MALLA REDDY VISHWAVIDYAPEETH

(Deemed to be University)

Suraram X Roads, Jeedimetla, Hyderabad 500055

School of Public Health, Emerging Healthcare & Technology

(SPHEHT)

COURSE STRUCTURE
&
SYLLABUS DOCUMENT

Bachelor of Public Health

Year 2026–30 Batch

Course Structure

SEMESTER – I							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MC		Introduction to Public Health	3	0	0	3
2	MC		Human Anatomy	3	0	0	3
3	MC		Human Physiology	3	0	0	3
4	MC		Biochemistry	3	0	0	3
5	MC		Environmental and Occupational Health	3	1	0	4
6	VAC		English and Communication Skills	2	0	0	2
7	SEC		AI in Healthcare: Foundation	1	0	0	1
8	MC-P		Human Anatomy (Practical)	0	0	2	1
			TOTAL	**18**	**1**	**2**	**20**
			TOTAL CONTACT HOURS	**21**			

SEMESTER – II							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MC		Principles of Epidemiology	2	0	0	2
2	MC		Fundamentals of Biostatistics	2	1	0	3
3	MC		Pharmacology	2	0	0	2
4	MC		Microbiology	3	0	0	3
5	MC		General Pathology	3	0	0	3
6	MC-P		Microbiology (Practical)	0	0	2	1
7	MC-P		General Pathology (Practical)	0	0	2	1
8	VAC		Life and Professional Skills	0	0	2	1
9	SI		Summer Internship: Hospital and Healthcare Systems	0	0	8	4
			TOTAL	**12**	**1**	**14**	**20**
			TOTAL CONTACT HOURS	**27**			

SEMESTER – III							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MC		Epidemiological Methods and Study Designs	3	1	0	4
2	MC		Intermediate Biostatistics	2	2	0	4
3	MD		Sociology and Anthropology	4	0	0	4
4	MC		Communicable and Noncommunicable Diseases	3	0	0	3
5	SEC		Data Analytics using MS-Excel and R Programming	0	0	2	1

SEMESTER – III							
6	MC		Healthcare Delivery Systems	2	2	0	4
			TOTAL	**14**	**5**	**2**	**20**
			TOTAL CONTACT HOURS	**20**			

SEMESTER – IV							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MC		Research Methodology	2	2	0	4
2	MS		Data Science in Public Health	2	2	0	4
3	MC		Public Health Governance, Law, and Bioethics	2	1	0	3
4	MC		Hospital Management	2	0	0	2
5	MC		Health Programmes in India	3	0	0	3
6	SI		Summer Internship: Industry or Nongovernment Organisation	0	0	8	4
			TOTAL	**11**	**5**	**8**	**20**
			TOTAL CONTACT HOURS	**24**			

SEMESTER – V							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MC		Advanced Statistical Methods	2	1	0	3
2	MC		Behavioural Health Sciences in Public Health	3	0	0	3
3	MD		Climate Change and Planetary Health	3	0	0	3
4	MC		Maternal, Newborn, Child, and Adolescent Health	3	0	0	3
5	MS		Digital Interventions in Public Health	1	1	0	2
6	SEC		Statistical Software Laboratory (Practical)	0	0	6	3
Specialisations/Electives (Choose Any One)							
7	MS: Health Data Science and Analytics		Predictive Health Analytics and EHR Mining	3	0	0	3
7	MS: Infectious Diseases		Molecular Epidemiology and Genomics of Pathogens	3	0	0	3
7	MS: Maternal and Child Health		Perinatal and Neonatal Health Epidemiology	3	0	0	3
7	MS: Noncommunicable Diseases		Epidemiology of Cardiovascular and Metabolic Diseases	3	0	0	3

SEMESTER – V							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
7	MS: Planetary Health and Sustainability		Global Health Security and Pandemic Preparedness	3	0	0	3
7	MS: Public Health Nutrition		Community Nutritional Assessment and Surveillance	3	0	0	3
			TOTAL	**15**	**2**	**6**	**20**
			TOTAL CONTACT HOURS	**23**			

SEMESTER – VI							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MS		Healthcare Informatics	2	1	0	3
2	MC		Demography and Population Studies	3	0	0	3
3	MC		Healthy Ageing and Geriatric Public Health	3	0	0	3
4	MS		Artificial Intelligence in Public Health	2	2	0	4
5	SI		Summer Internship: Community Outreach Programme	0	0	8	4
Specialisations/Electives (Choose Any One)							
6	MS: Health Data Science and Analytics		Big Data Analytics and Cloud Computing	3	0	0	3
6	MS: Infectious Diseases		Antimicrobial Resistance and Stewardship	3	0	0	3
6	MS: Maternal and Child Health		Adolescent Reproductive Health and Interventions	3	0	0	3
6	MS: Noncommunicable Diseases		Cancer Epidemiology	3	0	0	3
6	MS: Planetary Health and Sustainability		Climate Resilient Health Systems	3	0	0	3
6	MS: Public Health Nutrition		Public Health Nutrition Policies and Food Security	3	0	0	3
			TOTAL	**14**	**2**	**8**	**20**
			TOTAL CONTACT HOURS	**24**			

SEMESTER – VII							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MC		Global Health Governance and Diplomacy	3	1	0	4
2	AEC		Introduction to Entrepreneurship	2	2	0	4
3	MC		Health Economics and Financing	3	0	0	3
4	MC		Public Health Nutrition	3	0	0	3
5	VAC		Biomedical Waste Management and Safety	3	0	0	3
Electives (Choose Any One)							
6	MS: Health Data Science and Analytics		Spatial Epidemiology and GIS Mapping	2	1	0	3
6	MS: Infectious Diseases		Tropical Diseases, Vector Control, and Zoonoses	2	1	0	3
6	MS: Maternal and Child Health		Global Maternal Policy and Emergency Care	2	1	0	3
6	MS: Noncommunicable Diseases		Behavioural Health Epidemiology	2	1	0	3
6	MS: Planetary Health and Sustainability		Sustainable Cities and Urban Environmental Health	2	1	0	3
6	MS: Public Health Nutrition		Micronutrient Deficiencies and Malnutrition Programmes	2	1	0	3
			TOTAL	**16**	**4**	**0**	**20**
			TOTAL CONTACT HOURS	**20**			

SEMESTER – VIII							
S. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**C**
CORE							
1	MD		One Health and Sustainable Development Goals	2	0	0	2
2	VAC		Corporate Social Responsibility	2	0	0	2
3	MD		Interprofessional Practice in Public Health	1	1	0	2
4	MC		Monitoring and Evaluation in Health Systems	2	0	0	2
5	RP		Research Project / Dissertation	0	0	24	12
			TOTAL	**7**	**1**	**24**	**20**
			TOTAL CONTACT HOURS	**32**			

Detailed Syllabus

Semester - I

Introduction to Public Health

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Introduce the fundamental concepts, scope, historical evolution, and essential functions of public health.
- Analyze the biological, social, and environmental determinants of health, population health concepts, and health equity.
- Apply core public health strategies for disease prevention, health promotion, health protection, and community health improvement.
- Evaluate health systems, healthcare delivery models, and emerging innovations (such as AI, digital health, and One Health) to enhance population health services.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the concepts, scope, historical evolution, and essential functions of public health.
- **CO2:** Analyze the determinants of health, population health concepts, and factors influencing health equity and disparities.
- **CO3:** Apply public health strategies for disease prevention, health promotion, health protection, and community health improvement.
- **CO4:** Evaluate healthcare systems, healthcare delivery models, and emerging public health innovations to recommend improvements in health services and population health.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA5 (Effective Communication), GA8 (Social Responsibility, Sustainability & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Concept, Scope, and Evolution of Public Health

- Definition, philosophy, associated terms, and scope of public health
- Essential Public Health Functions (EPHFs) and global vs. local health concerns
- Historical evolution, major milestones, pioneers, and achievements in public health
- Multidisciplinary foundations and contributing disciplines to public health practice

Unit II: Determinants of Health and Population Health Strategies

- Biological, social, behavioural, and environmental determinants of health
- Population health concepts, health equity, and social health disparities
- Primary, secondary, and tertiary strategies for disease prevention and control
- Health promotion, health protection, and community health improvement frameworks

Unit III: Health Systems and Healthcare Delivery

- Overview of health systems and health system structures
- Healthcare delivery in India: public, private, and non-profit sectors
- Comparative global healthcare delivery models

- Strategies for health system strengthening, quality improvement, and service integration

Unit IV: Future of Public Health and Emerging Innovations
- Emerging global public health challenges and planetary health priorities
- Digital health technologies, mobile health (mHealth), and health informatics
- Artificial Intelligence (AI) applications in disease surveillance and public health
- One Health approach, climate change resilience, and Sustainable Development Goals (SDGs)

Suggested Readings
- Schneider, M.J. *Introduction to Public Health*. Jones & Bartlett Learning.
- Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot.
- Detels, R., Gulliford, M., Karim, Q.A., & Tan, C.C. *Oxford Textbook of Global Public Health*. Oxford University Press.
- Ministry of Health & Family Welfare. *National Health Policy 2017*. Government of India.

Human Anatomy

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3
Course Objectives
- Understand the structural organization of the human body, anatomical terminology, body planes, and fundamental musculoskeletal systems.
- Explain the gross anatomy and structural organization of major visceral organ systems.
- Identify key anatomical landmarks and organ orientations necessary to interpret normal anatomical alignments.
- Correlate human anatomical structures with common public health conditions, physical screening, and health promotion practices.

Course Outcomes: On completion, students will be able to:
- **CO1:** Describe the organization of the human body, including anatomical terminology, body planes, tissues, and fundamental musculoskeletal structures.
- **CO2:** Explain the general gross anatomy and basic structural organization of major visceral organ systems.
- **CO3:** Identify key anatomical landmarks and organ structures to interpret normal body orientation and basic physiological alignments.
- **CO4:** Analyze anatomical correlations with common public health conditions, physical examinations, and community health promotion practices.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Structural Organization & Musculoskeletal Anatomy
- Anatomical terminology, body planes, levels of organization, cell/tissue types, body cavities, and superficial anatomical orientation
- General classification of bones, axial and appendicular skeleton overview
- Joint types and movement mechanics

- Major muscle groups and surface musculoskeletal alignment

Unit II: Cardiovascular & Respiratory Anatomy
- Gross anatomical structure of the heart and major blood vessels
- Systemic and pulmonary circulation pathways
- Upper and lower respiratory system: nasal cavity, trachea, and bronchial tree
- Gross anatomy of lungs, pleura, thoracic cavity, and diaphragm

Unit III: Digestive, Renal, and Endocrine Systems
- Gross structure of the gastrointestinal tract (GI tract)
- Structure and orientation of accessory digestive organs: liver, gallbladder, and pancreas
- Anatomy of the urinary system: kidneys, ureters, and urinary bladder
- Anatomical locations and structural organization of major endocrine glands

Unit IV: Neuroanatomy, Special Senses, and Applied Public Health Anatomy
- General organization of the nervous system: brain, spinal cord, meninges, and peripheral/autonomic nerves
- Gross structure of special senses: eye, ear, nose, and tongue
- Male and female reproductive organs and pelvic cavity overview
- Anatomical basis of common public health disorders, injuries, screening practices, and physical examinations

Suggested Readings

- Chaurasia, B.D. *BD Chaurasia's Human Anatomy*. CBS Publishers & Distributors.
- Drake, R.L., Vogl, A.W., & Mitchell, A.W.M. *Gray's Anatomy for Students*. Elsevier.
- Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot.

Human Physiology

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3
Course Objectives
- Introduce the fundamental concepts of general physiology, cellular transport, and homeostatic control mechanisms.
- Explain the functional physiology of the cardiovascular, circulatory, respiratory, hemato-immune, and renal systems.
- Understand the mechanisms of body fluid regulation, gastrointestinal digestion, absorption, and metabolic temperature regulation.
- Describe neurophysiological control systems, sensory mechanisms, endocrine regulation, and human reproductive physiology.

Course Outcomes: On completion, students will be able to:
- **CO1:** Explain the concepts of homeostasis, cellular membrane transport mechanisms, and neuromuscular physiology.
- **CO2:** Describe the physiological mechanisms governing the cardiovascular, circulatory, respiratory, and immune systems.
- **CO3:** Analyze renal excretion mechanisms, fluid-electrolyte balance, gastrointestinal digestion, and metabolic regulation.
- **CO4:** Evaluate neurophysiological control networks, sensory integration, and endocrine-reproductive regulatory axes.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: General Physiology, Cell Membrane Transport, and Neuromuscular Physiology

- Functional organization of the human body, internal environment (*milieu intérieur*), and homeostatic control systems
- Cellular functional systems, membrane potentials, resting membrane potential, and action potentials
- Transport of substances through cell membranes: passive diffusion, facilitated transport, and active transport
- Physiology of skeletal and smooth muscle contraction, neuromuscular junction transmission, and excitation-contraction coupling

Unit II: Cardiovascular, Respiratory, and Hemato-Immune Systems

- Cardiac muscle physiology, cardiac cycle, heart valves, cardiac output, and basic principles of the electrocardiogram (ECG)
- Overview of circulation: vascular pressure, flow, resistance, microcirculation, capillary exchange, and arterial pressure regulation
- Mechanics of pulmonary ventilation, pulmonary volumes/capacities, gas exchange across the respiratory membrane, and regulation of respiration
- Blood composition, erythropoiesis, hemoglobin, blood types, hemostasis, blood coagulation, and innate/adaptive immune responses

Unit III: Renal, Body Fluid, Gastrointestinal, and Metabolic Physiology

- Body fluid compartments (intracellular and extracellular fluids), fluid exchange dynamics, and edema formation
- Renal functional anatomy, glomerular filtration rate (GFR), tubular reabsorption and secretion, and acid-base regulation
- Gastrointestinal motility, enteric nervous system, secretory functions, digestion, and nutrient absorption
- Energy metabolism, basal metabolic rate (BMR), dietary energetics, and body temperature regulation

Unit IV: Neurophysiology, Endocrine, and Reproductive Systems

- Central and peripheral nervous system organization, synaptic transmission, and neurotransmitters
- Somatic sensory receptors, pain mechanisms, and special senses overview (vision and hearing)
- Endocrine regulation: pituitary, thyroid, parathyroid, adrenal, and pancreatic hormone actions
- Male and female reproductive physiology, spermatogenesis, oogenesis, menstrual cycle, pregnancy, and lactation physiology

Suggested Readings

- Hall, J.E., & Hall, M.E. *Guyton and Hall Textbook of Medical Physiology*. 14th/15th ed., Elsevier.
- Barrett, K.E., Barman, S.M., Brooks, H.L., & Yuan, J.X.J. *Ganong's Review of Medical Physiology*. McGraw Hill.

- Sembulingam, K., & Sembulingam, P. *Essentials of Medical Physiology*. Jaypee Brothers Medical Publishers.

Biochemistry

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3
Course Objectives

- Introduce the fundamental chemical principles of life, cellular organization, bioenergetics, and enzyme kinetics.
- Explain the structure, digestion, absorption, metabolic pathways, and clinical disorders of carbohydrates and lipids.
- Describe the structure, functions, metabolic fates, and molecular biology of proteins and nucleic acids.
- Analyze the biochemical roles of vitamins and minerals, metabolic integration during fed and fasting states, and their applications in public health nutrition.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental principles of biochemistry, cellular organization, bioenergetics, and the chemical basis of life.
- **CO2:** Describe the structure, functions, digestion, absorption, metabolic pathways, and related disorders of carbohydrates, lipids, proteins, and nucleic acids.
- **CO3:** Explain the mechanisms of enzyme action, coenzymes, and the physiological roles of vitamins and minerals in regulating biochemical processes.
- **CO4:** Apply metabolic integration, nutritional bioenergetics, and biochemical principles to evaluate public health, physiological, and nutritional problems.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Research Aptitude & Evidence-Based Practice), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Fundamentals of Biochemistry, Bioenergetics, and Enzymology

- Definition, scope, importance, cell organization, and biochemical composition of the cell
- Water, pH, buffers, acid–base balance, bioenergetics, and high-energy compounds (ATP)
- Nomenclature, classification, and properties of enzymes
- Mechanism of enzyme action, coenzymes, cofactors, isoenzymes, enzyme kinetics/inhibition, and clinical importance

Unit II: Carbohydrate and Lipid Chemistry & Metabolism

- Classification, properties, biological functions, digestion, and absorption of carbohydrates
- Carbohydrate metabolic pathways: Glycolysis, Tricarboxylic Acid (TCA/Krebs) cycle, glycogenesis, glycogenolysis, gluconeogenesis, blood glucose regulation, and diabetes mellitus
- Classification, properties, fatty acids, triglycerides, phospholipids, glycolipids, cholesterol, and lipoproteins
- Lipid metabolism: Digestion, absorption, β-oxidation of fatty acids, fatty acid synthesis, cholesterol metabolism, ketone bodies, and lipid disorders

Unit III: Protein Chemistry, Protein Metabolism, and Molecular Biology

- Amino acids classification/properties, protein structures, plasma proteins, digestion, and absorption of proteins
- Protein metabolism: Transamination, deamination, formation/fate of ammonia, urea cycle, hemoglobin, myoglobin, and protein metabolic disorders
- Structure and functions of DNA, RNA, nucleotides, and nucleosides
- Basic concepts of DNA replication, transcription, translation, and biological significance of nucleic acids

Unit IV: Vitamins, Minerals, and Nutritional Biochemistry

- Fat-soluble and water-soluble vitamins: Sources, functions, and deficiency disorders
- Major and trace minerals: Sources, physiological functions, and deficiency states
- Integration of carbohydrate, lipid, and protein metabolism during fed and fasting states
- Hormonal regulation of metabolism (insulin, glucagon, adrenaline), balanced diet, Recommended Dietary Allowance (RDA), Basal Metabolic Rate (BMR), Specific Dynamic Action (SDA), protein-energy malnutrition, and nutritional biochemistry in public health

Suggested Readings

- Satyanarayana, U., & Chakrapani, U. *Biochemistry*. Elsevier.
- Ferrier, D.R. *Lippincott Illustrated Reviews: Biochemistry*. Wolters Kluwer.
- Rodwell, V.W., Bender, D.A., Botham, K.M., Kennelly, P.J., & Weil, P.A. *Harper's Illustrated Biochemistry*. McGraw-Hill Education.

Environmental and Occupational Health

Category: Major Core (MC) | **L-T-P:** 3-1-0 | **Credits:** 4

Course Objectives

- Explain the foundational concepts, principles, and determinants of environmental and occupational health.
- Analyze physical, chemical, biological, radiological, and workplace hazards, environmental pollution, and climate change impacts on human health.
- Apply environmental sanitation, waste management, vector control, and workplace safety practices for disease prevention.
- Evaluate occupational health surveillance systems, risk assessment methods, hazard control hierarchies, ergonomics, and workplace safety regulations.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the concepts, principles, determinants, and significance of environmental and occupational health, including their role in protecting public health.
- **CO2:** Analyze environmental hazards, pollution, climate change, and workplace hazards to assess their impact on human health.
- **CO3:** Apply environmental health protection measures, occupational safety practices, and disease prevention strategies to promote healthy living and safe workplaces.
- **CO4:** Evaluate occupational health management systems, workplace risk assessment, hazard control measures, ergonomics, and health promotion strategies to improve occupational health and safety.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA7 (Ethical Reasoning & Professional Integrity),

GA8 (Social Responsibility, Sustainability & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Environmental Health and Environmental Hazards

- Definition, concepts, scope, importance, environment–human health relationship, and determinants of environmental health
- Physical, chemical, biological, radiological, and psychosocial environmental hazards
- Environmental pollution sources, routes of exposure, and adverse health effects
- Radiation hazards, climate change dynamics, and environmental health risk assessment

Unit II: Environmental Health Protection and Sanitation Management

- Environmental sanitation principles, safe drinking water supply, and water quality standards
- Solid waste management, electronic waste (e-waste), and hazardous waste handling
- Biomedical waste management guidelines and municipal sewage disposal systems
- Vector control strategies, pest management, and environmental protection measures

Unit III: Foundations of Occupational Health, Diseases, and Workplace Safety

- Concepts, principles, and scope of occupational health across formal and informal work settings
- Workplace hazards and the impact of occupation on worker health
- Overview of occupational diseases, work-related illnesses, and occupational toxicities
- Work-related injury prevention, essential workplace safety practices, and accident control

Unit IV: Occupational Health Management, Ergonomics, and Risk Assessment

- Occupational health surveillance and workplace health risk assessment methodologies
- Hierarchy of hazard control measures (engineering, administrative, and personal controls)
- Ergonomics, workplace design, and Personal Protective Equipment (PPE) standards
- Workplace health promotion, occupational safety legislation, and health management systems

Suggested Readings

- Levy, B.S., Wegman, D.H., Baron, S.L., & Sokas, R.K. *Occupational and Environmental Health: Recognizing and Preventing Disease and Injury*. Oxford University Press.
- Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot.
- Friis, R.H. *Essentials of Environmental Health*. Jones & Bartlett Learning.

English and Communication Skills

Category: Ability Enhancement Course (AEC) | **L-T-P:** 2-0-0 | **Credits:** 2

Course Objectives

- Develop foundational proficiency in English grammar, vocabulary, scientific terminology, and language accuracy.
- Master academic, scientific, and professional written communication including paragraph organization, summaries, reports, and emails.
- Apply effective verbal, non-verbal, active listening, and interpersonal skills in healthcare, academic, and teamwork environments.

- Build professional public speaking, presentation design, group discussion, interviewing, and workplace networking skills.

Course Outcomes: On completion, students will be able to:

- **CO1:** Demonstrate proficiency in English grammar, vocabulary, and language conventions for effective communication in academic and professional settings.
- **CO2:** Produce clear, coherent, and well-organized academic, scientific, and professional written documents using appropriate writing conventions.
- **CO3:** Apply effective verbal, non-verbal, interpersonal, and teamwork skills in academic, healthcare, and public health settings.
- **CO4:** Demonstrate active listening, professional etiquette, conflict resolution, and constructive communication while working in teams.
- **CO5:** Design and deliver professional presentations and participate confidently in interviews, group discussions, and other professional interactions.

