts on environmental biochemical processes.

1.2 Ecosystem Energetics and Biogeochemical Cycles: Ecosystem energetics and biochemical cycling of matter, Greenhouse gases and global climate change, Nutrient cycling and eutrophication (basic concepts), Carbon cycle: photosynthesis, respiration and carbon sequestration, Nitrogen and phosphorus cycles, Anthropogenic effects on biogeochemical cycles.

1.3 Energy Metabolism and Environmental Stress: ATP generation and energy metabolism, Role of cofactors in biological oxidation (NAD⁺ and FAD), Environmental influences on energy metabolism, Aerobic and anaerobic metabolism, Lactate production during hypoxia and exercise.

1.4 Oxidative Stress and Antioxidant Defense: Free radicals and reactive oxygen species (ROS), Oxidative stress and lipid peroxidation, Enzymatic antioxidants: Superoxide dismutase (SOD), Catalase and Glutathione peroxidase, non-enzymatic antioxidants: Glutathione, Vitamins C and E.

1.5 Biochemical Adaptation to Environmental Stress: Biochemical responses to heat, cold and dehydration, Heat shock proteins (basic concepts), Physiological adaptation to environmental stress, Oxidative stress induced by environmental pollutants.

Unit II: Environmental Pollution and Human Health Hazards

2.1 Air Pollution: definition, sources, air pollutants, effects of air pollution on human health, concept of ozone hole, greenhouse effects and global warming.

2.2 Water Pollution: definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, concept of safe drinking water standards.

2.3 Soil Pollution: causes, health hazards, solid waste managements- bioremediation, phytoremediation.

2.4 Sound Pollution: definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (noise standards).

2.5 Radionuclide Pollution: ionizing radiations, effects of ionizing radiation on human health, permissible doses.

Practical:

2 Credit

1. Measurement of dissolved oxygen.
2. Relative humidity measurement.
3. Suspended particulate matter of specific air sample.
4. Noise intensity measurement by Sound Level Meter.
5. Light intensity measurement by Lux Meter.
6. Demonstration of antioxidant enzyme activity

References:

1. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 9th ed. New York: W.H. Freeman; 2025.
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8. Enger ED, Smith BF. Environmental Science: A Study of Interrelationships. 16th ed. New York: McGraw-Hill Education; 2023.
9. Sharma PD. Ecology and Environment. 14th ed. Meerut: Rastogi Publications; 2022.
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13. Raven PH, Berg LR, Hassenzahl DM. Environment. 10th ed. Hoboken (NJ): John Wiley & Sons; 2020.
14. De AK. Environmental Chemistry. 8th ed. New Delhi: New Age International Publishers; 2018.
15. Sembulingam K, Sembulingam P. Essentials of Medical Physiology. 9th ed. New Delhi: Jaypee Brothers Medical Publishers; 2024.

Course: Major-18E

Paper Title: Human Nutrition

Paper Code: PHY-MAJ18E

Course Objectives: From this course students will gather the knowledge about Understand the principles of human nutrition. The course would fortify to the students to analyze the causes, prevention, and management of nutritional disorders. From this course students will gather the knowledge about the role of nutrition in physical activity and sports. From this course students will gather the knowledge about Apply the principles of clinical nutrition and dietetics, describe the fundamental concepts of food microbiology, understand the microbiological principles of food preservation and safety, the basic principles of food engineering and food processing.

Theory:

04 Credit

Unit I: Nutritional Policy, Sports and Clinical Nutrition

1.1 Nutrition, Growth and National Nutrition Policy: Nutritional counselling, epidemiology, National and international bodies of research organization, Community nutrition, midday meal, ICDS, Nutritional education, policies and laws

1.2 Dietary and Nutritional Imbalances: Malnutrition: Prenatal, postnatal malnutrition and their impact on the growth and development of the child. Protein-energy malnutrition – Kwashiorkor, Marasmus; classification and management. Anaemia

1.3 Nutrition & Exercise: Nutrition in relation to work, sports, exercise. Importance of glycogen loading in the athlete, Nutrition for endurance sports. Nutrition for strength/power sports

1.4 Hospital nutrition and dietetics: Assessment, Diagnosis, Intervention, Monitoring & Evaluation (ADIME). Hospital Food Service & Dietetic Management, Planning menus for hospital patients. Role of dietitians in ICU and critical care nutrition