Graduate Attributes Addressed: GA5 (Effective Communication), GA6 (Interpersonal & Teamwork Skills), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of English Language and Grammar

- Grammar fundamentals: parts of speech, sentence structure, tenses, and subject–verb agreement
- Vocabulary development, scientific terminology, sentence construction, and common errors
- Functional English applications for academic and professional settings
- Language accuracy: punctuation, spelling standards, and proofreading techniques

Unit II: Academic, Scientific, and Professional Writing

- Principles of effective writing, paragraph structure, coherence, and logical flow
- Academic writing skills: summarising, paraphrasing, and note-making
- Introduction to scientific writing and technical documentation
- Professional writing: email etiquette, reports, and formal correspondence

Unit III: Communication and Interpersonal Skills

- Principles of verbal and non-verbal communication, body language, and tone
- Active listening skills and empathetic communication in healthcare contexts
- Professional communication etiquette, teamwork, collaboration, and leadership
- Conflict resolution, negotiation strategies, and constructive feedback mechanisms

Unit IV: Professional Speaking and Presentation Skills

- Elevator pitch, professional self-introduction, and public speaking confidence
- Presentation planning, visual slide design, and effective audience engagement
- Presentation delivery techniques and handling Q&A sessions effectively
- Group discussion strategies, job interview skills, and professional networking

Suggested Readings

- Seely, J. *Oxford Guide to Effective Writing and Speaking*. Oxford University Press.
- Hewitt, B. *Communication Skills for Health Professionals*. Wiley-Blackwell.
- Rizvi, M.A. *Effective Technical Communication*. McGraw-Hill Education.

AI in Healthcare: Foundation

Category: Foundation | **Mode:** Lecture and hands-on demos (12 h) plus activities and assessment (4 h) | **Credits:** 1

Course Objectives

- Introduce core AI concepts and explain how they are applied across the healthcare system.
- Identify major healthcare use cases of AI and critically evaluate AI tools using basic performance measures.
- Apply ethical, legal, and regulatory principles to AI use in healthcare.
- Facilitate the responsible use of no-code AI tools to propose realistic healthcare solutions.

Course Outcomes: On completion, students will be able to:

- CO1: Explain core AI concepts (machine learning, deep learning, NLP, generative AI) and how they are applied across the healthcare system, in plain language.
- CO2: Identify and describe major healthcare use cases of AI, such as diagnostics and imaging, clinical decision support, drug discovery, public health surveillance, and hospital operations.
- CO3: Critically evaluate an AI tool's claims by interpreting basic performance measures (accuracy, sensitivity, specificity, false positives/negatives) and recognising bias, data-quality problems and limitations.
- CO4: Apply ethical, legal and regulatory principles (privacy, consent, fairness, accountability, transparency) to AI use in healthcare.
- CO5: Use no-code AI tools responsibly and propose a realistic AI solution for a healthcare problem in their own discipline.

Graduate Attributes Addressed: Disciplinary and interdisciplinary knowledge, Critical thinking and problem solving, Digital and technological literacy, Ethics, professionalism and social responsibility, Communication and teamwork, Innovation and entrepreneurship, Lifelong learning

Unit I: Introduction to AI and Health Data

- What AI is and isn't; AI vs ML vs deep learning; how machines "learn" from data (no maths).
- Types of health data (EHR, imaging, genomics, wearables); data quality and "garbage in, garbage out".
- Activity: train a simple image classifier using Teachable Machine.

Unit II: AI Applications in Healthcare

- Medical imaging (radiology, pathology, ophthalmology); clinical decision support and risk prediction.
- NLP for clinical notes; generative AI and chatbots; drug discovery; public health and epidemic surveillance; hospital operations and telemedicine.
- Activity: case demos and group discussion.

Unit III: Evaluating AI: Does It Actually Work?

- Reading performance metrics in plain terms; sensitivity vs specificity with clinical examples; overfitting.

- Validation and clinical trials of AI; bias and generalisability across populations; explainability.
- Activity: critique a published AI tool's claim.

Unit IV: Ethics, Law and Governance

- Patient privacy and consent (HIPAA/GDPR/India's DPDP Act at awareness level).
- Algorithmic bias and health equity; accountability when AI errs; regulation of AI as a medical device; human-in-the-loop principles.
- Activity: ethical dilemma role-play.

Unit V: Using AI Responsibly and Capstone

- Prompting generative AI for clinical and academic work; hallucinations and verification; future trends.
- Final group presentation proposing an AI solution to a healthcare problem.

Prerequisites

- None. No coding or mathematics beyond basic statistics is needed.
- Hands-on work uses no-code tools (e.g., ChatGPT/Claude, Teachable Machine, Orange Data Mining, Google Colab notebooks run as pre-built demos, public AI-demo sites for imaging and symptom checkers).

Teaching Methods

- Interactive lectures, live demonstrations, case-based learning, group discussions, role-play and short guided no-code exercises.

Recommended Readings

Key Textbooks & Reference Books

1. **Topol, E.** (2019). *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*. Basic Books.
2. **Bohr, A., & Memarzadeh, K.** (Eds.). (2020). *Artificial Intelligence in Healthcare*. Academic Press.
3. **Agrawal, A., Gans, J., & Goldfarb, A.** (2018). *Prediction Machines: The Simple Economics of Artificial Intelligence*. Harvard Business Review Press.

Regulatory Reports & Ethical Guidelines

1. **World Health Organization.** (2021). *Ethics and governance of artificial intelligence for health: WHO guidance*. Geneva: World Health Organization.
2. **Ministry of Law and Justice, Government of India.** (2023). *The Digital Personal Data Protection Act, 2023 (DPDP Act)*. Gazette of India.
3. **U.S. Food and Drug Administration (FDA).** (2021). *Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device (SaMD) Action Plan*.

Online Interactive & No-Code Resources

1. **Google Teachable Machine:**
   `[https://teachablemachine.withgoogle.com/](https://teachablemachine.withgoogle.com/)`

2. **Orange Data Mining (Visual Programming & Interactive Workflows):** https://orangedatamining.com/
3. **WHO / ITU Focus Group on Artificial Intelligence for Health (FG-AI4H) Resources:** https://www.who.int/initiatives/cih

Human Anatomy (Practical)

Category: Major Core (MC) | **L-T-P:** 0-0-2 | **Credits:** 1

Course Objectives

- Provide hands-on training in identification of anatomical structures.
- Develop skill in using models, charts and specimens for anatomical study.

Course Outcomes: On completion, students will be able to:

CO1: Identify bones, joints and organs on models and charts.

CO2: Demonstrate surface anatomy landmarks on the human body.

CO3: Maintain a practical record of anatomical observations.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA10 (Lifelong Learning & Self-Directed Growth)

Practical/Field Contents

- Identification of bones of the axial and appendicular skeleton
- Surface marking of major organs and vessels
- Study of joints using models
- Histology slides: epithelial, connective, muscular, nervous tissue
- Identification of major muscles using charts
- Practical assessment and viva-voce

Suggested Readings

- Chaurasia, B.D. Human Anatomy. CBS Publishers.
- Cunningham's Manual of Practical Anatomy. Oxford University Press.

Semester II

Principles of Epidemiology

Category: Major Core (MC) | **L-T-P:** 2-0-0 | **Credits:** 2

Course Objectives

- Describe the history, evolution, fundamental concepts, and scope of epidemiology in public health practice.
- Explain the modes of disease transmission, the epidemiologic triad, natural history of disease, levels of prevention, and screening concepts.
- Differentiate between descriptive, analytical, and experimental epidemiological study designs and understand outbreak investigation protocols.
- Calculate and interpret basic measures of disease frequency, risk ratios, and participate in field-level surveillance activities.

Course Outcomes: On completion, students will be able to:

- **CO1:** Describe the historical development, fundamental principles, and basic scope of epidemiology in public health practice.
- **CO2:** Explain the modes of disease transmission, the natural history of disease, and levels of prevention in populations.
- **CO3:** Outline the primary steps in investigating disease outbreaks and observe field-level public health surveillance activities.
- **CO4:** Differentiate between basic descriptive, analytical, and experimental epidemiological study designs.
- **CO5:** Calculate and interpret basic measures of disease frequency, association, and simple epidemiological metrics.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Epidemiology, Disease Dynamics, and Prevention

- History, evolution, basic concepts, definitions, and scope of public health and epidemiology
- Modes and dynamics of infectious disease transmission and the Epidemiologic Triad
- Natural history of disease and its application across primary, secondary, and tertiary levels of prevention
- Basic strategies for disease prevention and introductory concepts of health screening

Unit II: Epidemiological Study Designs

- Introduction and classification of fundamental epidemiological study designs
- Descriptive study designs: Person, place, and time analysis (case reports, case series, and cross-sectional studies)
- Basic analytical study designs: Principles, design logic, and applications of Case-Control and Cohort studies
- Introduction to experimental study designs, community trials, and elementary clinical trials

Unit III: Epidemiological Metrics and Quantitative Data Analysis

- Calculation and interpretation of basic measures of disease frequency: incidence, prevalence, and person-time
- Calculation and interpretation of risk metrics, Risk Ratios, and measures of association
- Practical exercises in elementary data analysis and epidemiological calculations
- Learning-by-doing assignments corroborating quantitative classroom discussions

Unit IV: Outbreak Investigation, Surveillance, and Field Practice
- Fundamental steps in investigating a community disease outbreak
- Principles of public health surveillance and monitoring systems in communities
- Field exposure visit to local health centers and community surveillance units to observe real-world operations
- Experiential learning synthesis, field reporting, and practical epidemiologic case studies

Suggested Readings
- Celentano, D.D., Szklo, M., & Farag, Y. *Gordis Epidemiology*. 7th ed., Elsevier.
- Aschengrau, A., & Seage, G.R. *Essentials of Epidemiology in Public Health*. 4th ed., Jones & Bartlett Learning.
- Szklo, M., & Nieto, F.J. *Epidemiology Beyond the Basics*. 4th ed., Jones & Bartlett Learning.

Fundamentals of Biostatistics

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3
Course Objectives
- Introduce fundamental concepts of random variables, probability theory, probability laws, and standard theoretical distributions used in health data analysis.
- Develop practical competence in using R statistical software for computing descriptive metrics and generating graphical data visualizations.
- Understand sampling methodologies, sample size determination, statistical power calculation, and formal hypothesis testing principles.
- Execute inferential statistical procedures including one-sample and bivariate tests on real-world health datasets using R software.

Course Outcomes: On completion, students will be able to:
- **CO1:** Explain fundamental concepts of variables, probability theory, and standard theoretical probability distributions used in health data analysis.
- **CO2:** Utilize R statistical software to compute descriptive metrics and generate graphical representations of public health data.
- **CO3:** Apply sampling techniques, calculate appropriate sample sizes, and perform statistical power analysis for health research design.
- **CO4:** Formulate hypothesis testing frameworks and perform inferential statistical tests (one-sample and bivariate analysis) on health datasets.
- **CO5:** Evaluate real-world health datasets using R software to execute comprehensive biostatistical analysis and draw data-driven conclusions.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Research Aptitude & Evidence-Based Practice), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Introduction to Variables, R Software, and Descriptive Statistics

- Random variables (discrete and continuous), expected value, variance, and classification/types of variables
- Overview, syntax, and operational environment of R statistical software
- Descriptive statistics: measures of location/central tendency, variance, standard deviation, and standard error of the mean
- Graphical methods for descriptive data: scatterplots, box plots, bar graphs, histograms, line diagrams, and pie charts with R software lab practice

Unit II: Probability Theory and Theoretical Probability Distributions

- Concepts of probability, addition and multiplication laws, conditional probability, total probability rule, permutations, factorials, and combinations
- Discrete probability distributions: Binomial distribution, Poisson distribution, and Poisson approximation to the binomial distribution
- Continuous probability distributions: Normal distribution, standard normal distribution, and key properties
- Normal approximation to binomial and Poisson distributions, and the Central Limit Theorem

Unit III: Hypothesis Testing, Sampling, and Power Analysis

- Foundations of hypothesis testing, Type-I error (α), Type-II error (β), p-values, 95% confidence intervals, and one-tailed vs. two-tailed tests
- Sampling methods, sample size estimation, and statistical power calculation
- Applied lab sessions with statistical software for sampling and power analysis

Unit IV: Inferential Statistics, Bivariate Analysis, and Applied Dataset Review

- One-sample inferential statistical tests and bivariate analytical procedures
- Practical lab sessions executing one-sample and bivariate analysis using statistical software
- Comprehensive review lab session: conducting end-to-end biostatistical analysis on real-world health datasets using R
- Interpreting output metrics and deriving evidence-based public health conclusions

Suggested Readings

- Rosner, B. *Fundamentals of Biostatistics*. 9th ed., Cengage Learning.
- Zuur, A.F., Ieno, E.N., & Meesters, E.H.W.G. *A Beginner's Guide to R*. Springer.
- Singhal, Y.K. *Methods in Biostatistics*. 11th ed., Jaypee Brothers Medical Publishers.
- Petrie, A., & Sabin, C. *Medical Statistics at a Glance*. 4th ed., Wiley-Blackwell.
- Indrayan, A., & Malhotra, R.K. *Medical Biostatistics*. 4th ed., CRC Press/Chapman & Hall.
- Swinscow, T.D.V. *Statistics at Square One*. 11th ed., BMJ Books.
- Armitage, P., & Colton, T. *Encyclopedia of Biostatistics*. John Wiley & Sons.

Pharmacology

Category: Major Core (MC) | **L-T-P:** 2-0-0 | **Credits:** 2
Course Objectives

- Understand basic pharmacokinetic and pharmacodynamic principles, routes of drug administration, and drug safety profiles.
- Apply concepts of Essential Medicines Lists (EML), rational prescribing, and antimicrobial stewardship in public health practice.
- Utilize Standard Treatment Guidelines (STGs), vaccine cold chain management, and Mass Drug Administration (MDA) strategies for public health programs.
- Analyze pharmacovigilance systems, drug regulations, pricing policies, and strategies for equitable access to essential medicines.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain basic pharmacokinetic and pharmacodynamic principles, routes of administration, and drug safety concepts.
- **CO2:** Apply principles of essential medicines, rational drug use, and antimicrobial stewardship in public health scenarios.
- **CO3:** Utilize standard treatment guidelines and vaccine cold chain protocols for priority public health disease management.
- **CO4:** Analyze pharmacovigilance mechanisms, drug regulations, and policies governing equitable access to essential medicines.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Basic Principles of Pharmacology

- Basic principles of pharmacokinetics: absorption, distribution, metabolism, and excretion (ADME)
- Basic principles of pharmacodynamics, mechanisms of drug action, and receptor interaction concepts
- Routes of drug administration, dosage forms, and therapeutic windows
- Drug safety profiles, adverse reaction concepts, and toxicity evaluation

Unit II: Essential Medicines, Rational Drug Use, and Antimicrobial Stewardship

- Concepts, criteria, and development of Essential Medicines Lists (EML)
- Rational drug prescribing practices and prevention of irrational medication usage
- Antimicrobial Resistance (AMR) dynamics, global implications, and antimicrobial stewardship programs
- Over-the-counter (OTC) medication, self-medication practices, and community drug safety

Unit III: Pharmacotherapy in Public Health Programs and Vaccine Logistics

- Standard Treatment Guidelines (STGs) for priority infectious and non-communicable diseases
- Vaccine cold chain logistics, temperature monitoring, storage protocols, and maintenance
- Mass Drug Administration (MDA) protocols and campaigns in national public health strategies.
- Implementation of pharmaceutical strategies within national health programs

Unit IV: Pharmacovigilance, Policy, Regulation, and Equitable Access

- Pharmacovigilance frameworks, adverse drug reaction (ADR) reporting, and post-marketing surveillance
- Drug regulatory authorities, legal frameworks, and quality assurance standards
- Drug pricing policies, intellectual property regulations, and pharmaceutical economics
- Strategies for equitable drug access, supply chain management, and public health policy interventions

Suggested Readings

- Tripathi, K.D. *Essentials of Medical Pharmacology*. Jaypee Brothers Medical Publishers.
- Katzung, B.G., & Vanderah, T.W. *Basic & Clinical Pharmacology*. McGraw-Hill Education.
- World Health Organization. *The Selection and Use of Essential Medicines*. WHO Technical Report Series.

Microbiology

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Understand the fundamental principles of microbiology, microbial classification, host-pathogen interactions, and normal human microbiota.
- Explain the morphology, pathogenesis, laboratory diagnosis, prevention, and control of medically important bacteria, viruses, fungi, and parasites.
- Apply practical concepts of diagnostic microbiology, clinical specimen handling, staining techniques, sterilization, and biosafety protocols.
- Evaluate immunology, vaccination strategies, infection control measures, antimicrobial resistance (AMR), and One Health surveillance in public health.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the principles of microbiology, classification of microorganisms, and host–microbe interactions.
- **CO2:** Describe the morphology, transmission, pathogenesis, laboratory diagnosis, prevention, and control of microorganisms of public health importance.
- **CO3:** Explain bacterial, viral, fungal, and parasitic diseases of public health significance.
- **CO4:** Apply principles of infection prevention and control, sterilization, immunization, and laboratory safety in healthcare and community settings.
- **CO5:** Discuss antimicrobial resistance, emerging infectious diseases, disease surveillance, and the role of microbiology in public health.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Introduction to Microbiology & Host–Microbe Interaction

- Definition, scope, branches, history, milestones, classification of microorganisms, and role in public health
- Morphology and general characteristics of bacteria, viruses, fungi, and parasites

- Structural organization of bacterial cells vs. eukaryotic cells, microbial growth phases, and reproduction
- Normal human microbiota, opportunistic pathogens, chain of infection, reservoirs, portals of entry/exit, and modes of transmission
- Host-pathogen interactions and biological factors influencing infectious disease occurrence

Unit II: Systematic Bacteriology and Virology of Public Health Importance

- Classification, morphology, laboratory diagnosis, prevention, and control of medically important bacteria
- Gram-positive bacteria (*Staphylococcus*, *Streptococcus*, *Clostridium*, *Corynebacterium diphtheriae*) and Gram-negative bacteria (*E. coli*, *Salmonella*, *Shigella*, *Vibrio cholerae*, *Klebsiella*, *Pseudomonas*)
- Acid-fast bacteria (*Mycobacterium tuberculosis*, *Mycobacterium leprae*) and Spirochetes (*Treponema pallidum*, *Leptospira*)
- General properties, morphology, and classification of viruses
- DNA viruses (*Herpes simplex virus*, *Hepatitis B virus*) and RNA viruses (*Poliovirus*, *Rabies virus*, *Influenza virus*, *HIV*, *Dengue virus*, *Chikungunya virus*)

Unit III: Mycology, Parasitology, and Diagnostic Microbiology

- General characteristics, classification, diagnosis, and control of fungi (*Dermatophytes*, *Candida*, *Aspergillus*
- Protozoan parasites (*Entamoeba histolytica*, *Giardia lamblia*, *Plasmodium* spp.) and Helminths (*Ascaris lumbricoides*, Hookworm, *Enterobius vermicularis*, *Taenia* spp.
- Collection, transport, and preservation of clinical specimens
- Microscopy and staining techniques (Simple stain, Gram stain, and Ziehl–Neelsen stain), culture media, and bacterial culture methods
- Overview of serological/molecular diagnostic tools (ELISA, PCR), principles of antimicrobial susceptibility testing (AST), and biosafety practices

Unit IV: Infection Prevention, Immunology, AMR, and One Health

- Sterilization (physical/chemical methods), disinfection, antisepsis, standard precautions, hand hygiene, healthcare-associated infections (HAIs), and biomedical waste management
- Innate and adaptive immunity, antigens, antibodies, antigen–antibody reactions, active/passive immunization, and vaccine types/routes
- Antimicrobial agents and mechanisms of antimicrobial resistance (AMR)
- Major multidrug-resistant pathogens (MRSA, ESBL-producing organisms, MDR/XDR-TB), antimicrobial stewardship, and the One Health approach
- Emerging and re-emerging infectious diseases and public health disease surveillance

Suggested Readings

- Ananthanarayan, R., & Paniker, C.K.J. *Ananthanarayan and Paniker's Textbook of Microbiology*. Universities Press.
- Willey, J.M., Sherwood, L.M., & Woolverton, C.J. *Prescott's Microbiology*. McGraw-Hill.
- Carroll, K.C., Butel, J.S., & Morse, S.A. *Jawetz, Melnick & Adelberg's Medical Microbiology*. McGraw-Hill.

General Pathology

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Introduce the basic concepts of disease, including cellular adaptation, cell injury, cell death, acute/chronic inflammation, tissue repair, wound healing, and immunity.
- Explain hemodynamic disorders, circulatory disturbances, basic principles of neoplasia, and carcinogenesis.
- Describe common nutritional, metabolic, genetic, congenital, and gastrointestinal disorders and their health impacts.
- Correlate pathological processes of major organ systems (cardiovascular, respiratory, musculoskeletal, and nervous) with disease causes, clinical features, and public health prevention strategies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental concepts of pathology, including cell injury, inflammation, tissue repair, wound healing, immunity, and the basic mechanisms of disease.
- **CO2:** Describe the pathological changes associated with hemodynamic disorders, neoplasia, nutritional and metabolic disorders, and common diseases affecting the cardiovascular, respiratory, musculoskeletal, and nervous systems.
- **CO3:** Apply the principles of pathology to interpret the causes, progression, and prevention of common diseases and relate them to public health practice.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: General Mechanisms of Disease, Cell Injury, and Inflammation

- Basic concepts of disease etiology, pathogenesis, cellular adaptation (hypertrophy, hyperplasia, atrophy, metaplasia)
- Mechanisms of cell injury, reversible and irreversible cell damage, and cell death (necrosis and apoptosis)
- Vascular and cellular events of acute inflammation, chronic inflammation, chemical mediators, tissue repair, and wound healing
- Basics of immunology, hypersensitivity reactions, autoimmune diseases, and immunodeficiency states

Unit II: Disorders of Circulation and Neoplasia

- Circulatory disturbances: Edema, hyperemia, congestion, hemorrhage, thrombosis, and embolism
- Pathophysiology of infarction, ischemia, and shock mechanisms
- Neoplasia overview: Definitions, classification, nomenclature, and differences between benign and malignant tumors
- Carcinogenesis, etiology of cancer, metastasis routes, tumor markers, and principles of cancer screening/prevention

Unit III: Nutritional, Metabolic, Genetic, and Gastrointestinal Disorders

- Nutritional pathology: Protein-energy malnutrition (Kwashiorkor, Marasmus), vitamin deficiency states, and obesity

- Metabolic and systemic disorders: Diabetes mellitus, gout, lipid storage disorders, and amyloidosis
- Genetic, chromosomal, and congenital disorders and their population health effects
- Pathological features of common gastrointestinal disorders: Peptic ulcer disease, inflammatory bowel disease, cirrhosis of the liver, and hepatitis

Unit IV: Common Systemic Disorders and Applied Public Health Pathology

- Cardiovascular system disorders: Atherosclerosis, hypertension, ischemic heart disease, and rheumatic heart disease
- Respiratory system disorders: Chronic obstructive pulmonary disease (COPD), asthma, pneumonia, tuberculosis, and occupational lung disease
- Musculoskeletal and nervous system disorders: Arthritis, osteoporosis, stroke (cerebrovascular accidents), and neurodegenerative diseases
- Application of pathology principles to disease surveillance, primary prevention, early clinical detection, and public health interventions

Suggested Readings

- Mohan, H. *Textbook of Pathology*. Jaypee Brothers Medical Publishers.
- Kumar, V., Abbas, A.K., & Aster, J.C. *Robbins and Cotran Pathologic Basis of Disease*. Elsevier.

Microbiology (Practical)

Category: SEC | **L-T-P:** 0-0-2 | **Credits:** 1

Course Objectives

- Provide hands-on laboratory training in basic microbiological techniques.

Course Outcomes: On completion, students will be able to:

CO1: Demonstrate aseptic technique, staining and culture methods.
CO2: Identify common bacteria using microscopy and biochemical tests.
CO3: Maintain a laboratory record of microbiological experiments.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA10 (Lifelong Learning & Self-Directed Growth)

Practical/Field Contents

- Sterilisation techniques and aseptic practice
- Gram staining and microscopy
- Culture media preparation and streaking techniques
- Identification of common bacterial pathogens
- Antibiotic sensitivity testing (disc diffusion)
- Practical assessment and viva-voce

Suggested Readings

- Ananthanarayan, R., Paniker, J. Textbook of Microbiology. Universities Press.
- Practical Microbiology Manual, ICMR guidelines.

General Pathology (Practical)

Category: SEC | **L-T-P:** 0-0-2 | **Credits:** 1

Course Objectives

- Provide hands-on laboratory training in basic pathology techniques.

Course Outcomes: On completion, students will be able to:
CO1: Perform and interpret common haematological and clinical pathology tests.
CO2: Examine histopathology slides of common pathological lesions.
CO3: Maintain a laboratory record of pathology experiments.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA10 (Lifelong Learning & Self-Directed Growth)

Practical/Field Contents

- Complete blood count and peripheral smear examination
- Urinalysis: physical, chemical and microscopic examination
- Examination of histopathology slides: inflammation, neoplasia
- Basic haemostasis tests
- Practical assessment and viva-voce

Suggested Readings

- Harsh Mohan. Practical Pathology Manual. Jaypee Brothers.

Life and Professional Skills

Category: Value Added Course (VAC) | **L-T-P:** 0-0-2 | **Credits:** 1
*(Note: Students can choose either **Track A: Classical Dance (Bharatanatyam)** or **Track B: Media and Design** for Units II–IV after completing the common foundational module in Unit I.)*

Course Objectives

- Develop foundational life skills, emotional intelligence, personal discipline, and professional etiquette.
- Cultivate body awareness, posture, rhythm, and artistic expression (Track A) OR master visual literacy, graphic design principles, and media tools (Track B).
- Apply non-verbal communication and expressive storytelling techniques (Track A) OR construct impactful digital visual content for health communication (Track B).
- Build self-confidence, teamwork, and aesthetic appreciation through practical performance or digital portfolio presentation.

Course Outcomes: On completion, students will be able to:

- **CO1:** Demonstrate self-management, emotional intelligence, professional etiquette, and workplace ethics.
- **CO2:** Perform fundamental Bharatanatyam movements (*Adavus*), hand gestures (*Hastas*), and rhythmic cycles (Track A) OR apply core principles of design, color theory, typography, and visual hierarchy (Track B).
- **CO3:** Express emotional nuances and storytelling using *Abhinaya* and *Rasas* (Track A) OR design digital posters, infographics, and visual campaign assets using graphic software (Track B).
- **CO4:** Present a collaborative classical dance performance (Track A) OR construct a professional digital media portfolio showcasing creative communication skills (Track B).

Graduate Attributes Addressed: GA5 (Effective Communication), GA6 (Interpersonal & Teamwork Skills), GA7 (Ethical Reasoning & Professional Integrity), GA9 (Creative & Innovative Thinking), GA10 (Lifelong Learning & Self-Directed Growth)

Unit Syllabus

Unit I: Core Life Skills and Professional Etiquette (Common to All Students)

- Self-awareness, emotional intelligence, stress management, and personal resilience
- Goal setting, time management, personal discipline, and self-directed growth
- Professional workplace etiquette, active listening, body language, and grooming
- Principles of creative expression, aesthetic appreciation, and holistic well-being

Unit II: Foundational Track Skills (Elective Track Choice)

- **Track A (Bharatanatyam):** Origins and philosophy of Bharatanatyam, basic standing posture (*Araimandi*), fundamental feet and hand movements (*Adavus*), single and combined hand gestures (*Asamyutta & Samyutta Hastas*), and basic rhythmic cycles (*Tala*).
- **Track B (Media & Design):** Introduction to visual literacy, core design elements (line, shape, color, texture, space), color theory, typography fundamentals, layout balance, and principles of visual hierarchy.

Unit III: Expressive Practice and Communication (Elective Track Choice)

- **Track A (Bharatanatyam):** Facial expressions (*Mukhabhinaya*), exploration of the nine classical emotions (*Navarasas*), expressive storytelling (*Abhinaya*), rhythmic coordination, and developing stage presence.
- **Track B (Media & Design):** Digital design software (Canva / Adobe Express / Illustrator basics), visual storytelling, designing public health awareness posters, creating infographics, and digital layout optimization.

Unit IV: Performance, Portfolio, and Synthesis (Elective Track Choice)

- **Track A (Bharatanatyam):** Group choreography, synchronisation, stage entry/exit etiquette, public performance, peer review, and reflection on dance as a stress-relief practice.
- **Track B (Media & Design):** Principles of visual brand identity, executing a health awareness media campaign, portfolio assembly, digital presentation skills, and peer design critique.

Suggested Readings

- **Common Life Skills:**
  - Cottrell, S. *Skills for Success: Personal Development and Employability*. Palgrave Macmillan.
- **Track A (Bharatanatyam):**
  - Vatsyayan, K. *Classical Indian Dance in Literature and the Arts*. Sangeet Natak Akademi.
  - Kothari, S. *Bharata Natyam*. Marg Publications.
- **Track B (Media & Design):**
  - Lupton, E. *Thinking with Type: A Critical Guide for Designers, Writers, Editors, & Students*. Princeton Architectural Press.

- Lidwell, W., Holden, K., & Butler, J. *Universal Principles of Design*. Rockport Publishers.

Summer Internship: Hospital and Healthcare Systems

Category: Internship / Experiential Learning | **L-T-P:** 0-0-8 | **Credits:** 4

Course Objectives

- Gain practical, hands-on exposure to the operational, administrative, and clinical support workflows of hospitals and healthcare organizations.
- Analyze hospital management systems, patient care pathways, quality control measures, and infection control protocols in real-world settings.
- Understand health information systems (HIS), medical records management, supply chain dynamics, and regulatory compliance in healthcare facilities.
- Develop professional conduct, interprofessional teamwork skills, problem-solving abilities, and field reporting skills in healthcare settings.

Course Outcomes: On completion, students will be able to:

- **CO1:** Map and explain the administrative, operational, and clinical workflow structures of modern healthcare organizations and hospital departments.
- **CO2:** Evaluate hospital infection control practices, patient safety protocols, bio-medical waste management, and quality assurance standards (e.g., NABH/JCI guidelines).
- **CO3:** Analyze health data systems, billing processes, supply chain/pharmacy operations, and public health integration within hospital networks.
- **CO4:** Synthesize field experiences into a professional internship report and present evidence-based observations and operational recommendations to a review panel.

Graduate Attributes Addressed: GA4 (Practical & Health Assessment Skills / Field Competency), GA5 (Effective Communication), GA6 (Interpersonal & Teamwork Skills), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Internship Structure & Field Syllabus

Module I: Healthcare Facility Orientation and Governance (Weeks 1–2)

- Overview of hospital organization structure, governance models, and leadership workflows
- Orientation to front-office operations: patient registration, admission, discharge, and transfer (ADT) processes
- Understanding emergency care units, outpatient departments (OPD), and inpatient departments (IPD) management
- Orientation to institutional safety, emergency response codes, and patient rights and responsibilities

Module II: Clinical Support Services, Infection Control, and Quality (Weeks 3–4)

- Practical exposure to central diagnostic labs, radiology, CSSD (Central Sterile Supply Department), and pharmacy workflows
- Observation of Hospital Infection Control Committee (HICC) protocols, hand hygiene compliance, and biosafety practices
- Biomedical Waste (BMW) segregation, handling, storage, and disposal monitoring

- Introduction to accreditation standards (NABH/NABL), quality indicators, patient safety goals, and incident reporting

Module III: Health Information Systems, Operations, and Material Management (Weeks 5–6)

- Hands-on exposure to Hospital Information Systems (HIS), Electronic Health Records (EHR), and ICD coding basics
- Material management, inventory control, drug procurement, cold chain storage, and medical equipment maintenance routines
- Hospital billing systems, health insurance processing, TPA (Third Party Administrator) desk operations, and revenue cycle management
- Integration of public health programs (e.g., national disease control programs, compulsory disease notifications) within hospital operations

Module IV: Departmental Attachment, Project Execution, and Reporting (Weeks 7–8)

- Dedicated attachment to a specific operational department (e.g., Quality, Operations, Public Health Outpatient Cell, or Medical Records)
- Identification of an operational/quality improvement challenge and data collection under facility mentorship
- Compilation of daily activity logs, weekly learning reflections, and formal field internship documentation
- Preparation and submission of the final Summer Internship Report and viva-voce presentation

Evaluation Criteria

- **Internal Assessment / Field Supervisor Evaluation (40%):** Attendance, discipline, daily logbook maintenance, field performance, and workplace ethics evaluation by the facility mentor.
- **Institutional Internship Report (30%):** Comprehensive written report detailing departmental rotations, operational workflows, case studies, and observational analysis.
- **Final Presentation & Viva-Voce (30%):** Defense of internship report, key learnings, and operational recommendations before an academic and industry expert panel.

Suggested Readings & Reference Materials

- Sakharkar, B. M. *Principles of Hospital Administration and Planning*. Jaypee Brothers Medical Publishers.
- Goel, S. L., & Kumar, R. *Hospital Administration and Management: Theory and Practice*. Deep & Deep Publications.
- National Accreditation Board for Hospitals & Healthcare Providers (NABH). *Standards for Hospitals*. Quality Council of India.
- World Health Organization. *Hospital Care Documentation & Patient Safety Guidelines*. WHO Guidelines Approved by the Guidelines Review Committee.

Semester III

Epidemiological Methods and Study Designs

Category: Major Core (MC) | **L-T-P:** 3-1-0 | **Credits:** 4

Course Objectives

- Develop advanced competencies in evaluating and selecting appropriate epidemiological study designs for complex public health research.
- Analyze measures of disease occurrence and association while differentiating between statistical association and causal inference.
- Evaluate threats to study validity—including selection/information bias, confounding, and effect measure modification—and apply techniques for mitigation.
- Apply survival analysis, multivariate adjustment methods, and epidemiological perspectives to communicable and non-communicable disease prevention through field exposure.

Course Outcomes: On completion, students will be able to:

- **CO1:** Evaluate the strengths and limitations of various epidemiological study designs and select the most appropriate design for a research project.
- **CO2:** Evaluate and interpret measures of disease occurrence and association, and differentiate between association and causation.
- **CO3:** Identify and evaluate threats to validity of a research study (bias, confounding, and interaction/effect measure modification) and apply strategies to avoid, analyze, and report them.
- **CO4:** Apply epidemiological perspectives to communicable and noncommunicable diseases and synthesize field-level public health surveillance data.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Advanced Study Designs, Association, and Causal Inference

- Systematic review of observational and experimental epidemiological study designs and decision frameworks for design selection
- Evaluation, calculation, and interpretation of advanced measures of disease occurrence, risk, and rate ratio metrics
- Concepts of association vs. causation, causal models, and Hill's criteria for causal inference
- Study design protocols, sampling strategies, and data collection frameworks in population-based research

Unit II: Threats to Study Validity — Bias, Confounding, and Interaction

- Threats to Validity I: Selection bias, information bias, recall bias, misclassification, and methods to minimize observational errors
- Threats to Validity II: Identification, mechanisms, and control of confounding at the design and analysis stages
- Threats to Validity III: Interaction, effect measure modification, additive vs. multiplicative interaction models

- Reporting standards (STROBE/CONSORT guidelines) for presenting validity threats and analytical adjustments

Unit III: Analytical Methods, Stratification, and Survival Analysis

- Stratification, direct/indirect standardization, and adjustment techniques
- Introduction to multivariate analysis, logistic regression, and linear regression principles in epidemiology
- Fundamentals of survival analysis: time-to-event data, life tables, Kaplan-Meier curves, and introduction to Cox proportional hazards models
- Practical computer lab exercises in secondary data analysis and epidemiologic problem-solving

Unit IV: Applied Epidemiology of Disease and Field Practice

- Epidemiological perspectives, transmission dynamics, outbreak control, and surveillance of communicable diseases
- Epidemiological transition, risk factor profiling, and prevention strategies for non-communicable diseases (NCDs)
- Experiential field visit to local health centers, disease surveillance units, or community field research sites
- Field observations, primary data gathering, experiential learning synthesis, and field study reporting

Suggested Readings

- Szklo, M., & Nieto, F.J. *Epidemiology Beyond the Basics*. 4th ed., Jones & Bartlett Learning.
- Celentano, D.D., Szklo, M., & Farag, Y. *Gordis Epidemiology*. 7th ed., Elsevier.
- Lash, T.L., VanderWeele, T.J., Haneuse, S., & Rothman, K.J. *Modern Epidemiology*. 4th ed., Wolters Kluwer.

Intermediate Biostatistics

Category: Major Core (MC) | **L-T-P:** 2-2-0 | **Credits:** 4

Course Objectives

- Master computer lab procedures for data entry, cleaning, transformation, and management using statistical software.
- Evaluate diagnostic test metrics including sensitivity, specificity, predictive values, and Receiver Operating Characteristic (ROC) curves.
- Apply parametric, non-parametric, and categorical hypothesis testing procedures to continuous and discrete health data.
- Perform bivariate/multivariable regression analyses and epidemiologic risk estimations on public health survey datasets.

Course Outcomes: On completion, students will be able to:

- **CO1:** Execute basic data entry, transformation, and summary procedures using statistical software.
- **CO2:** Calculate and interpret primary diagnostic metrics including sensitivity, specificity, and ROC curves.
- **CO3:** Perform parametric and non-parametric hypothesis tests for continuous and categorical health data using software.

- **CO4:** Estimate measures of epidemiologic association (Risk Ratios, Odds Ratios) and simple regression parameters.
- **CO5:** Conduct guided statistical analyses on public health datasets to interpret research findings.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Data Management and Diagnostic Test Evaluation

- Review of introductory biostatistics principles and computer-based data management workflows
- Practical/Tutorial Session: Software operations for data entry, missing value handling, data cleaning, and variable transformation
- Evaluation of diagnostic tests: Sensitivity, specificity, positive/negative predictive values (PPV/NPV)
- Practical/Tutorial Session: Construction, interpretation, and area under the curve (AUC) analysis for Receiver Operating Characteristic (ROC) curves

Unit II: Parametric, Non-Parametric, and Categorical Hypothesis Testing

- Parametric hypothesis testing for two groups: Independent two-sample t-test, paired t-test, and F-test for equality of variances
- Practical/Tutorial Session: Running and interpreting two-sample parametric tests using statistical software
- Non-parametric tests for continuous data: Wilcoxon Signed-Rank test and Mann-Whitney U test
- Categorical data analysis: Pearson’s Chi-square test of independence, Fisher's exact test, and McNemar's test for paired categorical data
- Practical/Tutorial Session: Cross-tabulation generation, expected frequency verification, and non-parametric hypothesis test execution

Unit III: Epidemiologic Association, Correlation, and Multivariable Regression

- Epidemiologic measures of association: Calculation and interpretation of Risk Ratios (RR), Odds Ratios (OR), and 95% Confidence Intervals
- Practical/Tutorial Session: Computing 2x2 contingency table metrics and risk estimates
- Bivariate correlation (Pearson and Spearman) and Simple Linear Regression model specification
- Practical/Tutorial Session: Scatter plot visualization, regression parameter estimation, fit diagnostics, and software output interpretation
- Overview of multivariable statistical modeling: Principles, assumptions, and basic model execution for Multiple Linear Regression and Simple Logistic Regression

Unit IV: Analysis of Variance (ANOVA) and Applied Public Health Data Analysis

- Comparing multiple group means: One-Way Analysis of Variance (ANOVA) assumptions, F-statistic, and non-parametric Kruskal-Wallis test
- Practical/Tutorial Session: Executing ANOVA models, post-hoc pairwise comparisons, and interpreting software outputs
- Applied Biostatistics Tutorial/Lab: Guided practice analyzing real-world public health survey datasets

- Practical/Tutorial Session: End-to-end data analysis workflow, including hypothesis formulation, statistical test selection, software execution, and evidence-based interpretation of findings

Suggested Readings

- Rosner, B. *Fundamentals of Biostatistics*. 9th ed., Cengage Learning.
- Zuur, A.F., Ieno, E.N., & Meesters, E.H.W.G. *A Beginner's Guide to R*. Springer.
- Singhal, Y.K. *Methods in Biostatistics*. 11th ed., Jaypee Brothers Medical Publishers.
- Petrie, A., & Sabin, C. *Medical Statistics at a Glance*. 4th ed., Wiley-Blackwell.
- Indrayan, A., & Malhotra, R.K. *Medical Biostatistics*. 4th ed., CRC Press/Chapman & Hall.
- Swinscow, T.D.V. *Statistics at Square One*. 11th ed., BMJ Books.
- Armitage, P., & Colton, T. *Encyclopedia of Biostatistics*. John Wiley & Sons.

Sociology and Anthropology

Category: Multi-Disciplinary (MD) / Minor Core | **L-T-P:** 4-0-0 | **Credits:** 4

Course Objectives

- Explain fundamental sociological concepts, social structures, institutions, and their direct relevance to health dynamics and public health practice.
- Analyze social organization, stratification, social determinants of health, health inequities, and health-seeking behaviors across diverse population groups.
- Examine anthropological perspectives, human diversity, traditional health practices, and indigenous healthcare knowledge systems.
- Evaluate ethnomedicine, medical pluralism, and qualitative anthropological research methods to address contemporary public health challenges.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental concepts, theories, and principles of sociology, including social organization, culture, institutions, and their relevance to public health.
- **CO2:** Analyze the influence of social determinants, health inequalities, social issues, and community participation on health and development.
- **CO3:** Apply anthropological concepts to understand indigenous communities, traditional health practices, and the role of culture in health and healthcare.
- **CO4:** Evaluate anthropological approaches, ethnomedicine, medical pluralism, and qualitative research methods in addressing contemporary public health challenges.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility, Sustainability & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Sociology, Social Organization, and Social Change

- Definitions, nature, scope, and foundational concepts of sociology: society, culture, socialization, and social institutions
- Relevance of sociology in understanding health, illness, and public health systems
- Social organization, primary and secondary social groups, formal organizations, and mechanisms of social control
- Social stratification (caste, class, gender, ethnicity), social mobility, and dynamics of social change

Unit II: Society, Health, Development, and Social Issues

- Interrelationship between society and health; social determinants of health (SDOH) frameworks
- Health equity, social gradient in health, health-seeking behaviors, and illness perceptions
- Community participation, social empowerment, and social mobilization in public health and development programs
- Overview of major social issues (poverty, gender discrimination, marginalization, urban-rural divides) and their impact on individual and community well-being

Unit III: Foundations of Anthropology and Indigenous Health Systems

- Concepts, scope, major branches, and core theoretical perspectives of anthropology
- Relevance of anthropology to public health and understanding global human biological and cultural diversity
- Anthropological perspectives on tribal and indigenous communities, socio-cultural structures, and livelihoods
- Traditional health practices, role of traditional healers, ethno-botanical knowledge, and preservation of indigenous healthcare heritage

Unit IV: Anthropological Approaches, Ethnomedicine, and Qualitative Methods

- Ethnomedicine, cross-cultural concepts of disease and healing, and medical pluralism in plural societies
- Qualitative research methods in public health: ethnography, participant observation, key informant interviews, and focus group discussions (FGDs)
- Applied medical anthropology in designing culturally appropriate health interventions and health communication
- Evaluating anthropological approaches to address contemporary global and local public health challenges

Suggested Readings

- Haralambos, M., & Holborn, M. *Sociology: Themes and Perspectives*. Collins.
- Ember, C.R., Ember, M., & Peregrine, P.N. *Anthropology*. Pearson.

Communicable and Noncommunicable Diseases

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the epidemiological transition, double burden of disease, disease transmission dynamics, and basic communicable disease concepts.
- Describe the epidemiology, surveillance, prevention, and control strategies for major communicable, vaccine-preventable, and zoonotic diseases.
- Analyze the risk factors, screening protocols, and public health management of major non-communicable diseases and mental health conditions.
- Evaluate national and global disease control policies, health initiatives, and field-level public health applications using case-based approaches.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the epidemiological transition, disease transmission dynamics, and the epidemiology of communicable diseases.