Unit II: Nutritional Microbiology and Technology

2.1 Food Microbiology: Scope and history of food microbiology, Important groups of food microorganisms: bacteria, yeasts, molds, viruses, Sources of contamination in foods. Foodborne infections: Salmonella, Shigella, E. coli, Listeria, Campylobacter

2.2 Food Preservation Microbiology: Food Quality Assurance and Safety, Microbiological standards of food and water, Principles of microbial control in foods, Physical methods: heat (pasteurization, sterilization), cold storage, drying, irradiation. Chemical preservatives: organic acids, nitrates, sulphites, natural antimicrobials

2.3 Fermented Foods and Probiotics: Microbiology of dairy fermentations: yogurt, cheese, kefir. Probiotics, prebiotics, and functional foods, Industrial production of microbial enzymes and metabolites

2.4 Food engineering: Principles of heat transfer, mass transfer, fluid flow. Dairy processing & dairy products, Meat, poultry, fish processing. GM foods

Practical:

2 Credit

1. Abnormal constituents of urine: Urea, uric acid, creatinine.

2. Blood constituents: Studies on enzyme activity: SGOT, SGPT

3. Blood constituents: Studies on Ca, P

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3. Srilakshmi B. Dietetics. 8th ed. New Delhi: New Age International Publishers; 2019.
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11. Fellows PJ. Food Processing Technology: Principles and Practice. 5th ed. Cambridge: Woodhead Publishing; 2022.
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15. Campbell-Platt G, editor. Food Science and Technology. 2nd ed. Oxford: Wiley-Blackwell; 2017.

Course: Major-18F

Paper Title: Human Immunology and Microbiology

Paper Code: PHY-MAJ18F

Course Objectives: This course introduces the basic principles of the immune system, immune responses, antigen-antibody interactions, vaccination, hypersensitivity, autoimmunity and clinical applications of immunology.

Theory:

04 Credit

Unit I. Classical Immunology

1.1 Introduction: Immunity and immune system, Cells and organs of the immune system, Innate immunity, Adaptive immunity, Humoral and cell-mediated immunity

1.2 Antigens and Antibodies: Antigens and epitopes, Immunoglobulins: structure and classes, Antigen-antibody reactions, Complement system, Cytokines and chemokines

1.3 Immune Responses: B lymphocytes, T lymphocytes, Antigen presentation, Major Histocompatibility Complex (MHC), Primary and secondary immune responses, Immunological memory, Antigen recognition by T- lymphocytes and T-cell mediated immunity, Antigen receptors and accessory molecules, Cytotoxic T cell function, helper T cell and B cell peptide.

1.4. Molecular immunology: T-Lymphocyte development and expression of antigen receptors (TCR), T cell education, affinity, maturation, B-Lymphocyte development and expression

immunoglobulin receptors (BCR), molecular basis of receptor editing, class switching, affinity maturation, immunological memory.

Unit II. Clinical and Applied Immunology

2.1 Immunity in Health and Diseases: Vaccines and immunization, Hypersensitivity reactions, Autoimmune diseases, Immunodeficiency disorders, Transplantation and tissue rejection, Tumor immunology (basic concepts)

2.2 Applied Immunology: ELISA (9 principles, techniques and applications), Agglutination tests, Precipitation reactions, Rapid diagnostic tests, Monoclonal antibodies, Immunology in infectious diseases, Introduction to immunotherapy

Practical

2 Credit

1. Identification of lymphoid organs (charts/models)
2. Separation of human lymphocytes, monocytes and neutrophils from whole blood
3. Blood grouping (ABO and Rh)
4. Agglutination test
5. ELISA (demonstration/kit-based)
6. Ouchterlony double diffusion (demonstration)
7. Preparation of simple immunology charts/models
8. Hospital or diagnostic laboratory visit
9. Seminar/assignment on vaccines or emerging infectious diseases

References:

1. Owen JA, Punt J, Stranford SA. Kuby Immunology. 9th ed. New York: W.H. Freeman and Company; 2023.
2. Delves PJ, Martin SJ, Burton DR, Roitt IM. Roitt's Essential Immunology. 14th ed. Hoboken (NJ): Wiley-Blackwell; 2023.
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10. Paniker CKJ. Ananthanarayan and Paniker's Textbook of Microbiology. 11th ed. Hyderabad: Universities Press; 2022. (For applied immunology, immunization, and host immunity.)