- **CO2:** Describe the epidemiology, prevention, and control of major communicable diseases of public health importance.
- **CO3:** Explain the epidemiology, risk factors, prevention, and control of major noncommunicable diseases.
- **CO4:** Apply principles of disease prevention and evaluate national and global policies, programmes, and strategies for communicable and noncommunicable disease control.
- **CO5:** Analyze public health case studies and apply evidence-based approaches to disease prevention and control in diverse population settings.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Epidemiological Transition, Transmission Dynamics, and Priority Infectious Diseases

- The Epidemiological Transition: Shift from infectious to chronic diseases and the "Double Burden" of disease in India
- Dynamics of disease transmission: Chain of infection, basic reproduction number (R_0), and herd immunity principles
- Introduction to communicable disease epidemiology and general prevention/control measures
- Major infectious diseases (I): Epidemiology, clinical features, prevention, and national strategy for Tuberculosis, Malaria, and Leprosy
- Major infectious diseases (II): Transmission dynamics, clinical spectrum, and public health control of HIV/AIDS and Viral Hepatitis

Unit II: Vaccine-Preventable Diseases, Zoonoses, and One Health Frameworks

- Vaccine-Preventable Diseases (VPDs): Universal Immunization Program, Mission Indradhanush, and U-WIN portal for digital immunization tracking
- One Health framework and intersectoral approaches to zoonotic disease surveillance
- Epidemiology, prevention, and emergency response to priority zoonoses: National One Health Mission, Nipah virus, Rabies, and Avian Influenza
- Disease surveillance, outbreak response protocols, and community containment strategies

Unit III: Non-Communicable Diseases, Chronic Conditions, and Mental Health

- Introduction to non-communicable disease (NCD) epidemiology, lifestyle risk factors, and social determinants
- Cardiovascular and chronic respiratory diseases: Epidemiology, primary prevention, and management of Hypertension, Coronary Heart Disease, Stroke, and COPD
- Metabolic and endocrine disorders: Epidemiology, screening initiatives, and population management of Diabetes Mellitus and Obesity
- Oncology: Cancer epidemiology, major carcinogens, early screening programs, and preventive strategies
- Mental health integration: Mental health as an NCD domain, integration into primary healthcare NCD clinics, and the Tele-MANAS initiative

Unit IV: National Programs, Policies, Case Studies, and Field Applications

- National and global health policies, programs, and strategic frameworks for communicable and NCD prevention and control
- Public health case studies: Analyzing evidence-based disease interventions in diverse population settings
- Field exposure visits to local health centers, NCD screening clinics, and disease surveillance hubs
- Synthesis of field observations, practical case analysis, and evidence-based reporting on national health programs

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.
- Blaser, M.J., Cohen, J.I., & Holland, S.M. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 10th ed., Elsevier.
- Narain, J.P., & Kumar, R. *Textbook of Chronic Noncommunicable Diseases: The Health Challenge of 21st Century*. 1st ed., Jaypee Brothers Medical Publishers.

Data Analytics using MS-Excel and R Programming

Category: Skill Enhancement Course (SEC) | **L-T-P:** 0-0-2 | **Credits:** 1

Course Objectives

- Provide hands-on training in data entry, manipulation, logical operations, and data visualization using MS-Excel.
- Develop practical skills in importing, cleaning, analyzing, and plotting structured datasets using R Programming.

Course Outcomes: On completion, students will be able to:

- CO1: Perform data validation, logical formula implementation, and lookup operations in MS-Excel.
- CO2: Create data summaries, interactive Pivot Tables, and visual dashboards for exploratory data analysis.
- CO3: Import, clean, and manipulate health datasets using R and the dplyr package.
- CO4: Construct publication-ready visual analytics using ggplot2 and execute basic inferential statistical tests in R.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: MS-Excel Fundamentals, Data Validation, and Lookup Operations

- Arithmetic operations, formatting, cell references, filtering, grouping, and data validation rules in MS-Excel
- Practical/Tutorial Session: Implementing formulas, logical operators (IF, AND, OR), nested structures, and conditional formatting
- Data searching routines, VLOOKUP/XLOOKUP functionalities, and index-match principles

- Practical/Tutorial Session: Connecting external data sources, querying raw health datasets, and setting up automated lookup tables

Unit II: Data Aggregation, Visual Analytics, and Macros in MS-Excel

- Data aggregation principles, Pivot Table architecture, calculated fields, and multi-dimensional summaries
- Practical/Tutorial Session: Building interactive Pivot Charts, slicers, and visual dashboards for exploratory data analysis
- Data analysis tools, descriptive statistics utilities, and Analysis ToolPak applications
- Practical/Tutorial Session: Introduction to spreadsheet automation, macro recording, and macro-enabled analytical workflows

Unit III: R Environment, Data Manipulation, and Visualizations with ggplot2

- Overview of RStudio environment, R syntax, data types (numeric, character, factor), data structures (vectors, matrices, data frames), and package management
- Practical/Tutorial Session: Importing/exporting datasets across formats (CSV, Excel), missing value handling, and data cleaning routines
- Data frame manipulation, subsetting, filtering, mutating, and transformation using the dplyr package
- Practical/Tutorial Session: Generating descriptive statistics, graphical exploratory analysis, and publication-ready visual analytics using Base R and ggplot2

Unit IV: Inferential Statistics, Predictive Modeling, and Integrated Analytics

- Inferential statistics in R: Hypothesis testing principles, two-sample t-tests, and Analysis of Variance (ANOVA)
- Practical/Tutorial Session: Executing parametric statistical tests, interpreting model outputs, and evaluating statistical significance
- Predictive modeling in R: Correlation analysis, Simple/Multiple Linear Regression, and Binary Logistic Regression
- Integrated Project Practical: End-to-end dataset analysis, predictive modeling, automated reporting, and visual project presentations using MS-Excel and R

Suggested Readings

- Harvey, G. *Excel 2016 All-in-One For Dummies*. John Wiley & Sons.
- Walkenbach, J. *Microsoft Excel 2016 Bible: The Comprehensive Tutorial Resource*. Wiley Publishers.
- Wickham, H., Çetinkaya-Rundel, M., & Grolemund, G. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. 2nd ed., O'Reilly Media.

Healthcare Delivery Systems

Category: Major Core (MC) | **L-T-P:** 2-2-0 | **Credits:** 4

Course Objectives

- Introduce the fundamental concepts, evolution, and major health committees that have shaped healthcare delivery globally and in India.
- Explain the tiered structure of healthcare delivery (Primary, Secondary, Tertiary) and the organizational framework of Indian healthcare facilities.
- Analyze the roles of the healthcare workforce, health system governance structures, and major initiatives like the National Health Mission.

- Evaluate the quality of healthcare services and apply theoretical knowledge through case studies and field-based observations.

Course Outcomes: On completion, students will be able to:

- CO1: Explain the structure, organization, and components of healthcare delivery systems in India and globally.
- CO2: Describe the different levels of healthcare delivery and the organization of healthcare services in India.
- CO3: Explain the roles of the healthcare workforce, health system governance, and the National Health Mission in healthcare delivery.
- CO4: Apply knowledge of healthcare delivery systems to analyze healthcare services through case studies and field-based observations of healthcare facilities.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA8 (Social Responsibility, Sustainability & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Introduction and Evolution of Healthcare Systems

- Concept, objectives, and principles of healthcare delivery
- Evolution of Global and Indian healthcare systems; public and private healthcare sectors
- Major Indian Health Committees: Bhore Committee (1946), Mudaliar Committee (1962), Chadha Committee (1963), Mukherjee Committee (1965), Jungalwalla Committee (1967), Kartar Singh Committee (1973), Shrivastav Committee (1975), and Bajaj Committee (1986)

Unit II: Levels and Organization of Healthcare Delivery

- Levels of Healthcare Delivery: Primary, Secondary, and Tertiary healthcare; Referral system principles
- Organization of frontline Healthcare Services in India: Sub-Centre, Health & Wellness Centre (HWC), and Primary Health Centre (PHC)
- Organization of referral facilities: Community Health Centre (CHC), District Hospital, and Medical College Hospital

Unit III: Health Workforce, Governance, and National Health Mission

- Healthcare Workforce: Healthcare professionals and frontline workers (ASHAs, ANMs, AWWs), and their respective roles and responsibilities
- Health System Governance: Ministry of Health and Family Welfare, State Health Departments, and Local Health Authorities
- National Health Mission: Strategic frameworks of the National Rural Health Mission (NRHM) and National Urban Health Mission (NUHM)

Unit IV: Quality of Care and Field Applications

- Quality of Healthcare Services: Accessibility, availability, equity, quality, patient safety, and healthcare facility accreditation
- Case Studies and Public Health Applications: Analyzing healthcare services and delivery challenges
- Field Visit to Healthcare Facilities: Observational visits to local health infrastructure (Sub-Centre, Health & Wellness Centre, and Primary Health Centre)

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.
- World Health Organization. *Health Systems: Improving Performance*. WHO Publications.
- Turnock, B.J. *Essentials of Public Health*. 4th ed., Jones & Bartlett Learning.

Semester IV

Research Methodology

Category: Major Core (MC) | **L-T-P:** 2-2-0 | **Credits:** 4

Course Objectives

- Explain fundamental concepts, principles, types, and ethical considerations of public health research.
- Formulate clear research problems, hypotheses, study designs, sampling techniques, and sample size estimations.
- Master quantitative and qualitative data collection tools, field data management, and basic statistical analysis methods.
- Develop a complete research proposal, execute a mini field-based research project, write scientific reports, and present empirical findings.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental concepts, principles, and ethics of public health research.
- **CO2:** Formulate research problems, objectives, research questions, and select appropriate research designs and sampling techniques.
- **CO3:** Describe quantitative and qualitative research methods, data collection techniques, and basic data analysis used in public health research.
- **CO4:** Apply research methodology principles to develop a research proposal, conduct a field-based study, and communicate research findings effectively.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Research Foundations, Problem Formulation, and Study Designs

- Definitions, scope, importance, types of research, research process, and characteristics of good scientific inquiry
- Identification of research problems, formulation of research objectives, research questions, and hypothesis development
- Literature review techniques, academic database searching strategies, and sources of scientific literature
- Practical/Tutorial Session: Problem identification exercises, formulation of research questions, and conducting literature searches
- Quantitative, qualitative, and mixed-method study designs; descriptive and analytical research methodologies

Unit II: Sampling Techniques, Sample Size Estimation, and Quantitative Data Management

- Probability sampling methods: Simple random, systematic, stratified, and cluster sampling
- Non-probability sampling techniques: Convenience, purposive, quota, and snowball sampling
- Principles and formulas for sample size calculation in quantitative health studies
- Practical/Tutorial Session: Sample size estimation exercises, quantitative tool design (questionnaires, measurement scales, structured interviews)

- Quantitative data management: Data coding, entry, cleaning, tabulation, descriptive statistics, and graphical presentation

Unit III: Qualitative Research Approaches, Data Collection, and Research Ethics

- Concepts, characteristics, importance, and applications of qualitative research in public health
- Qualitative approaches: Phenomenology, Grounded Theory, Ethnography, Participatory Action Research (PAR), and Case Study
- Qualitative data collection methods: In-depth Interviews (IDI), Focus Group Discussions (FGD), and Key Informant Interviews (KII)
- Practical/Tutorial Session: Developing qualitative interview guides, FGD protocols, and role-playing field data collection
- Research ethics: Research integrity, informed consent, Participant Information Sheet (PIS), confidentiality, Institutional Ethics Committee (IEC) governance, and plagiarism prevention

Unit IV: Scientific Writing, Proposal Development, and Field-Based Research Project

- Scientific writing standards, structure of a research report, citation styles, referencing tools, and plagiarism detection
- Practical/Tutorial Session: Preparation and peer-review of a public health research proposal
- Applied field research project: Conducting field data collection using standardized quantitative/qualitative tools
- Practical/Tutorial Session: Field data entry, qualitative/quantitative analysis, mini-project report writing, presentation, and dissemination of findings

Suggested Readings

- Kothari, C.R., & Garg, G. *Research Methodology: Methods and Techniques*. 4th ed., New Age International Publishers.
- Crosby, R.A., Salazar, L.F., & DiClemente, R.J. *Research Methods in Public Health*. Jones & Bartlett Learning.
- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.

Data Science in Public Health

Category: Skill Enhancement Course (SEC) | **L-T-P:** 2-2-0 | **Credits:** 4

Course Objectives

- Introduce concepts and tools of data science applied to public health problems.
- Develop practical skills in handling, analysing and visualising large health datasets.

Course Outcomes: On completion, students will be able to:

CO1: Explain the data science workflow applied to public health.
CO2: Apply data wrangling and exploratory data analysis techniques.
CO3: Use basic machine learning concepts for health data classification and prediction.
CO4: Present data-driven insights for public health decision-making.

Graduate Attributes Addressed: GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA9 (Entrepreneurship & Innovation Mindset)

Unit I: Introduction to Data Science in Health

- Data science workflow: collection, cleaning, analysis, communication
- Types of health data: structured, unstructured, big data
- Tools and platforms for health data science
- Data ethics and privacy in health data science

Unit II: Data Wrangling and Exploratory Analysis

- Data cleaning and preprocessing
- Exploratory data analysis and visualisation
- Handling missing data and outliers
- Descriptive analytics for health indicators

Unit III: Introduction to Predictive Analytics

- Basic concepts of machine learning
- Classification and regression, overview
- Model evaluation metrics
- Application in disease prediction and risk stratification

Unit IV: Applications in Public Health

- Big data in disease surveillance
- Data science for health system strengthening
- Case studies: outbreak prediction, health resource allocation
- Ethical and governance issues in health data science

Suggested Readings

- Raghupathi, W. Data Analytics in Healthcare: A Comprehensive Guide. Springer.
- Provost, F., Fawcett, T. Data Science for Business. O'Reilly.
- James, G. et al. An Introduction to Statistical Learning. Springer.
- WHO. Big Data and Artificial Intelligence for Health. World Health Organization.

Public Health Governance, Law and Bioethics

Category: VAC | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain concepts of public health law, constitutional guarantees, governance structures, and international right-to-health covenants.
- Analyze statutory frameworks regulating food safety, pharmaceuticals, intellectual property rights, and access to essential medicines.
- Examine medical jurisprudence, patient rights, informed consent, medical negligence, and health regulations for vulnerable groups.
- Evaluate core bioethical principles, clinical trial regulations, and ethical issues in end-of-life care, organ donation, and health research.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the legal frameworks, constitutional guarantees, and international covenants governing public health in India and globally.
- **CO2:** Analyze the interrelationship between law, public health policy, socio-environmental determinants, and governance structures.

- **CO3:** Evaluate ethical principles, regulatory frameworks, and bioethical concerns in medical practice, clinical research, and public health delivery.
- **CO4:** Apply health legislation and statutory safeguards to address epidemic control, food safety, reproductive rights, vulnerable populations, and legal epidemiology.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Health Law, Human Rights, and Public Health Governance

- Concepts and principles of public health law, constitutional mandates, and legal epidemiology
- International right-to-health covenants and declarations: UDHR, ICESCR, WHO frameworks, and the Declaration of Helsinki
- Public health governance structures: Roles, functions, and oversight of the Ministry of Health and Family Welfare (MoHFW) and Directorate General of Health Services (DGHS)
- National and state public health policies, programs, and social health protection/insurance schemes (NHM, NUHM, JSY, RSBY)
- Statutory safeguards and criminal health offenses related to public safety and epidemic control under the IPC and CrPC

Unit II: Regulation of Food Safety, Pharmaceuticals, and Intellectual Property

- Right to food, food security principles, and statutory regulation under the Food Safety and Standards Act (FSSA), 2006
- Pharmaceutical and medical technology regulation: Drugs & Cosmetics Act, Medical Devices Rules, and ICMR research guidelines
- Intellectual Property Rights (IPR) in healthcare: TRIPS agreement, patent regimes, and compulsory licensing mechanisms
- Trade policies, drug pricing control, and strategies for ensuring global and national access to essential medicines

Unit III: Medical Jurisprudence, Patient Rights, and Healthcare Legislation

- Legal foundations of the doctor-patient relationship, informed consent, patient autonomy, and medical confidentiality
- Medical negligence, standard of care, professional misconduct, and applications of the Consumer Protection Act in healthcare
- Governance of medical education and clinical practice under the National Medical Commission (NMC) Act, 2019, and anti-quackery enforcement
- Disability rights in healthcare, reproductive rights, and legal protections for vulnerable and marginalized populations

Unit IV: Bioethics, Clinical Research, and Public Health Practice Ethics

- Core bioethical standards and foundational guidelines: Belmont Report and ICMR Ethical Guidelines for Biomedical Research
- Research ethics: Clinical trial regulations, human participant protections, informed consent processes, and Institutional Ethics Committee (IEC) review
- Legal and bioethical perspectives on euthanasia, end-of-life care, advance directives, and living wills

- Regulatory and bioethical frameworks governing organ transplantation, stem cell research, and legal protections under HIV/AIDS prevention and control legislation

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
- Moitra, S., Chatterjee, C., & Debnath, D. *A Compendium on Health Laws*. New Era Law Publication.
- Herring, J. *Medical Law and Ethics*. Oxford University Press.

Hospital Management

Category: Major Core (MC) | **L-T-P:** 2-0-0 | **Credits:** 2

Course Objectives

- Understand the organizational framework, system dynamics, strategic planning, and administrative roles within the hospital sector in India.
- Analyze the design considerations, staffing requirements, equipment needs, and operational management of clinical, critical care, and surgical units.
- Evaluate the operational workflows, spatial layout, quality control, and safety protocols for diagnostic, imaging, and sterilization departments.
- Assess administrative support services, logistics systems, patient safety standards, medico-legal guidelines, and biomedical waste management protocols.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the structural framework, system dynamics, planning considerations, and administrative roles within the Indian hospital sector.
- **CO2:** Analyze the design, staffing, equipment requirements, and managerial challenges in clinical and critical care departments.
- **CO3:** Evaluate managerial operations, spatial design, and equipment needs of diagnostic and sterilization support units.
- **CO4:** Apply quality management frameworks, patient safety standards, and medico-legal guidelines to hospital administrative workflows.
- **CO5:** Assess hospital administrative support services, utility logistics, and biomedical waste management protocols for efficient hospital operations.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Hospital Administration, System Planning, and Outpatient/Emergency Care

- Overview of the hospital sector in India: Classification, types, public/private sectors, and primary functions of hospitals
- Hospital as a system: Organizational structure, inter-departmental relationships, and administrative leadership roles
- Strategic planning considerations: Master planning, architectural design principles, and facility establishment workflows
- Outpatient Department (OPD) services: Spatial design, equipment selection, manpower planning, and managerial challenges

- Accident & Emergency Services: Design principles, triage systems, staffing, equipment, and medico-legal aspects

Unit II: In-Patient, Critical Care, Isolation, and Surgical Facilities

- In-patient services: Ward layout design, staffing norms, equipment needs, ward management, and operational issues
- Intensive Care Unit (ICU): Structural design, specialized equipment, staffing requirements, and critical care management
- Isolation Facilities: Design specifications, infection prevention controls, equipment, and operational protocols
- Operation Theatre (OT) complex: Zoning concepts, environmental control/HVAC standards, equipment, staffing, and managerial issues

Unit III: Diagnostic, Sterilization, and Quality Management Services

- Clinical Laboratory services: Spatial layout, safety protocols, instrumentation, staffing, and quality control management
- Radiology and Imaging services: Radiation protection design, equipment specifications, staffing norms, and workflow management
- Central Sterile Services Department (CSSD): Workflows, zoning, sterilization technology, equipment, and quality control
- Overview of quality management in healthcare: Quality frameworks, patient safety metrics, continuous quality improvement (CQI), and accreditation standards

Unit IV: Administrative Support Services, Utility Logistics, and Biomedical Waste Management

- Hospital front office operations, patient admission workflows, and billing management
- Ambulance services, patient transport systems, and fleet management logistics
- Materials management: General stores administration, inventory control, and procurement workflows
- Hospital support operations: Kitchen and dietetic services, Medical Records Department (MRD), mortuary administration, and Medical Gas Pipeline Systems (MGPS)
- Biomedical waste management: Legal guidelines, waste classification, color-coded segregation, handling, storage, transport, and disposal protocols

Suggested Readings

- Goel, S.L., & Kumar, R. (Eds.). *Hospital Core Services: Hospital Administration in the 21st Century*. Deep and Deep Publications.
- Gupta, S. *Hospital Administration*. 1st ed., Jaypee Brothers Medical Publishers.
- Kunders, G.D. *Hospitals: Facilities, Planning & Management*. McGraw Hill Education.

Health Programs in India

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the concepts, evolution, committee recommendations, and policy foundations of health planning and programs in India.
- Describe the organizational structure, components, and target strategies of major National Health Missions, RMNCH+A, and nutrition initiatives.

- Analyze public health strategies, clinical spectrums, and elimination goals of national communicable and non-communicable disease control programs.
- Evaluate national health protection initiatives, program monitoring/evaluation metrics, and field-level public health applications.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the evolution, organization, and objectives of health programmes in India.
- **CO2:** Describe the structure, components, implementation, and scope of major national health programmes.
- **CO3:** Explain the role of national health missions, health policies, and programme monitoring in improving population health.
- **CO4:** Apply knowledge of national health programmes to analyze public health services through case studies and field-based observations.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Health Planning, Health Policies, and National Health Mission

- Introduction to health programs in India: Concepts, key objectives, and historical evolution
- Health planning committees in India: Bhore, Mudaliar, Kartar Singh, Srivastava, and Bajaj Committee recommendations
- Policy frameworks: National Health Policy, NITI Aayog strategic initiatives, and alignment with Sustainable Development Goals (SDGs)
- National Health Mission (NHM): Architecture, strategic objectives, and key components of National Rural Health Mission (NRHM) and National Urban Health Mission (NUHM)
- Health infrastructure transformation: Health & Wellness Centres (HWCs) and Ayushman Arogya Mandir

Unit II: Maternal, Child, Adolescent Health, Nutrition, and Communicable Disease Control Programmes

- Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCH+A) strategic framework
- National immunization and nutrition initiatives: Universal Immunization Programme (UIP), POSHAN Abhiyaan, and Anaemia Mukt Bharat
- Priority infectious disease elimination programs: National Tuberculosis Elimination Programme (NTEP) and National AIDS Control Programme (NACP)
- Vector-borne, chronic, and viral disease programs: National Vector Borne Disease Control Programme (NVBDCP), National Leprosy Eradication Programme (NLEP), and National Viral Hepatitis Control Programme (NVHCP)

Unit III: Non-Communicable Disease Programmes, Mental Health, and Health Protection Initiatives

- Chronic disease control: National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD)

- Specialized national programs: National Mental Health Programme (NMHP), National Programme for Health Care of the Elderly (NPHCE), and National Programme for Palliative Care (NPPC)
- Financial risk protection: Ayushman Bharat–Pradhan Mantri Jan Arogya Yojana (PM-JAY)
- Digital health and specialized public health initiatives: Ayushman Bharat Digital Mission (ABDM), National Blood Programme, and National Organ Transplant Programme (NOTP)

Unit IV: Programme Implementation, Monitoring, Case Studies, and Field Applications

- Programme planning, implementation frameworks, supervision mechanisms, and reporting structures
- Public health indicators, program performance tracking, monitoring metrics, and evaluation tools
- Public health case studies: Applied analysis of national health program delivery and operational challenges
- Field exposure visits to a Primary Health Centre (PHC), Urban Health Centre, or District Health Office
- Field report synthesis: Documenting program implementation, ground-level service delivery, and health system integration

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.
- Kishore, J. *National Health Programs of India*. 13th ed., Century Publications.