(Course Specific for 4 years Honours)

Course: Major-19

Paper Title: Biotechnology and Bioinformatics

Paper Code: PHY-MAJ19

Course Objectives: This course introduces undergraduate students to the basic principles of biotechnology and bioinformatics and their applications in health sciences. It familiarizes students with recombinant DNA technology, molecular diagnostic methods, biomedical applications, and biological databases while providing an elementary understanding of computational biology.

Unit I: Biotechnology

1.1 Introduction to Biotechnology - Definition, scope and branches of biotechnology, Historical development and milestones, Cell as a biological factory, DNA, RNA and proteins as tools of biotechnology, Overview of modern biotechnology and its importance, Applications of biotechnology in health sciences

1.2 Basic Techniques in Biotechnology - Recombinant DNA technology: basic concept, Restriction enzymes and DNA ligase, Plasmids and cloning vectors (elementary concepts), Polymerase Chain Reaction (PCR): principle and applications, Gel electrophoresis, DNA sequencing (basic idea), Introduction to CRISPR and gene editing (overview)

1.3 Applications of Biotechnology-Medical biotechnology, Recombinant insulin, Vaccines, Monoclonal antibodies, Gene therapy (introduction), Agricultural biotechnology, Genetically modified crops, Biofertilizers and biopesticides, Environmental biotechnology, Bioremediation, Wastewater treatment, Industrial biotechnology, Fermentation technology, Production of enzymes and antibiotics

Unit II: Bioinformatics

1.1 Fundamentals - Definition and scope of bioinformatics, Biological databases, GenBank, Protein Data Bank (PDB), PubMed, DNA and protein sequence databases, Sequence alignment (basic concept), Introduction to phylogenetic analysis, Drug discovery and personalized medicine (overview)

1.2 Emerging Trends, AI and Ethics - Biotechnology in precision medicine, AI in biotechnology and bioinformatics, AI-assisted drug discovery, Applications of biotechnology in disease diagnosis, Biosafety levels and laboratory safety, Bioethics in biotechnology, Intellectual Property Rights (IPR), patents and biosafety regulations

Practical (25 Marks)

1. Familiarization with biotechnology laboratory equipment.
2. Identification of bio-instruments used research and their applications
3. Demonstration of micropipette handling.
4. Observation of agarose gel electrophoresis.
5. Chromatographic separation of amino acids.
6. Estimation of proteins.
7. Demonstration of PCR workflow (video/live demonstration).
8. Retrieval of DNA sequences from GenBank.
9. Retrieval of protein structures from Protein Data Bank.
10. Basic sequence comparison using freely available online tools.
11. Seminar on recent advances in biotechnology or AI in healthcare

References:

1. Satyanarayana U. Biotechnology. Hyderabad: Books and Allied (P) Ltd.; Latest edition.

2. Dubey RC. A Textbook of Biotechnology. 6th ed. New Delhi: S. Chand Publishing; Latest edition.
3. Brown TA. Gene Cloning and DNA Analysis: An Introduction. 8th ed. Hoboken: Wiley-Blackwell; 2021.
4. Kreuzer H, Massey A. Recombinant DNA and Biotechnology: A Guide for Students. 3rd ed. Washington DC: ASM Press; 2015.
5. Rastogi SC, Mendiratta N, Rastogi P. Bioinformatics: Methods and Applications. 5th ed. New Delhi: PHI Learning; 2022.
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8. Watson JD, Baker TA, Bell SP, et al. Molecular Biology of the Gene. 8th ed. Boston: Pearson; 2022.
9. Topol E. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. New York: Basic Books; 2019.
10. Sateesh MK. Bioethics and Biosafety. New Delhi: I.K. International Publishing House; Latest edition.

(Course Specific for 4 years Honours with research)

Course: Major-19

Paper Title: Final Submission of Research Dissertation

Paper Code: PHY-MAJ19

Course Outcome: Upon successful completion of the dissertation, students will be able to identify and investigate a research problem in physiology or allied life sciences, conduct a comprehensive literature review, design and execute a scientific study using appropriate methodologies, collect and analyze data using suitable statistical methods, interpret and discuss findings in the context of existing knowledge, prepare a scientifically written dissertation following ethical and academic standards, and effectively defend their research through a viva voce, demonstrating critical thinking, scientific communication, and problem-solving skills.