Summer Internship: Industry or Nongovernment Organisation

Category: Summer Internship (SI) | **L-T-P:** 0-0-8 | **Credits:** 4

Course Objectives

- Provide practical, hands-on exposure to real-world operations in healthcare industries, NGOs, or public health organizations.
- Enable students to apply theoretical knowledge and research principles to active public health, managerial, or field projects.
- Develop professional competencies in stakeholder engagement, health program implementation, data collection, and administrative workflows.
- Cultivate skills in scientific report writing, project synthesis, critical reflection, and professional dissemination of internship findings.

Course Outcomes: On completion, students will be able to:

- **CO1:** Understand organizational governance, structural workflows, and operational strategies of industry or non-governmental healthcare organizations.
- **CO2:** Execute practical public health tasks, field interventions, data collection, or administrative assignments under industry/institutional supervision.
- **CO3:** Analyze real-world public health challenges and program implementation dynamics through immersive experiential learning.
- **CO4:** Synthesize field-based learnings, prepare a comprehensive internship report, and present empirical findings to an expert panel.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship), GA9 (Communication Skills & Teamwork), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Organizational Orientation and Project Planning

- Orientation to host organization: History, vision, governance structure, key departments, and core healthcare/public health mandates
- Identification of internship objectives, mentor allocation, work plan formulation, and task timeline mapping
- Workplace ethics, professional conduct, institutional compliance, data confidentiality, and safety protocols
- Review of host organization project documentation, baseline datasets, and program delivery frameworks

Unit II: Field Execution, Operations, and Task Implementation

- Hands-on involvement in ongoing organizational projects, community health interventions, or industry operations
- Practical execution of field data collection, needs assessments, patient/stakeholder interviews, or program monitoring activities
- Participation in interprofessional team meetings, administrative workflows, public health advocacy, or healthcare delivery logistics
- Documentation of daily operational tasks, observational field logs, and preliminary data aggregation

Unit III: Data Analysis, Synthesis, and Problem Solving

- Processing, cleaning, and analyzing quantitative or qualitative data collected during the internship tenure
- Critical evaluation of operational challenges, health system bottlenecks, policy gaps, or administrative solutions
- Formulation of evidence-based recommendations for improving organizational performance or program implementation
- Draft outline preparation for the internship project report under the guidance of internal and external mentors

Unit IV: Report Compilation, Presentation, and Evaluation

- Compilation of a structured, comprehensive Summer Internship Report incorporating background, objectives, methodology, findings, and recommendations
- Preparation of visual presentation materials summarizing key activities, learnings, field contributions, and outcomes
- Submission of the final internship report and logbook certified by the host organization mentor
- Viva-voce examination and presentation before an expert evaluation committee

Suggested Readings

- World Health Organization. *Managing Programs in Health Services*. WHO Publications.
- Relevant institutional reports, program guidelines, policy briefs, and operational manuals provided by the host organization/industry.

Semester V

Advanced Statistical Methods

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain the role of advanced statistics, statistical thinking, assumptions of statistical tests, and criteria for selecting appropriate tests based on study designs and data types.
- Apply comparative parametric and non-parametric statistical tests, correlation techniques, and regression modeling using statistical software.
- Conduct multivariable analysis, trend analysis, and survival analysis to interpret complex public health datasets and evaluate health programs.
- Critically appraise published statistical literature, prepare publication-standard statistical reports, and present findings from real-world data analysis projects.

Course Outcomes: On completion, students will be able to:

- **CO1:** Select appropriate statistical methods based on research questions, study designs, and types of public health data.
- **CO2:** Apply advanced statistical techniques using statistical software for analyzing public health datasets.
- **CO3:** Interpret statistical outputs and communicate findings to support evidence-based public health practice.
- **CO4:** Analyze real-world public health datasets and prepare statistical reports for research and programme evaluation.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Advanced Statistics and Selection of Statistical Tests

- Role of advanced statistics in public health research, statistical thinking, and foundational principles
- Core assumptions of statistical tests, statistical significance, confidence intervals, effect size estimation, and statistical power
- Distinction between parametric and non-parametric statistical methods
- Test selection criteria based on study design, variable types (continuous, categorical, ordinal), and research objectives
- Practical/Tutorial Session: Evaluating dataset properties, testing distributional assumptions, and selecting statistical procedures

Unit II: Comparative Statistical Methods, Correlation, and Regression Analysis

- Comparative parametric tests: Student's t-test, Analysis of Variance (ANOVA), post-hoc analysis, and subgroup evaluations
- Comparative non-parametric tests: Chi-square test, Mann–Whitney U test, Wilcoxon signed-rank test, and Kruskal–Wallis test
- Correlation analysis: Pearson and Spearman rank correlation measures
- Predictive modeling: Simple linear regression, multiple linear regression, and logistic regression
- Practical/Tutorial Session: Executing hypothesis tests, running regression models in statistical software, model diagnostics, and output interpretation

Unit III: Advanced Public Health Data Analytics and Statistical Reporting

- Multivariable analysis methods, adjusting for confounders, and testing interaction effects in public health datasets
- Epidemiological trend analysis and quantitative techniques for health program evaluation
- Survival analysis fundamentals: Kaplan-Meier estimation and Cox proportional hazards modeling
- Statistical reporting standards: Structuring summary tables, generating data visualizations, and presenting statistical outputs
- Identifying and avoiding common statistical errors, misinterpretations, and conducting critical appraisals of research findings

Unit IV: Case Studies, Evidence Synthesis, and Practical Data Analysis Project

- Critical appraisal of published public health literature and evaluation of statistical methodology quality
- Evidence synthesis and translating complex statistical findings into public health decision-making and policy
- Practical Data Analysis Project: Hands-on end-to-end analysis of real-world public health datasets using statistical software
- Practical/Tutorial Session: Data cleaning, model specification, hypothesis testing, compiling formal statistical reports, and oral presentation of findings

Suggested Readings

- Daniel, W.W., & Cross, C.L. *Biostatistics: A Foundation for Analysis in the Health Sciences*. 11th ed., Wiley.
- Armitage, P., Berry, G., & Matthews, J.N.S. *Statistical Methods in Medical Research*. 2nd ed., Wiley-Blackwell.

Behavioral Health Sciences in Public Health

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the concepts, theoretical foundations, and determinants of behavioral health sciences in public health.
- Apply behavioral health theories, ecological models, and communication strategies to design behavior change interventions.
- Conduct behavioral assessments, KAP studies, and community engagement programs using qualitative and quantitative research methods.
- Evaluate ethical frameworks, digital health trends, and contemporary approaches in behavioral health practice.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental concepts, principles and scope of behavioral health sciences in public health.
- **CO2:** Describe the biological, psychological, social, cultural and environmental determinants influencing health behaviour.
- **CO3:** Apply behavioural science theories and models to understand health behaviours and design behaviour change interventions.

- **CO4:** Interpret the role of health communication, community engagement and behavioural research in promoting population health.
- **CO5:** Evaluate ethical issues, emerging technologies and contemporary approaches in behavioural health practice.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Behavioral Health Sciences, Theoretical Perspectives, and Determinants

- Definition, scope, importance, and historical evolution of behavioral health sciences in public health
- Biopsychosocial model of health and the role of behavioral sciences in disease prevention and health promotion
- Foundations of behavioral theories: Behaviorism (Classical and Operant Conditioning), Social Learning Theory, and cognitive models
- Developmental perspectives (Piaget, Vygotsky, Erikson) and humanistic frameworks (Maslow, Rogers)
- Determinants of health behavior: Biological, psychological, socio-cultural, family, peer, environmental, commercial, and political determinants, alongside health equity

Unit II: Health Behavior Theories, Ecological Models, and Behavior Change Communication

- Individual and interpersonal health behavior models: Health Belief Model (HBM), Theory of Reasoned Action (TRA), and Theory of Planned Behavior (TPB)
- Social Cognitive Theory (SCT) and Transtheoretical Model (TTM / Stages of Change)
- Ecological and community frameworks: Social Ecological Model, Diffusion of Innovations Theory, Community Organization Model, PRECEDE-PROCEED Model, and Behavior Change Wheel (COM-B framework)
- Principles of behavior change and health communication strategies: Information, Education, and Communication (IEC)
- Behavior Change Communication (BCC), Social and Behavior Change Communication (SBCC), social marketing, and behavioral economics

Unit III: Behavioral Assessment, Research Methods, and Community Engagement

- Behavioral assessment procedures, community needs assessment, and health indicator metrics
- Design and execution of Knowledge, Attitude, and Practice (KAP) studies and behavioral surveillance
- Qualitative and quantitative research methodologies in behavioral sciences; monitoring and evaluating behavior change interventions
- Community participation, empowerment, mobilization, stakeholder engagement, and multisectoral collaboration
- Behavioral counseling techniques, supportive interventions, and designing community-based behavior change programs

Unit IV: Ethics, Professional Practice, and Emerging Trends in Behavioral Health

- Ethical principles in behavioral health research and practice: Confidentiality, informed consent, and legal safeguards
- Cultural competence, working with diverse populations, and professional responsibilities in public health interventions
- Digital health innovations: Mobile health (mHealth) interventions, telehealth, and tele-counseling platforms
- Applications of artificial intelligence (AI) in behavioral health monitoring and interventions
- Concepts of wellness, resilience, positive mental health, and future directions in behavioral health sciences

Suggested Readings

- Glanz, K., Rimer, B.K., & Viswanath, K. *Health Behavior: Theory, Research, and Practice*. Jossey-Bass/Wiley.
- Coreil, J. *Social and Behavioral Foundations of Public Health*. Sage Publications.
- Larsen, K. *Health Promotion in Health Care – Vital Theories and Research*. Routledge.

Climate Change and Planetary Health

Category: Multidisciplinary (MD) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the scientific basis of climate change, planetary health, environmental determinants, and direct/indirect health impacts on vulnerable populations.
- Evaluate climate-sensitive infectious and non-communicable disease dynamics, food/water insecurity, and ecosystem disruptions affecting human health.
- Analyze climate adaptation, mitigation strategies, disaster preparedness, health system resilience, and national/global climate policy frameworks.
- Apply One Health principles, sustainable low-carbon healthcare models, climate justice, and risk communication strategies to public health practice.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the scientific basis of climate change and planetary health, including environmental determinants affecting human health.
- **CO2:** Assess the effects of climate change on communicable diseases, non-communicable diseases, nutrition, water security, occupational health, and vulnerable populations.
- **CO3:** Evaluate adaptation, mitigation, disaster preparedness, and health system resilience strategies for climate-related public health challenges.
- **CO4:** Critically examine national and international climate policies, governance frameworks, and sustainable development approaches relevant to public health.
- **CO5:** Design evidence-based public health interventions incorporating One Health, Planetary Health, climate communication, and sustainable healthcare principles.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Climate Change, Planetary Health, and Human Health Impacts

- Scientific foundations of climate systems, greenhouse effect, global warming, and climate variability
- Planetary boundaries, the Anthropocene epoch, and environmental determinants of human health
- Direct and indirect health impacts of climate change: Heat stress, extreme weather events, and ambient air pollution
- Climate-related mental health outcomes and health risks facing vulnerable and marginalized populations

Unit II: Climate-Sensitive Diseases, Food Systems, and Water Security

- Epidemiology of climate-sensitive infectious diseases: Vector-borne, water-borne, food-borne illnesses, and zoonoses
- Environmental drivers of changing ecosystems and emerging antimicrobial resistance (AMR)
- Sustainable food systems, agricultural productivity, biodiversity conservation, and ecosystem services
- Water, Sanitation, and Hygiene (WASH) infrastructure, water security, food security, and malnutrition mitigation

Unit III: Adaptation, Health System Resilience, Climate Governance, and Policy

- Disaster risk reduction (DRR), emergency preparedness, Heat Action Plans (HAPs), and early warning systems
- Frameworks and strategies for building climate-resilient health infrastructure and delivery systems
- Global climate policy and international covenants: UNFCCC, Paris Agreement, and the Sustainable Development Goals (SDGs)
- National climate policy governance in India: National Action Plan on Climate Change (NAPCC), State Action Plans (SAPCC), and the National Programme on Climate Change and Human Health (NPCCHH)

Unit IV: One Health, Planetary Health Interventions, Sustainable Healthcare, and Communication

- One Health and Planetary Health paradigms: Managing the human-animal-environment interface, ecosystem restoration, and environmental surveillance for emerging diseases
- Sustainable healthcare operational design: Transitioning to low-carbon health systems, Green Hospital initiatives, and healthcare waste management
- Healthcare carbon footprint accounting, resource efficiency, and environmentally sustainable operations
- Climate justice, public health advocacy, risk communication strategies, and designing evidence-based planetary health interventions

Suggested Readings

- Levy, B.S., & Patz, J. *Climate Change and Public Health*. Oxford University Press.
- Myers, S., & Frumkin, H. *Planetary Health: Protecting Nature to Protect Ourselves*. Island Press.
- Pachauri, S., Pachauri, A., & Jonathan, M.P. *Health and Climate Change: Unravelling the Connections*. Elsevier.
- Gronlund, C. *Environmental Health: Foundations for Public Health*. Springer Publishing.

Maternal, Newborn, Child, and Adolescent Health

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the epidemiological burden, determinants, indicators, and global/national targets related to maternal, newborn, child, and adolescent health.
- Analyze clinical interventions, essential care packages, and the continuum of care across the life-course approach (RMNCH+A).
- Evaluate health strategies for child nutrition, immunization, growth monitoring, disease management, and adolescent risk mitigation.
- Assess health system delivery platforms, national flagship programs, monitoring indicators, and quality of care frameworks in MNCAH.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the epidemiological trends, socio-biological determinants, and global/national health targets related to MNCAH.
- **CO2:** Describe maternal and newborn health interventions, essential care packages, and emergency obstetric workflows.
- **CO3:** Apply strategies for child health management, integrated management of neonatal and childhood illnesses (IMNCI), and nutritional interventions.
- **CO4:** Analyze adolescent health policies, sexual and reproductive health strategies, and gender-responsive public health approaches.
- **CO5:** Evaluate MNCAH program implementation, monitoring indicators, quality assurance frameworks, and field delivery systems.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Maternal and Newborn Health: Burden, Determinants, and Care Continuum

- Epidemiological trends, maternal mortality ratio (MMR), neonatal mortality rate (NMR), and global/national targets (SDGs)
- Socio-biological, cultural, commercial, and environmental determinants of maternal and newborn health
- Antenatal care (ANC), intrapartum care, and postnatal care (PNC) continuum of care service packages
- Emergency Obstetric and Newborn Care (EmONC), essential newborn care (ENC), facility resuscitation, and kangaroo mother care (KMC)
- Maternal and Perinatal Death Surveillance and Response (MPDSR) systems and audit frameworks

Unit II: Child Health, Nutrition, and Disease Management

- Under-5 mortality rate (U5MR) trends, infant mortality rate (IMR), and major causes of child morbidity/mortality
- Integrated Management of Neonatal and Childhood Illnesses (IMNCI) strategy and facility-based care (SNCU / NBSU)
- Universal Immunization Programme (UIP), vaccine-preventable diseases, cold chain maintenance, and vaccine safety

- Child nutrition: Infant and Young Child Feeding (IYCF) practices, management of Severe Acute Malnutrition (SAM), and POSHAN Abhiyaan
- Growth monitoring, developmental screening, and early childhood intervention under Rashtriya Bal Swasthya Karyakram (RBSK)

Unit III: Adolescent Health, Sexual and Reproductive Health (SRH)

- Adolescent health profile, neurodevelopmental changes, risk-taking behaviors, and unique public health needs
- Sexual and reproductive health strategies, family planning methods, birth spacing, and contraceptive logistics
- Rashtriya Kishor Swasthya Karyakram (RKSK): Adolescent Friendly Health Clinics (AFHC), menstrual hygiene, and nutritional supplementation
- Gender-based violence, prevention of early/child marriage, adolescent mental health, and substance abuse interventions
- School health initiatives, life skills education, and peer-led health promotion models

Unit IV: Program Strategies, Quality Assurance, Monitoring, and Governance

- Strategic architecture of the RMNCH+A continuum of care model and health systems integration
- National schemes: Janani Suraksha Yojana (JSY), Janani Shishu Suraksha Karyakram (JSSK), and Pradhan Mantri Surakshit Matritva Abhiyaan (PMSMA)
- Quality of care frameworks: LaQshya initiative, WHO quality standards, and patient safety in maternal and pediatric settings
- Monitoring indicators, Reproductive and Child Health (RCH) portal, Health Management Information Systems (HMIS), and program evaluation
- Digital health innovations, community engagement strategies, and multisectoral action for MNCAH advancement

Suggested Readings

- World Health Organization. *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities*. WHO Publications.
- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.
- Ministry of Health and Family Welfare (MoHFW), Government of India. *A Strategic Approach to Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+A) in India*. MoHFW.

Digital Interventions in Public Health

Category: Minor Specialization (MS) | **L-T-P:** 1-1-0 | **Credits:** 2

Course Objectives

- Explain the foundational concepts, evolution, global strategy frameworks, and health system integration of public health informatics.
- Examine frontline mobile health tools, health management information systems, telemedicine, electronic health records, and interoperability standards.
- Apply digital disease surveillance, spatial data mapping, big data analytics, and predictive artificial intelligence models to public health practice.
- Analyze human-centered design, scaling barriers, evaluation frameworks, digital divide issues, cybersecurity, ethics, and regulatory governance.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain fundamental concepts, terminology, global frameworks, and system architectures in digital health and public health informatics.
- **CO2:** Examine key digital tools, health information systems, remote care platforms, and data standards used to strengthen healthcare delivery.
- **CO3:** Apply principles of digital disease surveillance, spatial mapping, and advanced analytics for epidemiological monitoring and health decision-making.
- **CO4:** Analyze ethical, governance, equity, design, and implementation considerations necessary for scaling and evaluating digital health interventions.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Digital Health and Health Systems Integration

- Key concepts, definitions, taxonomy, and historical evolution of digital health
- Core principles of public health informatics and system architectures
- National and global strategy frameworks for digital health expansion
- Role of digital technology in health system strengthening and advancing Universal Health Coverage (UHC)
- Tutorial/Session: Critical analysis of global digital health strategies and national public health informatics frameworks

Unit II: Digital Tools, Health Information Systems, and Infrastructure

- Frontline mobile health (mHealth) applications for health workers and community delivery
- Health Management Information Systems (HMIS) and enterprise healthcare software
- Telemedicine, tele-consultation modalities, and remote clinical care platforms
- Electronic Health Records (EHR) and data interoperability standards (HL7, FHIR, ICD-11)
- Tutorial/Session: Hands-on evaluation of mHealth applications, HMIS dashboards, and interoperability protocols

Unit III: Data Analytics, Spatial Mapping, and Disease Surveillance

- Modern digital disease surveillance methodologies and real-time outbreak tracking
- Spatial data analysis, Geographic Information Systems (GIS), and epidemiological mapping
- Big data analytics and data warehousing in public health systems
- Artificial intelligence, machine learning, and predictive modeling for disease prevention
- Tutorial/Session: Practical exercises in spatial mapping software and public health predictive dataset modeling

Unit IV: Human-Centered Design, Implementation, Ethics, and Governance

- Human-centered design (HCD) principles and user experience (UX) optimization in public health tools
- Scaling strategies, organizational implementation barriers, and sustainability factors
- Comprehensive evaluation frameworks for digital health interventions (e.g., RE-AIM, WHO monitoring guidelines)

- Equity concerns, the digital divide, data privacy, cybersecurity, bioethics, and regulatory governance
- Tutorial/Session: Case study debates on digital health ethics, data security, privacy compliance, and human-centered design evaluation

Suggested Readings

- Novillo-Ortiz, D. *Digital Health and Public Health Practice*. Oxford University Press.

Statistical Software Laboratory (Practical)

Category: Skill Enhancement Course (SEC) | **L-T-P:** 0-0-6 | **Credits:** 3

Course Objectives

- Develop practical proficiency in navigating and utilizing standard statistical software environments (e.g., SPSS, R, or STATA) for public health data.
- Train students in data entry, coding, cleaning, and database management protocols for epidemiological research.
- Enable students to execute descriptive, comparative, and predictive statistical analyses using appropriate software commands.
- Cultivate skills in generating publication-quality data visualizations, graphs, and structured statistical reports.

Course Outcomes: On completion, students will be able to:

- **CO1:** Set up data files, import diverse datasets, and perform data cleaning and transformation procedures within statistical software.
- **CO2:** Generate descriptive statistics, cross-tabulations, and exploratory data visualizations to summarize public health data.
- **CO3:** Execute appropriate parametric and non-parametric hypothesis tests, interpreting the software output accurately.
- **CO4:** Apply correlation, linear, and logistic regression models to health datasets and diagnose model fit.
- **CO5:** Compile analytical outputs into standardized, scientifically rigorous research reports for health policy and program evaluation.

Graduate Attributes Addressed: GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Introduction to Software Environment and Data Management

- Lab Session: Software interface navigation, establishing working directories, and syntax/script basics
- Lab Session: Importing datasets (Excel, CSV, SQL) and understanding variable view vs. data view
- Lab Session: Defining variables, labeling, coding categorical data, and handling missing values
- Lab Session: Data transformation: Computing new variables, recoding, and filtering/splitting files for subgroup analysis

Unit II: Descriptive Statistics and Data Visualization

- Lab Session: Generating descriptive statistics (mean, median, standard deviation, variance, range) and checking data normality

- Lab Session: Creating frequency tables, cross-tabulations, and calculating prevalence/incidence rates
- Lab Session: Exploratory Data Analysis (EDA) using boxplots, histograms, and scatter plots
- Lab Session: Designing publication-quality graphics: Bar charts, line graphs, pie charts, and exporting visualizations

Unit III: Inferential Statistics and Hypothesis Testing

- Lab Session: Executing parametric comparative tests: One-sample, Independent, and Paired t-tests
- Lab Session: Running Analysis of Variance (ANOVA) and conducting post-hoc tests
- Lab Session: Executing non-parametric tests: Chi-square test of independence, Mann-Whitney U, and Kruskal-Wallis tests
- Lab Session: Interpreting p-values, confidence intervals, and effect sizes from software outputs

Unit IV: Predictive Modeling and Advanced Analytics

- Lab Session: Calculating Pearson and Spearman correlation coefficients and generating correlation matrices
- Lab Session: Building and interpreting Simple and Multiple Linear Regression models (checking multicollinearity and residuals)
- Lab Session: Executing Binary Logistic Regression for dichotomous public health outcomes (calculating Odds Ratios)
- Lab Session: Capstone Lab: End-to-end data analysis project—from data cleaning to final statistical report generation

Suggested Readings

- Field, A. *Discovering Statistics Using IBM SPSS Statistics*. 5th ed., SAGE Publications.
- R Core Team. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing.
- Daniel, W.W., & Cross, C.L. *Biostatistics: A Foundation for Analysis in the Health Sciences*. 11th ed., Wiley.

Predictive Health Analytics & EHR Mining

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the foundational architectures of Electronic Health Records (EHR), data interoperability standards, and the role of big data in predictive health.
- Apply data preprocessing, imputation, and feature engineering techniques to resolve complexities and noise in longitudinal clinical datasets.
- Construct and evaluate predictive machine learning models to forecast clinical outcomes, disease onset, and patient risk stratification.
- Analyze unstructured clinical text using Natural Language Processing (NLP) and evaluate the ethical, regulatory, and deployment challenges of algorithmic models in healthcare.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the architecture of Electronic Health Records (EHR) and the fundamental principles of predictive health analytics.

- **CO2:** Apply data cleaning, imputation, and feature extraction techniques specific to structured and unstructured clinical datasets.
- **CO3:** Develop predictive models using supervised and unsupervised machine learning algorithms for health outcome forecasting.
- **CO4:** Analyze unstructured clinical narratives and discharge summaries using Natural Language Processing (NLP) techniques.
- **CO5:** Evaluate predictive model performance, algorithmic bias, data privacy constraints, and real-world clinical deployment strategies.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of EHR Systems and Healthcare Analytics

- Evolution and architecture of Electronic Health Records (EHR), clinical data warehouses, and healthcare databases
- Types of clinical data: Structured (demographics, vitals, labs, billing codes) vs. unstructured data (clinical notes, imaging reports)
- Data interoperability standards in healthcare: HL7, FHIR, and terminology systems (ICD, SNOMED CT, LOINC)
- Introduction to predictive analytics in population health, precision medicine, and clinical decision support systems

Unit II: Data Preprocessing, Feature Engineering, and Cohort Construction

- Challenges of clinical data: Sparsity, missingness, noise, and irregular temporal sampling
- Clinical data imputation techniques and handling censored data in longitudinal patient records
- Electronic phenotyping and rule-based cohort selection for epidemiological studies
- Feature engineering for healthcare: Extracting temporal patterns, aggregating clinical events, and dimensionality reduction

Unit III: Predictive Modeling and Machine Learning in Healthcare

- Supervised learning applications: Predicting hospital readmissions, sepsis onset, and patient mortality (Logistic Regression, Random Forests, Gradient Boosting)
- Unsupervised learning for patient stratification, subtyping, and discovering novel disease phenotypes (K-means, hierarchical clustering)
- Survival analysis and time-to-event modeling using machine learning approaches
- Deep learning in health analytics: Recurrent Neural Networks (RNNs) for modeling temporal EHR sequences

Unit IV: EHR Text Mining, NLP, and Implementation Ethics

- Natural Language Processing (NLP) for clinical text: Tokenization, named entity recognition (NER), and relation extraction
- Mining discharge summaries and nursing notes to extract adverse drug events and social determinants of health (SDOH)
- Model evaluation metrics for imbalanced clinical data: AUROC, AUPRC, Sensitivity, Specificity, and F1-score

- Algorithmic fairness, mitigating bias in predictive models, and ensuring data privacy (HIPAA compliance, de-identification)
- Implementation science: Integrating predictive models into clinical workflows and alerting fatigue management

Suggested Readings

- Reddy, C.K., & Aggarwal, C.C. *Healthcare Data Analytics*. Chapman and Hall/CRC.
- Hoyt, R.E., & Hersh, W.R. *Health Informatics: Practical Guide for Healthcare and Information Technology Professionals*. Informatics Education.
- Esteva, A., et al. *A guide to deep learning in healthcare*. Nature Medicine.

Molecular Epidemiology & Genomics of Pathogens

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain fundamental principles of molecular biology, genomics, and biomarker utilization in epidemiological surveillance.
- Analyze pathogen sequencing technologies, phylogenetics, and genomic epidemiology in outbreak investigations.
- Evaluate molecular mechanisms of antimicrobial resistance (AMR), virulence factor transmission, and host-pathogen interactions.
- Apply genomic data interpretation and bioinformatics tools to public health disease control strategies and contact tracing.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain molecular principles, biomarkers, and genotyping techniques applied to infectious disease epidemiology.
- **CO2:** Apply next-generation sequencing (NGS) and phylogenetic tools to investigate pathogen evolution and outbreaks.
- **CO3:** Analyze genomic drivers of antimicrobial resistance, virulence factor transmission, and host-pathogen interactions.
- **CO4:** Interpret pathogen genomic data for public health surveillance, vaccine development, and contact tracing.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Molecular Epidemiology and Biomarkers

- Principles and historical evolution of molecular epidemiology in public health
- Molecular biomarkers: Susceptibility, exposure, and disease state markers in infectious diseases
- Conventional genotyping techniques: Polymerase Chain Reaction (PCR), Restriction Fragment Length Polymorphism (RFLP), Pulsed-Field Gel Electrophoresis (PFGE), and Multilocus Sequence Typing (MLST)
- Sampling strategies, specimen preservation, and biobanking protocols for genomic epidemiology

Unit II: Pathogen Genomics, Next-Generation Sequencing (NGS), and Phylogenetics

- High-throughput sequencing technologies: Next-Generation Sequencing (NGS), Whole Genome Sequencing (WGS), and metagenomics
- Principles of bioinformatics in pathogen identification, sequence alignment, and variant calling
- Phylogenetic analysis: Building phylogenetic trees, evolutionary distance estimation, and molecular clock models
- Translating genomic sequences into epidemiological intelligence and lineage tracking

Unit III: Molecular Mechanisms of AMR and Pathogen Evolution

- Genetic basis of antimicrobial resistance (AMR): Plasmid-mediated resistance, transposons, and gene mutation pathways
- Surveillance of drug-resistant pathogens: MRSA, MDR/XDR-TB, and carbapenem-resistant Enterobacteriaceae (CRE)
- Mechanisms of pathogen evolution: Recombination, reassortment, antigenic drift, and antigenic shift in viral pathogens
- Host-pathogen interactions, virulence factor profiling, and molecular mechanisms of immune evasion

Unit IV: Genomic Surveillance, Outbreak Investigation, and Public Health Applications

- Integrating genomic data with traditional epidemiological field data (Genomic Epidemiology)
- Application of genomic surveillance in tracing transmission chains and super-spreading events during outbreaks
- Wastewaters and environmental genomic surveillance for early disease detection
- Ethical, legal, and social implications (ELSI) of pathogen genomic data sharing and international biosecurity

Suggested Readings

- Foxman, B. *Molecular Epidemiology*. Academic Press.
- Tang, Y.W., et al. *Molecular Microbiology: Diagnostic Principles and Practice*. 3rd ed., ASM Press.
- Tibayrenc, M. *Genetics and Evolution of Infectious Diseases*. 2nd ed., Elsevier.

Perinatal & Neonatal Health Epidemiology

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Understand epidemiological metrics, determinants, and disease burden associated with perinatal and neonatal health globally and nationally.
- Analyze risk factors for preterm birth, low birth weight, birth asphyxia, neonatal sepsis, and congenital anomalies.
- Evaluate clinical and public health interventions across pre-conception, intrapartum, and immediate postnatal care phases.
- Examine surveillance systems, mortality audit methodologies, and quality improvement frameworks in perinatal care facilities.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain epidemiological measures and global/national burden of perinatal and neonatal mortality and morbidity.

- **CO2:** Analyze biological, socio-environmental, and maternal risk factors contributing to adverse birth outcomes.
- **CO3:** Evaluate evidence-based interventions for essential newborn care, resuscitation, and management of neonatal infections.
- **CO4:** Apply perinatal death audits, surveillance indicators, and quality of care metrics to reduce neonatal mortality.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Epidemiological Foundations of Perinatal and Neonatal Health

- Epidemiology of perinatal and neonatal mortality: Definitions, indicators (PMR, NMR, ENMR, LNMR), and global burden
- Historical trends, Sustainable Development Goal (SDG) targets, and Every Newborn Action Plan (ENAP)
- Physiological transition from intrauterine to extrauterine life and fetal/neonatal vulnerability
- Data sources for perinatal epidemiology: Vital registration, hospital registries, and demographic surveys

Unit II: Determinants and Etiology of Adverse Birth Outcomes

- Preterm birth and Low Birth Weight (LBW): Etiology, risk factors, and long-term neurodevelopmental consequences
- Intrapartum-related events: Birth asphyxia, hypoxic-ischemic encephalopathy (HIE), and obstetric trauma
- Neonatal infections: Epidemiology, risk factors, and prevention of neonatal sepsis, pneumonia, and tetanus
- Congenital anomalies, intrauterine growth restriction (IUGR), and maternal comorbidities (preeclampsia, gestational diabetes)

Unit III: Essential Neonatal Care and Clinical Public Health Interventions

- Essential Newborn Care (ENC) package: Thermal care, hygienic cord care, and immediate exclusive breastfeeding
- Neonatal resuscitation protocols, Special Newborn Care Units (SNCU), and Newborn Stabilization Units (NBSU)
- Care of small and sick newborns: Kangaroo Mother Care (KMC), CPAP respiratory support, and infection control
- Antenatal corticosteroids, maternal immunization, and preconception care for adverse outcome prevention

Unit IV: Perinatal Surveillance, Audit Systems, and Quality Improvement

- Perinatal and Neonatal Death Surveillance and Response (PNDSR) systems and death audit methodologies
- Facility-based quality improvement (QI) initiatives, LaQshya initiative standards, and patient safety
- Community-based newborn care strategies: Home-Based Newborn Care (HBNC) and ASHA worker delivery models
- Ethics in neonatal intensive care, palliative care, and equity in newborn health access

Suggested Readings

- Lawn, J.E., et al. *4 Million Neonatal Deaths: When? Where? Why?*. The Lancet Neonatal Survival Series.
- World Health Organization. *Pocket Book of Hospital Care for Children: Guidelines for the Management of Common Illnesses*. 2nd ed., WHO.
- Kramer, M.S. *Deterministic and Probabilistic Methods in Perinatal Epidemiology*. Oxford University Press.

Epidemiology of Cardiovascular and Metabolic Diseases

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Examine global and national epidemiological transitions, disease burden, and trend patterns of cardiovascular and metabolic disorders.
- Analyze pathophysiological mechanisms, risk factors, and behavioral, genetic, and environmental determinants of cardiometabolic health.
- Evaluate primary, secondary, and tertiary prevention strategies, including screening methodologies and lifestyle interventions.
- Assess health policy frameworks, health system readiness, and public health control programs for cardiometabolic disease management.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain epidemiological trends, distribution, and global burden of cardiovascular diseases, diabetes, and metabolic syndrome.
- **CO2:** Analyze behavioral, metabolic, environmental, and socio-economic risk factors driving cardiometabolic diseases.
- **CO3:** Evaluate population-based screening methodologies, early detection tools, and multi-sectoral lifestyle interventions.
- **CO4:** Assess public health policies, clinical care pathways, and national NCD control frameworks (e.g., NP-NCD).

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Global Burden and Epidemiology of Cardiometabolic Diseases

- Epidemiological transition, global burden of disease (GBD) estimates, and disability-adjusted life years (DALYs) for NCDs
- Epidemiology of Coronary Heart Disease (CHD), stroke, hypertension, and heart failure
- Epidemiology of Type 2 Diabetes Mellitus, gestational diabetes, obesity, and metabolic syndrome
- Geographical variation, urban-rural disparities, and socio-economic differentials in cardiometabolic mortality

Unit II: Risk Factors, Etiology, and Pathophysiology of Cardiometabolic Disorders

- Behavioral risk factors: Unhealthy diet, physical inactivity, tobacco consumption, and harmful alcohol use

- Metabolic and physiological risk factors: Dyslipidemia, raised blood pressure, elevated blood glucose, and adiposity
- Environmental and structural determinants: Air pollution, built environment, stress, and commercial determinants of health
- Life-course approach to cardiometabolic health: Fetal origins of adult disease (Barker hypothesis) and early childhood influences

Unit III: Prevention, Population Screening, and Lifestyle Interventions

- Primordial, primary, secondary, and tertiary prevention strategies for cardiovascular and metabolic conditions
- Population-wide vs. high-risk strategies (Rose's theorem) in cardiometabolic risk reduction
- Screening methodologies: Risk assessment scoring tools (e.g., WHO/ISH risk prediction charts), opportunistic screening, and point-of-care testing
- Evidence-based lifestyle interventions: Dietary modifications, salt reduction policies, physical activity promotion, and smoking cessation

Unit IV: Health Policy, Health Systems, and Programmatic Interventions

- National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD) in India
- WHO HEARTS technical package and PEN (Package of Essential Noncommunicable Disease Interventions)
- Primary healthcare strengthening, Health & Wellness Centres (HWCs), and chronic disease management models
- Regulatory policies: Trans-fat elimination, sugar-sweetened beverage taxation, front-of-pack nutrition labeling, and health system financing

Suggested Readings

- Marmot, M., & Elliott, P. *Coronary Heart Disease Epidemiology: From Aetiology to Public Health*. Oxford University Press.
- World Health Organization. *Global Status Report on Noncommunicable Diseases*. WHO Publications.
- Prabhakaran, D., et al. *Cardiovascular, Respiratory, and Related Disorders*. Disease Control Priorities (DCP3), Vol. 5, World Bank.

Global Health Security and Pandemic Preparedness

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Understand the principles of global health security, International Health Regulations (IHR 2005), and emergency response architectures.
- Analyze threat assessment, early warning systems, disease modeling, and risk communication during public health emergencies.
- Evaluate multi-sectoral coordination, One Health approaches, and supply chain logistics for pandemic response.
- Critically examine global governance, health equity, countermeasure distribution, and post-pandemic recovery frameworks.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain global health security frameworks, IHR compliance, and international epidemic governance architectures.
- **CO2:** Analyze early warning surveillance, risk assessment tools, and epidemic modeling techniques during public health crises.
- **CO3:** Apply One Health strategies, emergency operations protocols, and medical countermeasure logistics for pandemic management.
- **CO4:** Evaluate policies on health equity, global vaccine access, disaster recovery, and health system resilience.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Global Health Security and International Governance

- Concepts and evolution of Global Health Security (GHS), biosecurity, and biodefense
- International Health Regulations (IHR 2005): Core capacities, Public Health Emergencies of International Concern (PHEIC), and Joint External Evaluation (JEE)
- Global health governance architectures: Role of WHO, Africa CDC, BARDA, CEPI, GAVI, and international treaties
- National health security frameworks, emergency legislation, and institutional governance during crises

Unit II: Early Warning Surveillance, Threat Assessment, and Outbreak Analytics

- Global event-based surveillance, digital disease detection, and syndromic early warning networks
- Threat prioritization: WHO R&D Blueprint, Disease X, zoonotic spillover risks, and re-emerging pathogens
- Epidemic data analytics: Estimating reproduction numbers (R_0 and R_t), disease forecasting, and mathematical modeling
- Risk communication, community engagement (RCCE), infodemic management, and combating health misinformation

Unit III: Emergency Response Architecture, One Health, and Logistics Management

- Public Health Emergency Operations Center (PHEOC) structure and Incident Command Systems (ICS)
- One Health surveillance at the human-animal-environmental interface for emerging zoonotic outbreaks
- Supply chain resilience: Procurement, stockpiling, and distribution of Personal Protective Equipment (PPE), diagnostics, and therapeutics
- Non-pharmacological interventions (NPIs): Border controls, quarantines, lockdowns, isolation, and social distancing measures

Unit IV: Health Equity, Countermeasure Access, and Pandemic Resilience

- Access to medical countermeasures: COVAX facility, TRIPS waivers, technology transfer, and local manufacturing capacity
- Vulnerable populations in health emergencies: Refugees, low-income groups, gender-differentiated impacts, and human rights
- Post-pandemic health system recovery, building surge capacity, and resilient health infrastructure

- Financing global health security: Pandemic Fund, emergency contingency funds, and international donor mobilization

Suggested Readings

- World Health Organization. *International Health Regulations (2005)*. 3rd ed., WHO.
- Heymann, D.L. *Control of Communicable Diseases Manual*. 21st ed., American Public Health Association.
- Gostin, L.O. *Global Health Law*. Harvard University Press.

Community Nutritional Assessment and Surveillance

Category: Ms| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Master direct and indirect methods of community nutritional assessment (Anthropometric, Biochemical, Clinical, Dietary - ABCD approach).
- Understand principles of nutritional surveillance, data collection frameworks, and nutritional indicator tracking.
- Analyze malnutrition etiology, micronutrient deficiencies, and food security dynamics across diverse population groups.
- Design and evaluate community nutrition programs, emergency feeding interventions, and national nutrition policies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Apply direct and indirect nutritional assessment methodologies (ABCD approach) to measure community nutritional status.
- **CO2:** Analyze nutritional surveillance systems, national surveys (NFHS, NNMB), and nutritional monitoring indicators.
- **CO3:** Evaluate the etiology, prevalence, and public health impact of protein-energy malnutrition and micronutrient deficiencies.
- **CO4:** Design targeted community nutrition interventions, emergency feeding protocols, and policy strategies.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Methodologies of Community Nutritional Assessment (ABCD Approach)

- Overview of community nutritional assessment: Objectives, scope, and direct vs. indirect assessment techniques
- Anthropometric assessment: Measurement of height, weight, MUAC, head circumference, skinfold thickness, WHO growth standards, z-scores, stunting, wasting, and underweight
- Clinical assessment: Identifying physical signs of nutritional deficiencies (PEM, vitamin A, anemia, iodine deficiency, rickets)
- Biochemical assessment: Laboratory indicators for iron, vitamin A, iodine, zinc, and protein status evaluation

Unit II: Dietary Assessment Methods and Household Food Security

- Dietary assessment methodologies: 24-hour dietary recall, Food Frequency Questionnaires (FFQ), weighment method, and diet history
- Nutrient intake calculation using food composition tables (ICMR-NIN Dietary Guidelines for Indians)
- Measuring household food security, food diversity scores, coping strategies index, and hunger scales
- Socio-economic, cultural, gender, and environmental determinants of community dietary patterns

Unit III: Nutritional Surveillance Systems and National Surveys

- Concepts, objectives, and operational models of National Nutrition Surveillance Systems (NNSS)
- Methodologies and findings of national nutritional surveys in India: National Family Health Survey (NFHS), NNMB, and CNNS
- Key nutritional indicators: Infant and Young Child Feeding (IYCF) indicators, maternal nutrition indicators, and NCD dietary risk metrics
- Data quality control, field team training, standardization of anthropometric measurements, and error reduction

Unit IV: Malnutrition Management, Emergency Interventions, and Nutrition Policies

- Public health management of Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM); Nutrition Rehabilitation Centres (NRC)
- Prevention and control of Micronutrient Deficiencies (HID, IDA, VADD, IDD) through fortification, supplementation, and dietary diversification
- Emergency nutrition management during natural disasters, displacement, and acute food crises
- National nutrition programs and policies: POSHAN Abhiyaan, PM-POSHAN (Mid-Day Meal scheme), Anemia Mukt Bharat, and ICDS services

Suggested Readings

- Gibson, R.S. *Principles of Nutritional Assessment*. 2nd ed., Oxford University Press.
- Jelliffe, D.B., & Jelliffe, E.F.P. *Community Nutritional Assessment*. Oxford University Press.
- Indian Council of Medical Research (ICMR) - National Institute of Nutrition (NIN). *Nutrient Requirements and Dietary Guidelines for Indians*. ICMR-NIN.

Semester VI

Healthcare Informatics

Category: MS| **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain concepts, structural components, data standards, and applications of biomedical and public health informatics.
- Apply health information systems, electronic health records (EHR), interoperability protocols, and digital health technologies to healthcare delivery.
- Analyze health data, clinical decision support systems, artificial intelligence models, and public health surveillance platforms.
- Evaluate ethical, legal, cybersecurity, data privacy, and governance frameworks governing health informatics implementations.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the concepts, components, standards and applications of healthcare informatics within healthcare and public health systems.
- **CO2:** Apply health information systems, electronic health records, interoperability standards and digital health technologies for healthcare delivery and public health decision-making.
- **CO3:** Analyze health data using informatics principles to support surveillance, quality improvement, healthcare management and evidence-based practice.
- **CO4:** Evaluate ethical, legal, privacy, security and governance issues related to health information systems and digital health.
- **CO5:** Design informatics-enabled solutions to improve healthcare quality, patient safety and population health.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Healthcare Informatics, Information Systems, and EHR Standards

- Definition, scope, evolution, and role of biomedical, clinical, and public health informatics in digital healthcare transformation
- Healthcare Data Ecosystem: Components of Health Information Systems (HIS), Hospital Information Systems, Laboratory (LIS), Radiology (RIS), and Pharmacy (PIS) workflows
- Electronic Health Record (EHR), Electronic Medical Record (EMR), and Personal Health Record (PHR) architectures
- Healthcare data interoperability standards: HL7, FHIR, SNOMED CT, ICD, and LOINC terminologies

Unit II: Digital Health Technologies, Health Data Analytics, and Clinical Decision Support

- Digital Health Technologies: Telemedicine, telehealth, mHealth apps, wearable technology, Internet of Medical Things (IoMT), remote patient monitoring, digital therapeutics, and patient portals

- Health Data Analytics: Health databases, data quality assurance, data cleaning, descriptive/predictive analytics, executive dashboards, and visualization tools
- Population health analytics and metrics for tracking healthcare quality indicators
- Clinical Decision Support Systems (CDSS): Decision concepts, AI-assisted clinical tools, Computerized Physician Order Entry (CPOE), alerts, and medication safety integration

Unit III: Public Health Informatics, Artificial Intelligence, and Emerging Technologies

- Public Health Informatics: Disease surveillance systems, immunization registries, outbreak management, GIS mapping, health registries, One Health informatics, and digital epidemiology
- Applications of Artificial Intelligence (AI), Machine Learning (ML), and Natural Language Processing (NLP) in clinical and public health informatics
- Big Data architectures, cloud computing, blockchain for health data exchange, and generative AI applications
- Precision medicine informatics and emerging technological trends in healthcare systems

Unit IV: Privacy, Security, Digital Health Governance, and Implementation Evaluation

- Health Information Security and Ethics: Confidentiality, cybersecurity threats, informed consent, ethical AI principles, and WHO ethical guidelines
- Data Privacy Legislation: Regulatory compliance under the Indian Digital Personal Data Protection (DPDP) Act and international health data protection norms
- Digital Health Policies: Strategic execution of Ayushman Bharat Digital Mission (ABDM), National Digital Health Mission, and WHO Global Digital Health Strategy
- Implementation, Evaluation, and Future Directions: Change management, usability, system performance indicators, precision public health, digital twins, smart hospitals, and learning health systems

Suggested Readings

- Shortliffe, E.H., & Cimino, J. *Biomedical Informatics*. Springer.
- Magnuson, J.A., & Fu, P. *Public Health Informatics and Information Systems*. Springer.