Submission of Research Dissertation-

50 marks

Evaluation Component: Title, Objectives and Research Problem 5

Review of Literature 10

Materials and Methods 10

Results and Data Presentation 10

Discussion and Conclusion 10

Scientific Writing, Referencing and Formatting 5

Seminar Presentation of Research Dissertation-

15 marks

Viva Voce / Dissertation Defence –

10 marks

(Common for both 4 years Honours and Honours with research)

Course: Minor-6

Paper Title: Human Nutrition, Dietetics and Community Health

Paper Code: PHY-MIN6

Course Objectives: This course is designed to provide undergraduate students with a comprehensive understanding of the principles of human nutrition, energy metabolism, balanced diet planning, and nutritional assessment. It aims to develop knowledge of community nutrition, public health issues, therapeutic nutrition, food hygiene, and nutritional management across different physiological and pathological conditions, enabling students to apply nutritional principles for health promotion, disease prevention, and improved community well-being.

Theory:

04 Credit

Unit I Human Nutrition and Dietetics

1.1 Fundamentals of Nutrition and Energy Metabolism: Constituents of food and their significance, Basic concept of energy and units, Basal metabolic rate (BMR) – factors affecting BMR and determination by Benedict-Roth apparatus, Respiratory quotient (RQ), Specific dynamic action (SDA), Calorific value of foods, Body calorie requirements – adult consumption unit.

1.2 Nutritional Requirements and Balanced Diet: Dietary requirements of carbohydrates, proteins, lipids and other nutrients, Balanced diet and principles of formulation of balanced diets for growing child, adult man and woman, pregnant woman and lactating woman., Nitrogen balance, essential amino acids and biological value of proteins, Supplementary value of proteins, Protein efficiency ratio (PER) and net protein utilization (NPU) of dietary proteins, Dietary fibres, Vitamins, Sources and physiological significance of vitamins and minerals

1.3 Applied Nutrition and Nutritional Assessment: Composition and nutritional value of common Indian foodstuffs: rice, wheat, pulses, egg, meat, fish and milk, Dietary fibres: types, functions and health benefits, Energy and calorie requirements, Adult Consumption Unit (ACU): concept and applications, Principle of diet survey, Principles of formulation of balanced diets for growing children, adult men and women, pregnant women and lactating women, Physiology of starvation and obesity.

Unit II Community Health

1.1 Community Nutrition and Public Health: Basic concepts of community health and public health, Community nutritional problems: Malnutrition, overnutrition and obesity—causes, consequences and preventive measures, Basic concepts of Protein-Calorie Malnutrition (PCM), marasmus and kwashiorkor; prevention, Iron and iodine deficiency disorders and their prevention, Sound pollution as a community health issue: definition, concept of noise, sources of excessive sound, effects of noise pollution on human health and noise standards (Noise Index)

1.2 Therapeutic Nutrition and Diet Planning: Principles of therapeutic nutrition, Dietary management of obesity, Dietary management of diabetes mellitus, Dietary management of hypertension., Nutritional requirements and diet planning for athletes.

1.3 Hygiene and awareness: Food hygiene, food safety and prevention of food-borne diseases; nutrition education and nutrition awareness programmes

Practical:

02 Credit

1. Qualitative assessment of noise.

2. Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report on his/her own family or neighbouring family.

3.A report (hand-written) on any ONE of the followings:

- a. Physiological parameters of human (at least three parameters).
- b. Anthropometric measurements on human (at least three parameters).
- c. Epidemiological studies on human.

References:

1. Srilakshmi B. Nutrition Science. 7th ed. New Delhi: New Age International (P) Ltd.; 2018.
2. Srilakshmi B. Dietetics. 8th ed. New Delhi: New Age International (P) Ltd.; 2019.
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7. Indian Council of Medical Research–National Institute of Nutrition. Dietary Guidelines for Indians. 2nd ed. Hyderabad: ICMR-NIN; 2024.
8. Indian Council of Medical Research–National Institute of Nutrition. Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR) for Indians. Hyderabad: ICMR-NIN; 2024.
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