Demography and Population Studies

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the scope, core principles, and primary data sources in demography and public health.
- Calculate and interpret key demographic indicators of fertility, mortality, migration, and population composition.
- Analyze demographic/epidemiological transitions, population aging, and urbanization dynamics on public health outcomes.
- Apply demographic techniques, life tables, standardization, and population forecasting to health planning and policy evaluation.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the concepts, principles, and sources of demographic data and describe population composition, distribution, and dynamics.

- **CO2:** Calculate and interpret demographic measures of fertility, mortality, migration, and population growth for public health assessment.
- **CO3:** Analyze demographic transition, population ageing, urbanization, migration, and their implications for population health.
- **CO4:** Apply demographic tools including population pyramids, life tables, standardization, and population projections in health planning.
- **CO5:** Evaluate demographic evidence for population policies, health programme planning, and monitoring national and global population health indicators.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Demography, Data Sources, and Population Composition

- Definition, scope, and importance of demography; relationship between demography and public health
- Sources of demographic data: Census, Civil Registration System (CRS), Sample Registration System (SRS), NFHS, DHS, and UN databases
- Population size, age-sex composition, dependency ratio, sex ratio, and population distribution
- Determinants of population growth and demographic dynamics

Unit II: Measures of Fertility, Mortality, Migration, and Urbanization

- Fertility measures and indicators, reproductive measures, and total fertility rate interpretation
- Mortality indicators, age-specific death rates, infant and maternal mortality, and life expectancy measures
- Types, patterns, and determinants of population migration
- Urbanization processes, demographic consequences, and health implications for changing populations

Unit III: Demographic Transition, Population Aging, and Analytical Techniques

- Concepts and models of demographic transition and epidemiological transition
- Demographic dividend, population aging, and changing chronic disease/disability patterns
- Demographic techniques: Construction and analysis of population pyramids
- Life table construction, direct/indirect standardization methods, population projections, and forecasting

Unit IV: Population Health Planning, Policy, and Program Evaluation

- National Population Policy frameworks, strategic objectives, and reproductive health policies
- Alignment of population dynamics with Sustainable Development Goals (SDGs)
- Application of demographic data in public health planning, resource allocation, and program implementation
- Monitoring and evaluation of national and global population health indicators

Suggested Readings

- Rowland, D.T. *Demographic Methods and Concepts*. Oxford University Press.

- Weeks, J.R. *Population: An Introduction to Concepts and Issues*. Cengage Learning.
- Preston, S.H., Heuveline, P., & Guillot, M. *Demography: Measuring and Modeling Population Processes*. Blackwell Publishing.
- Siegel, J.S., & Swanson, D.A. *The Methods and Materials of Demography*. Academic Press.

Healthy Ageing and Geriatric Public Health

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain concepts, principles, demographic transitions, and global/national trends in population aging and healthy aging.
- Analyze biological, psychological, social, and environmental determinants, as well as common physical and mental health conditions in older adults.
- Evaluate healthy aging strategies, age-friendly environment frameworks, community-based geriatric care, and long-term support models.
- Assess national policies, welfare acts, community-based interventions, and programmatic frameworks for senior citizens through field learning and case studies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the concepts, principles, and demographic trends related to ageing and healthy ageing.
- **CO2:** Describe the physical, psychological, social, and public health aspects of ageing, including common health problems among older adults.
- **CO3:** Explain strategies for promoting healthy ageing, community-based geriatric care, and national programmes for older adults.
- **CO4:** Apply the principles of healthy ageing and geriatric public health through case studies, community-based approaches, and field learning.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Gerontology, Demography, and Determinants of Aging

- Definitions, concepts, scope, and public health importance of gerontology and healthy aging
- Demographic transition, global/national population aging patterns, and changing dependency metrics
- Physical, psychological, social, and environmental dimensions of human aging
- Social determinants of healthy aging, gender dynamics in later life, and nutrition/lifestyle promotion for older adults

Unit II: Health Conditions, Chronic Diseases, and Geriatric Syndromes

- Communicable and non-communicable disease burden in aging populations
- Geriatric syndromes: Frailty, physical disability, gait impairment, falls, and sensory impairments
- Mental health disorders in old age: Depression, cognitive decline, and dementia
- Social vulnerabilities: Elder abuse, neglect, isolation, and economic insecurity

Unit III: Healthy Aging, Age-Friendly Environments, and Community Care Systems

- Frameworks for healthy aging, active aging, intrinsic capacity, and functional ability
- Developing age-friendly environments, accessible communities, and social participation models
- Community-based geriatric care: Family dynamics, caregiver support, and home-based clinical services
- Long-term care infrastructure, physical rehabilitation models, and end-of-life palliative care

Unit IV: National Policies, Public Health Programs, and Field Applications

- National Programme for Health Care of the Elderly (NPHCE) and National Policy for Senior Citizens
- Statutory protection: Maintenance and Welfare of Parents and Senior Citizens Act
- Global policies: WHO Decade of Healthy Ageing (2021–2030) strategic goals
- Case studies in community elder care and field visits to day care centers, old age homes, or specialized geriatric clinics

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.
- World Health Organization. *World Report on Ageing and Health*. WHO Publications.
- World Health Organization. *Decade of Healthy Ageing: Baseline Report (2021–2030)*. WHO Publications.

Artificial Intelligence in Public Health

Category: MS| **L-T-P:** 2-2-0 | **Credits:** 4

Course Objectives

- Explain fundamental concepts, algorithms, machine learning paradigms, and terminology of AI in health systems.
- Apply AI methodologies to population health datasets, disease surveillance, outbreak forecasting, and geospatial modeling.
- Evaluate AI-driven analytical tools, generative models, and digital technologies for decision support and precision public health.
- Analyze ethical principles, regulatory policies, algorithmic bias, and governance frameworks for responsible AI deployment.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental concepts, techniques, and terminology of Artificial Intelligence and their relevance to public health.
- **CO2:** Apply AI concepts to public health data, surveillance, epidemiological investigations, and decision-making.
- **CO3:** Evaluate AI tools and technologies used for disease prediction, health programme planning, and population health management.
- **CO4:** Analyze ethical, legal, governance, and equity considerations in the development and implementation of AI for public health.
- **CO5:** Critically assess emerging AI innovations and their future role in strengthening public health systems and improving population health outcomes.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Introduction to AI, Machine Learning Paradigms, and Public Health Data Readiness

- Evolution, definitions, scope, and ecosystem of AI in public health; contribution to Sustainable Development Goals (SDGs)
- Machine learning taxonomy: Supervised, unsupervised, and reinforcement learning; neural networks, natural language processing (NLP), and computer vision
- Health data sources and AI readiness: Surveillance feeds, EHRs, disease registries, GIS, and wearable sensor streams
- Data quality, interoperability, FAIR data principles, and data preprocessing workflows
- Practical/Lab: Exploratory data preprocessing, dataset cleaning, and data readiness assessment for AI pipelines

Unit II: Core Public Health Applications, Disease Surveillance, and AI Tools

- AI in core functions: Automated disease surveillance, early outbreak detection, epidemic forecasting, and risk prediction
- Predictive modeling, decision support systems, health needs assessment, and resource optimization
- Practical AI tools: NLP text mining, conversational agents/chatbots, computer vision for diagnostic imaging, and geospatial AI
- Generative AI applications: Automated literature synthesis, evidence extraction, and scientific report drafting
- Practical/Lab: Demonstrations and hands-on exercises with public health predictive tools, dashboard analytics, and geospatial mapping

Unit III: Precision Public Health Research, Ethics, and Responsible AI

- Precision public health: High-risk group identification, social determinants of health analytics, and environmental risk tracking
- Digital epidemiology, genomics integration with AI, and implementation evaluation of AI interventions
- Ethics and Responsible AI: Model transparency, Explainable AI (XAI), algorithmic bias, fairness, and accountability
- Patient privacy protection, data security, informed consent protocols, and WHO AI ethics principles
- Practical/Lab: Evaluating algorithmic bias, privacy risks, and fairness metrics across public health datasets

Unit IV: Policy, Regulation, Model Validation, and Emerging Horizons

- Digital health governance: WHO Global Strategy on Digital Health, India's National Strategy for AI, and ABDM integration
- Regulatory considerations, validation frameworks, implementation barriers, and scalability in LMICs
- Performance evaluation: Validation metrics, cost-effectiveness, and human-in-the-loop AI workflows
- Emerging horizons: Foundation models, federated learning, digital twins, wearable AI, IoMT, and planetary health intelligence

- Practical/Lab: Case study evaluation of real-world AI public health deployment plans and validation models

Suggested Readings

- Bohr, A., & Memarzadeh, K. *Artificial Intelligence in Healthcare*. Academic Press.
- Russell, S., & Norvig, P. *Artificial Intelligence: A Modern Approach*. Pearson.

Summer Internship: Community Outreach Programme

Category: Experiential Learning / Internship (INT) | **L-T-P:** 0-0-8 | **Credits:** 4

Course Objectives

- Engage directly with communities to conduct health needs assessments, socio-demographic profiling, and situational analyses.
- Design and execute evidence-based health outreach activities, health education campaigns, and community interventions.
- Collaborate with primary health facilities, non-governmental organizations, local government bodies, and community leaders.
- Synthesize field practice experiences into structured technical reports, reflecting on healthcare access barriers, health behavior, and outreach impact.

Course Outcomes: On completion, students will be able to:

- **CO1:** Appraise community health dynamics, socio-cultural determinants, and healthcare access barriers through immersive field placement.
- **CO2:** Conduct primary health needs assessments using quantitative surveys, qualitative inquiries, and participatory appraisal tools.
- **CO3:** Design and execute culturally tailored health awareness campaigns, IEC/BCC interventions, and community engagement drives.
- **CO4:** Collaborate effectively with local healthcare infrastructure, frontline health workers, and non-governmental stakeholders.
- **CO5:** Compile a professional field internship portfolio, logbook, and technical analytical report for dissemination.

Graduate Attributes Addressed: GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA5 (Communication & Interpersonal Skills), GA8 (Social Responsibility & Global Citizenship), GA9 (Leadership & Teamwork), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Field Orientation, Preparation, and Community Profiling

- Fieldwork preparation: Objectives, ethical guidelines, field safety protocols, and cultural sensitivity training
- Community rapport building and initial entry strategies with local leaders, administrative bodies, and health workers
- Designing community profiling instruments: Socio-economic questionnaires, household rosters, and resource mapping tools
- Field logbook setup, workplan scheduling, and daily reporting mechanisms under field supervision

Unit II: Community Health Needs Assessment and Participatory Diagnostics

- Execution of household demographic, environmental, and health-seeking behavior surveys
- Conducting Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) with community members and local health workers
- Application of Participatory Rural Appraisal (PRA) / Participatory Urban Appraisal (PUA) tools in field settings
- Prioritization of community health issues, disease vulnerabilities, and local environmental sanitation hazards

Unit III: Field Outreach Execution, Health Campaigns, and Stakeholder Engagement

- Designing and pre-testing Information, Education, and Communication (IEC) / Behavioral Change Communication (BCC) materials
- Planning and executing targeted health promotion drives (e.g., maternal-child health, nutrition, hygiene, NCD awareness)
- Collaborative activities with Primary Health Centres (PHCs), Health & Wellness Centres, ASHA workers, and Anganwadi staff
- Assisting in organizing health screening camps, immunization mobilization drives, or community health days

Unit IV: Field Data Synthesis, Evaluation, Portfolio Development, and Presentation

- Qualitative and quantitative field data analysis, outcome tracking, and intervention reflection
- Documentation of field logbooks, detailed case studies, narrative reflections, and community profiles
- Compilation of the comprehensive Summer Internship / Community Outreach Technical Report
- Defense presentation, poster showcase, and dissemination of outreach findings to academic faculty and field supervisors

Suggested Readings

- World Health Organization. *Working with Individuals, Families and Communities to Improve Maternal and Newborn Health*. WHO Publications.
- Ministry of Health and Family Welfare (MoHFW), Government of India. *Guidelines for Community Processes and ASHA Integration*. MoHFW.
- Mukherji, N. *Participatory Learning and Action: With Activities on Water and Sanitation*. Concept Publishing Company.

Big Data Analytics and Cloud Computing

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives:

- Explain big data characteristics, cloud computing paradigms, and health data storage architectures.
- Apply distributed processing frameworks and analytics pipelines to extract insights from large-scale health datasets.
- Evaluate cloud-based health data architectures, data lakes, and scalable computing platforms.
- Assess data security, privacy compliance, and regulatory governance in cloud-based big data implementations.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain big data characteristics, cloud delivery models, and health data storage architectures.
- **CO2:** Apply distributed computing frameworks and analytical pipelines to process large-scale public health data.
- **CO3:** Evaluate cloud infrastructure, data lake designs, and scalable computing platforms for health analytics.
- **CO4:** Assess cybersecurity, data privacy regulations, and governance protocols in cloud big data environments.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Big Data Fundamentals and Health Data Architectures

- Dimensions of big data in public health: Volume, Variety, Velocity, Veracity, and Value (5 Vs)
- Sources of big health data: EHRs, genomic sequencing, wearable sensors, digital surveillance, and claims databases
- Distributed storage and file systems: Hadoop Distributed File System (HDFS), object storage, and relational vs. NoSQL databases
- Data warehousing vs. Data Lakes: Architectures for structuring heterogeneous health data

Unit II: Cloud Computing Infrastructure and Health Platforms

- Cloud computing service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
- Deployment models: Public, private, hybrid, and multi-cloud health architectures
- Overview of major enterprise cloud platforms in health analytics (e.g., AWS, Microsoft Azure, Google Cloud)
- Serverless computing, virtual machinery, and scalable resource provisioning for high-performance processing

Unit III: Big Data Analytics and Distributed Processing Pipelines

- Distributed computing frameworks: Apache Spark, MapReduce, and batch vs. real-time stream processing
- Predictive analytics and scalable machine learning on big health data
- Natural Language Processing (NLP) at scale for processing clinical notes and medical literature
- Designing analytical workflows, real-time public health dashboards, and query optimization

Unit IV: Cloud Governance, Cybersecurity, Privacy, and Health Applications

- Data security and encryption protocols (at rest and in transit) in cloud environments
- Regulatory compliance: HIPAA, GDPR, and Indian Digital Personal Data Protection (DPDP) Act standards
- Anonymization, de-identification, and synthetic data generation techniques for public health research

- Case studies in cloud-based pandemic tracking, population-scale genomic analysis, and predictive healthcare operations

Suggested Readings

- Reddy, C.K., & Aggarwal, C.C. *Healthcare Data Analytics*. Chapman and Hall/CRC.
- Buyya, R., Vecchiola, C., & Selvi, S.T. *Mastering Cloud Computing: Foundations and Applications Programming*. Morgan Kaufmann.
- Dinov, I.D. *Data Science and Predictive Analytics: Biomedical and Health Applications using R*. Springer.

Antimicrobial Resistance and Stewardship

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain mechanisms, biological pathways, and drivers of antimicrobial resistance (AMR) across human, animal, and environmental domains.
- Analyze AMR surveillance networks, diagnostic tools, and consumption monitoring systems.
- Apply principles of Antimicrobial Stewardship Programs (ASP) in clinical, outpatient, and community settings.
- Evaluate One Health policy frameworks, global strategies, and regulatory measures to curb drug resistance.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the biological mechanisms, evolutionary pressure, and multi-sectoral drivers of antimicrobial resistance.
- **CO2:** Analyze national and global AMR surveillance architectures, diagnostic tools, and consumption data.
- **CO3:** Apply Antimicrobial Stewardship Program (ASP) strategies across primary, secondary, and tertiary care facilities.
- **CO4:** Evaluate One Health policy interventions, regulatory frameworks, and global action plans against AMR.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Biological Foundations, Mechanisms, and Drivers of AMR

- Introduction to antimicrobial resistance: History, taxonomy of antimicrobials, intrinsic vs. acquired resistance
- Molecular mechanisms of resistance: Enzymatic degradation, efflux pumps, target modification, and gene transfer (plasmids, transposons)
- Drivers of AMR: Over-prescribing, self-medication, non-adherence, agricultural/livestock overuse, and pharmaceutical waste
- Global burden of AMR: Mortality estimates, economic costs, and impact on modern medicine and surgery

Unit II: AMR Surveillance, Diagnostics, and Monitoring Systems

- Global and national surveillance networks: WHO GLASS, ICMR AMR Surveillance Network, and CDC AR Network
- Laboratory diagnostic tools: Susceptibility testing (disk diffusion, MIC), rapid molecular assays, and point-of-care diagnostics
- Monitoring antimicrobial consumption and use: Defined Daily Doses (DDD), point prevalence surveys, and pharmacy sales data
- Environmental surveillance: Detecting resistant genes and drug residues in wastewater, soil, and food chains

Unit III: Antimicrobial Stewardship Programs (ASP) in Practice

- Core elements of hospital Antimicrobial Stewardship Programs: Multidisciplinary teams, leadership, and audit-feedback loops
- WHO AWaRe classification of antibiotics (Access, Watch, Reserve) and clinical treatment guidelines
- Behavioral interventions, prescriber education, diagnostic stewardship, and infection prevention and control (IPC)
- Community stewardship: Public awareness campaigns, regulation of over-the-counter sales, and patient communication

Unit IV: One Health Governance, Policy, and Future Solutions

- The One Health paradigm: Intersecting human, animal, food production, and environmental AMR pathways
- National Action Plan on AMR (NAP-AMR) in India and alignment with the WHO Global Action Plan
- Regulatory frameworks: Banning non-therapeutic growth promoters in livestock, effluent discharge standards
- Innovations: Novel antibiotic pipelines, alternative therapies (phage therapy, monoclonal antibodies), vaccines, and economic incentive models

Suggested Readings

- World Health Organization. *Global Action Plan on Antimicrobial Resistance*. WHO Publications.
- Gould, I.M., & van der Meer, J.W. *Antimicrobial Stewardship*. CABI.
- Indian Council of Medical Research. *AMR Surveillance Network Annual Reports*. ICMR.

Adolescent Reproductive Health and Interventions

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Understand the socio-biological, psychological, and rights-based aspects of adolescent growth and development.
- Analyze major sexual and reproductive health (SRH) issues facing adolescents globally and nationally.
- Evaluate adolescent-friendly health service delivery models, school programs, and peer-led interventions.
- Design gender-transformative, evidence-based adolescent health policies and community outreach interventions.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain socio-biological, psychological, and rights-based foundations of adolescent sexual and reproductive health.
- **CO2:** Analyze key challenges in adolescent SRH, including early pregnancy, STIs/HIV, menstrual health, and gender-based violence.
- **CO3:** Evaluate Adolescent Friendly Health Services (AFHS), school health frameworks, and peer-led education models.
- **CO4:** Design evidence-based, gender-transformative adolescent health interventions and policy frameworks.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Biological, Psychological, and Social Dimensions of Adolescence

- Definitions, developmental stages (early, middle, late adolescence), and demographic profile of adolescents
- Pubertal physiology, neurodevelopmental changes, risk-taking behavior, and cognitive maturation
- Rights-based approach to adolescent health: Autonomy, evolving capacities, informed consent, and confidentiality
- Social determinants: Gender norms, socio-economic status, peer influence, cultural taboos, and media influence

Unit II: Key Adolescent Sexual and Reproductive Health Issues

- Unintended adolescent pregnancy, unsafe abortion, maternal mortality among young mothers, and contraceptive access
- Sexually Transmitted Infections (STIs) and HIV burden, prevention, screening, and treatment pathways
- Menstrual Health and Hygiene Management (MHM): Infrastructure, stigma, products, and school absenteeism
- Gender-Based Violence (GBV), early and child marriage, sexual coercion, and mental health linkages

Unit III: Programmatic Delivery Models and Adolescent Friendly Health Services

- Adolescent Friendly Health Clinics (AFHCs) standards: Accessibility, acceptability, equity, and quality care
- Rashtriya Kishor Swasthya Karyakram (RKSK) strategic pillars and implementation mechanisms
- Comprehensive Sexuality Education (CSE), school health and wellness programs, and curriculum integration
- Community mobilization and peer-led education models: Recruitment, training, and supervision

Unit IV: Policy Frameworks, Digital Innovations, and Program Evaluation

- Legal frameworks: Protection of Children from Sexual Offences (POCSO) Act, legal age of marriage, and health access implications
- Digital health innovations for youth: Tele-counselling, mobile applications, and online health platforms

- Designing gender-transformative interventions, engaging boys and young men in SRH promotion
- Monitoring indicators, evaluating youth program impact, and addressing marginalized adolescent sub-groups

Suggested Readings

- World Health Organization. *Global Standards for Quality Health Care Services for Adolescents*. WHO.
- Ministry of Health and Family Welfare (MoHFW), Government of India. *Rashtriya Kishor Swasthya Karyakram (RKSK) Strategy Handbook*. MoHFW.
- Chandra-Mouli, V., et al. *Making Health Services Adolescent Friendly*. World Health Organization.

Cancer Epidemiology

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:**

Course Objectives

- Explain the global and national descriptive epidemiology, incidence, mortality, and survival trends of major cancers.
- Analyze environmental, genetic, behavioral, and infectious etiologies of carcinogenesis.
- Evaluate population screening methodologies, early detection tools, and cancer registry operations.
- Assess national cancer control programs, preventive measures, and health system care pathways.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain global and national cancer incidence, mortality, survival metrics, and descriptive trends.
- **CO2:** Analyze environmental, lifestyle, genetic, and infectious causes of major cancer types.
- **CO3:** Evaluate cancer screening protocols, population registry operations, and early detection programs.
- **CO4:** Assess cancer prevention policies, National NCD control frameworks, and care continuum integration.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Descriptive Epidemiology and Biology of Cancer

- Principles of cancer biology: Multistage carcinogenesis, oncogenes, tumor suppressor genes, and metastasis
- Descriptive measures in cancer epidemiology: Age-standardized rates, cumulative risk, DALYs, and survival metrics
- Global burden of cancer (GLOBOCAN estimates) and national incidence patterns in India
- Cancer registries: Population-Based Cancer Registries (PBCR) vs. Hospital-Based Cancer Registries (HBCR) operations

Unit II: Etiology and Risk Factors of Major Cancers

- Behavioral and lifestyle risk factors: Tobacco (smokeless and smoked), alcohol consumption, diet, obesity, and physical inactivity
- Infectious agents and oncogenesis: Human Papillomavirus (HPV), Hepatitis B & C viruses, *Helicobacter pylori*, and EBV
- Environmental and occupational exposures: Air pollution, radiation (UV, ionizing), asbestos, pesticides, and industrial chemicals
- Genetic susceptibility, family history, and gene-environment interactions in cancer risk

Unit III: Prevention, Population Screening, and Early Detection

- Primary prevention strategies: Vaccination (HPV, HBV), tobacco control laws (COTPA), lifestyle promotion, and occupational safety
- Principles of population screening: Lead time bias, length bias, sensitivity, specificity, and positive predictive value
- Screening methodologies for major cancers:
    - Cervical Cancer: Visual Inspection with Acetic Acid (VIA), Pap smear, and HPV DNA testing
    - Breast Cancer: Clinical Breast Examination (CBE) and mammography
    - Oral Cancer: Visual oral screening and self-examination
- Early detection frameworks, diagnostic delays, and community awareness strategies

Unit IV: Health Systems, Cancer Control Policies, and Palliative Care

- National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD) cancer control strategies
- Infrastructure for cancer care: Daycare chemotherapy centers, radiotherapy networks, and tertiary cancer centers
- Palliative care epidemiology: Pain management, quality of life metrics, and home-based palliative care integration
- Health economics of cancer care: Financial catastrophe, universal health coverage benefits (Ayushman Bharat / PM-JAY), and equity

Suggested Readings

- Adami, H.O., Hunter, D., & Trichopoulos, D. *Textbook of Cancer Epidemiology*. Oxford University Press.
- Thun, M.J., et al. *Schottenfeld and Fraumeni Cancer Epidemiology and Prevention*. 4th ed., Oxford University Press.
- National Center for Disease Informatics and Research (NCDIR-ICMR). *Report on National Cancer Registry Programme*. ICMR.

Climate Resilient Health Systems

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain frameworks, transmission pathways, and operational components of climate-resilient health systems.
- Apply vulnerability assessment methodologies and early warning mechanisms to evaluate climate risks in health infrastructure.
- Formulate strategies for sustainable healthcare infrastructure, low-carbon supply chains, and environmental resource efficiency.

- Evaluate health emergency preparedness plans and international/national climate policy governance frameworks.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the conceptual frameworks and operational building blocks of climate-resilient health systems.
- **CO2:** Apply Vulnerability and Adaptation (V&A) assessments and early warning mechanisms to manage climate risks.
- **CO3:** Formulate strategies for building environmentally sustainable, low-carbon health facilities and green supply chains.
- **CO4:** Evaluate climate emergency response plans, national policy frameworks, and international financing mechanisms.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Frameworks for Climate-Resilient Health Systems

- WHO Guidance for Climate-Resilient Health Systems: Core concepts, building blocks, and adaptation pathways
- Transmission pathways: Direct impacts (heatwaves, floods) and indirect impacts (vector distribution, water contamination, food supply)
- Climate risk concepts: Hazards, exposure, vulnerability, adaptive capacity, and health system shocks
- Integrating climate resilience into universal health coverage (UHC) and primary healthcare strengthening

Unit II: Vulnerability Assessment, Surveillance, and Early Warning

- Conducting Climate Change Vulnerability and Adaptation (V&A) assessments for health facilities and regions
- Climate-informed early warning systems (EWS) for extreme heat, floods, vector-borne outbreaks, and air pollution spikes
- Syndromic environmental surveillance, real-time monitoring, and GIS spatial modeling
- Assessing community vulnerability, social determinants of climate exposure, and local adaptation capacity

Unit III: Resilient Infrastructure, Sustainable Resources, and Decarbonization

- Structural and non-structural resilience of healthcare facilities: Structural integrity, flood defenses, and microgrids
- Energy resilience: Solar power integration, cold chain security, and uninterrupted clean power supply
- Water security, sanitation, and sustainable waste management in health facilities during climate emergencies
- Decarbonizing healthcare: Calculating facility carbon footprints, green procurement, and environmentally sustainable operations

Unit IV: Preparedness, Policy Governance, and Climate Financing

- Disaster Risk Reduction (DRR), Heat Action Plans (HAPs), and mass casualty management protocols

- National governance: National Action Plan on Climate Change (NAPCC) and National Programme on Climate Change and Human Health (NPCCHH)
- International climate agreements and global reporting: Paris Agreement, NDCs, COP health commitments, and Sendai Framework
- Accessing climate financing for health: Green Climate Fund (GCF), Adaptation Fund, and multilateral donor mobilization

Suggested Readings

- World Health Organization. *WHO Guidance for Climate-Resilient and Environmentally Sustainable Health Facilities*. WHO.
- World Health Organization. *Operational Framework for Building Climate Resilient Health Systems*. WHO.
- Health Care Without Harm. *Global Road Map for Healthcare Decarbonization*. HCWH.

Public Health Nutrition Policies and Food Security

Category: MS| **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain the dimensions of food and nutrition security, food systems architecture, and sustainable dietary frameworks.
- Analyze national and global nutrition policies, regulatory strategies, and legal frameworks governing food access.
- Evaluate food safety standards, large-scale fortification programs, and quality assurance mechanisms.
- Design multi-sectoral public health interventions to address malnutrition, food insecurity, and dietary risks.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the multidimensional concepts of food security, nutrition security, and food systems dynamics.
- **CO2:** Analyze national and global public health nutrition policies, legal mandates, and social safety net programs.
- **CO3:** Evaluate food safety regulations, fortification policies, and quality assurance mechanisms.
- **CO4:** Design multi-sectoral strategies to combat malnutrition, micronutrient deficiencies, and food insecurity.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Food Security, Nutrition, and Food Systems

- Four pillars of food security: Availability, Access, Utilization, and Stability; concepts of nutrition security
- Global and national food systems architecture: Agricultural production, supply chains, food processing, and retail environments
- Sustainable diets, climate change impacts on food security, crop yield, and nutrient density

- Double burden of malnutrition: Coexistence of undernutrition, micronutrient deficiencies, and overnutrition/obesity

Unit II: Public Health Nutrition Policies and National Safety Nets

- Strategic analysis of national policies: National Nutrition Strategy, POSHAN Abhiyaan (National Nutrition Mission), and Anemia Mukt Bharat
- Statutory food safety nets: National Food Security Act (NFSA 2013), Targeted Public Distribution System (TPDS), and Fair Price Shops
- Child and maternal nutrition schemes: Integrated Child Development Services (ICDS) and PM-POSHAN (Mid-Day Meal Scheme)
- Global policy mandates: UN Decade of Action on Nutrition, WHO Global Nutrition Targets 2025, and Sustainable Development Goal 2 (Zero Hunger)

Unit III: Food Safety, Standards, Fortification, and Regulatory Governance

- Regulatory governance: Food Safety and Standards Authority of India (FSSAI) role, mandates, and enforcement mechanisms
- Large-scale food fortification strategies: Fortification of salt (Iodine/Iron), milk/oil (Vitamins A & D), and rice/wheat (Folic acid, B12, Iron)
- Biofortification, food adulteration prevention, consumer protection, and front-of-pack nutrition labeling (FOPNL)
- Trans-fat elimination regulations, marketing controls on unhealthy food targeting children, and food labeling standards

Unit IV: Multi-Sectoral Interventions, Emergency Nutrition, and Evaluation

- Nutrition-sensitive vs. nutrition-specific public health interventions across the life course
- Emergency nutrition management during natural disasters, displacement, economic shocks, and famine response
- Agriculture-nutrition pathways, local food sovereignty, and community-led food security initiatives
- Monitoring and evaluating public health nutrition programs, survey data analysis (NFHS, NNMB), and implementation research

Suggested Readings

- Edelstein, S. *Nutrition in Public Health: Principles, Policies, and Practice*. 4th ed., Jones & Bartlett Learning.
- Food Safety and Standards Authority of India (FSSAI). *Food Safety and Standards Act, Rules & Regulations*. Government of India.
- International Food Policy Research Institute (IFPRI). *Global Nutrition Report*. IFPRI.

Semester VII

Global Health Governance and Diplomacy

Category: Major Core (MC) | **L-T-P:** 3-1-0 | **Credits:** 4

Course Objectives

- Explain the scope, origins, organization, and functioning of international health systems and global health challenges.
- Analyze the role of global health diplomacy, soft/hard power, and international institutions in advancing Sustainable Development Goals (SDGs).
- Evaluate classical Westphalian negotiations, regional health diplomacy, and public-private partnerships in global health governance.
- Apply negotiation, cross-cultural competencies, advocacy, and strategic communication skills in transnational health cooperation.

Course Outcomes: On completion, students will be able to:

- **CO1:** Gain an understanding of the origins, organization, and functioning of international healthcare systems and cross-border health issues.
- **CO2:** Compare global healthcare systems to critically analyze varied healthcare challenges, successes, and failures across countries.
- **CO3:** Critically analyze the role of diplomacy, intergovernmental organizations, and public-private partnerships in an evolving global health sector.
- **CO4:** Apply negotiation, cross-cultural, and advocacy skills to advance global health diplomacy and the Sustainable Development Goals (SDGs).

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA5 (Communication & Interpersonal Skills), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Global Health, Globalization, and Health Systems

- Global health scope, relevance, MDGs, SDGs, and health issues transcending national boundaries
- Cultural, political, social, and economic processes of globalization affecting health
- Role and contributions of international health agencies and public health programs
- Growth and public health dimensions of international health tourism

Unit II: Global Health Diplomacy, Key Concepts, and Institutional Frameworks

- Origins, trajectory, meaning, and key actors/stakeholders in global health diplomacy
- Core concepts: Soft/hard power, healthscapes, epidemics, pandemics, and globalization dynamics
- Intergovernmental institutions: UN agencies (WHO, UNAIDS, UNICEF), Red Cross, and Bretton Woods institutions (World Bank)
- Regulatory frameworks, accountability, transparency, humanitarian crisis management (refugees, displaced persons), and pharmaceutical lobbying

Unit III: Public-Private Partnerships, Bilateral Negotiations, and Regionalism

- Global private philanthropies and public-private partnerships (e.g., MSF, Oxfam, Bill & Melinda Gates Foundation, GAVI)
- Classical Westphalian negotiations: Bilateral and multilateral treaties at regional and global levels

- Regionalism in health diplomacy: ASEAN, EU, BRICS, SCO, and IORA frameworks
- Transnational bilateral cooperation across governmental, corporate, research, and logistics sectors

Unit IV: Strategic Diplomacy Skills, South-South Cooperation, and 2030 Agenda

- Negotiation methodologies, diplomatic tactics, and strategy formulation
- Cross-cultural competencies, advocacy strategies, and public health communication
- Role of global health diplomacy in advancing the 2030 Agenda for Sustainable Development
- South-South and North-South-South cooperation models in global health governance

Suggested Readings

- Johnson, J.A., & Stoskopf, C. *Comparative Health Systems: Global Perspective for 21st Century*. Jones and Bartlett Publishers.
- Pillay, Y., & Holtz, T.H. *Textbook of International Health: Global Health in a Dynamic World*. 3rd ed., Oxford University Press.
- Basch, P.F. *Textbook of International Health*. Oxford University Press.
- Skolnik, R. *Global Health 101*. 2nd ed., Jones & Bartlett Learning.
- Merson, M., & Robert, E. *Global Health: Disease, Programmes, Systems and Policies*. 3rd ed., Jones & Bartlett Learning.

Introduction to Entrepreneurship

Category: Ability Enhancement Course (AEC) | **L-T-P:** 2-2-0 | **Credits:** 4

Course Objectives

- Explain concepts, characteristics, and ecosystem of entrepreneurship and innovation in healthcare.
- Apply design thinking and opportunity recognition methodologies to address community and public health challenges.
- Develop business models, value propositions, and prototypes for social and health enterprises.
- Evaluate startup support ecosystems, intellectual property rights, funding channels, and ethical pitching strategies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental concepts, characteristics, and ecosystem of entrepreneurship and innovation.
- **CO2:** Identify community and public health problems that can be addressed through entrepreneurial and innovative approaches.
- **CO3:** Apply basic entrepreneurial tools to develop feasible solutions for healthcare and social challenges.
- **CO4:** Explain the role of entrepreneurship support systems, legal frameworks, ethics, and intellectual property in venture development.
- **CO5:** Develop and effectively communicate a socially relevant entrepreneurial idea addressing a healthcare or community need.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA6 (Entrepreneurial Mindset & Innovation), GA9 (Leadership & Teamwork)

Unit I: Entrepreneurship Fundamentals and Public Health Opportunities

- Concepts and characteristics of entrepreneurship; entrepreneur vs. manager dynamics
- Entrepreneurial mindset and its role in social and economic development
- Entrepreneurship ecosystem, drivers, and innovation landscapes
- Entrepreneurial opportunities across healthcare delivery and public health sectors

Unit II: Creativity, Design Thinking, and Social Entrepreneurship

- Creativity, innovation processes, and design thinking frameworks
- Identifying community health problems, opportunity recognition, and idea generation techniques
- Social entrepreneurship concepts, SDG alignment, and community development
- Innovations in digital health, preventive care, sanitation, nutrition, and environmental health enterprises

Unit III: Business Model Generation and Venture Feasibility

- Formulating value propositions and customer segment identification
- Business Model Canvas (BMC) application for health ventures
- Market needs assessment, feasibility analysis, and problem-solving strategies
- Prototype development, MVP testing, and operational planning

Unit IV: Support Ecosystems, Legal-Ethical Frameworks, and Pitching

- Startup support programs: Startup India, Atal Innovation Mission, MSME support, incubators, and accelerators
- Funding basics, Intellectual Property Rights (IPR), regulatory compliance, and business ethics
- Leadership, teamwork, networking, and strategic negotiation skills
- Preparing, structuring, and delivering compelling entrepreneurial pitches

Suggested Readings

- Drucker, P.F. *Innovation and Entrepreneurship*. Harper Business.
- Ries, E. *The Lean Startup*. Crown Business.
- Osterwalder, A., & Pigneur, Y. *Business Model Generation*. Wiley.

Health Economics and Financing

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain micro/macro-economic concepts, health economics principles, and disease economic burdens.
- Apply economic evaluation methods (CEA, CBA, CUA) to healthcare interventions and public health programs.
- Analyze healthcare financing mechanisms, financial risk protection, Universal Health Coverage, and insurance frameworks.
- Evaluate resource allocation tools, National Health Accounts, public-private partnerships, and health financing policies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the basic concepts, principles, and terminology of health economics, including the economic burden of disease.

- **CO2:** Describe healthcare financing mechanisms and apply economic evaluation methods in healthcare.
- **CO3:** Explain health insurance systems, public–private partnerships, and national and global health financing initiatives.
- **CO4:** Apply principles of health economics and financing to analyze public health programmes and real-world case studies.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Health Economics and Disease Burden
- Micro and macro-economics concepts, scope, and importance of health economics
- Healthcare cost classification: Direct, indirect, and intangible costs
- Measuring economic burden of disease, Out-of-Pocket Expenditure (OOPE), and catastrophic health expenditure
- Demand and supply dynamics in health services markets

Unit II: Economic Evaluation Methodologies in Healthcare
- Principles and steps of economic evaluation in health interventions
- Cost Analysis and Cost-Effectiveness Analysis (CEA)
- Cost-Benefit Analysis (CBA) and Cost-Utility Analysis (CUA)
- Quality-Adjusted Life Years (QALYs) and Disability-Adjusted Life Years (DALYs) in economic appraisal

Unit III: Health Financing Systems, Insurance, and Risk Protection
- Health financing concepts, objectives, and revenue sources (tax-based, private, donor funding)
- Health insurance mechanics, risk pooling, and financial risk protection mechanisms
- Universal Health Coverage (UHC) frameworks and implementation of Ayushman Bharat–PM-JAY
- Public-Private Partnerships (PPP) in healthcare: Models, advantages, challenges, and service delivery roles

Unit IV: National Accounts, Resource Allocation, and Global Initiatives
- Health expenditure analysis and National Health Accounts (NHA) methodology
- Priority setting, resource allocation, and budgeting in health systems
- National health financing policies in India and WHO health financing frameworks
- Health financing alignment with Sustainable Development Goals (SDGs) and real-world case analyses

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. 28th ed., Banarsidas Bhanot Publishers.
- Bhattacharya, J., Hyde, T., & Tu, P. *Health Economics*. 3rd ed., Red Globe Press.
- Drummond, M.F., Sculpher, M.J., Claxton, K., Stoddart, G.L., & Torrance, G.W. *Methods for the Economic Evaluation of Health Care Programmes*. 4th ed., Oxford University Press.

Public Health Nutrition

Category: Major Core (MC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Explain concepts, determinants, dietary requirements, and nutrition transitions across population groups.
- Apply nutritional assessment methodologies, epidemiological tools, and surveillance systems to evaluate population nutritional status.
- Analyze undernutrition, micronutrient deficiencies, and nutrition-related non-communicable diseases across the life course.
- Design and evaluate nutrition policies, community-based interventions, food safety programs, and emergency nutrition responses.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the principles, determinants and concepts of public health nutrition and their application to population health.
- **CO2:** Apply methods of nutritional assessment, nutritional epidemiology and surveillance to assess the nutritional status of populations.
- **CO3:** Analyze the epidemiology, determinants and prevention of malnutrition and nutrition-related disorders across the life course.
- **CO4:** Evaluate the role of nutrition in preventing and controlling communicable and non-communicable diseases through evidence-based public health interventions.
- **CO5:** Design, implement and evaluate nutrition programmes, policies and community-based interventions to improve population nutritional status.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations, Requirements, and Nutritional Assessment

- Concepts, scope, and determinants of public health nutrition; nutrition transition and double burden of malnutrition
- Macronutrients, micronutrients, Dietary Reference Intakes (EAR, RDA, AI, UL), and dietary guidelines across the life course
- Nutritional assessment methods: Anthropometric, biochemical, clinical, dietary, and functional indicators
- Nutritional epidemiology, dietary surveys, nutrition surveillance, and National Nutrition Survey data analysis

Unit II: Malnutrition Spectrum, Life-Course Nutrition, and NCDs

- Protein-energy malnutrition (PEM), micronutrient deficiencies (Anaemia, Vitamin A, Iodine, Zinc), food fortification, and supplementation
- Maternal and child nutrition: Fetal programming (DOHaD), breastfeeding, Infant and Young Child Feeding (IYCF), and adolescent nutrition
- Nutrition in non-communicable diseases: Obesity, diabetes, cardiovascular disease, hypertension, and cancer epidemiology
- Healthy dietary patterns, physical activity integration, and food environment interventions

Unit III: Food Safety, Security, Programs, and Governance

- Food safety principles, FSSAI regulations, food labeling, biofortification, and sustainable food systems
- National Nutrition Policies and flagship programs: POSHAN Abhiyaan, ICDS, PM-POSHAN, Anaemia Mukt Bharat, and Eat Right India
- Global governance: WHO, UNICEF, and FAO nutrition agendas and SDG linkages
- Nutrition promotion, Social and Behavior Change Communication (SBCC), and community counseling models

Unit IV: Emergency Nutrition and Emerging Trends

- Nutrition management in disasters and emergencies; Community Management of Acute Malnutrition (CMAM) and Sphere standards
- Healthy aging nutrition and gut microbiome interactions
- Precision nutrition, nutrigenomics, and digital health applications in nutrition
- Monitoring, evaluation, and program appraisal methodologies for nutrition interventions

Suggested Readings

- Lawrence, M., Kraak, V., & Hughes, R. *Public Health Nutrition*. Wiley-Blackwell.
- Gibson, R.S. *Principles of Nutritional Assessment*. Oxford University Press.
- Mann, J., & Truswell, A.S. *Essentials of Human Nutrition*. Oxford University Press.
- Spark, A. *Nutrition in Public Health: Principles, Policies and Practice*. CRC Press.

Biomedical Waste Management and Safety

Category: Value Added Course (VAC) | **L-T-P:** 3-0-0 | **Credits:** 3

Course Objectives

- Analyze healthcare waste streams, profile hazardous/non-hazardous categories, and assess environmental health hazards.
- Evaluate point-of-generation waste segregation, color-coding, containment, storage, and barcoded tracking systems.
- Assess primary, secondary, and final treatment technologies, off-site disposal facilities (CBWTF), and ETP management.
- Design infection control protocols, biosafety standards, facility audits, and emergency spill management programs.

Course Outcomes: On completion, students will be able to:

- **CO1:** Analyze health facility waste streams, profile hazardous and non-hazardous waste categories, and assess their associated environmental and public health risks.
- **CO2:** Evaluate segregation, color-coding, containment, and handling techniques across healthcare settings.
- **CO3:** Assess primary, secondary, and final treatment technologies, off-site disposal methods, and environmental impacts.
- **CO4:** Design biosafety protocols, occupational hazard management, and emergency infection control frameworks for healthcare workers and communities.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship)

Unit I: Waste Stream Profiling and Environmental Risk Mapping

- Categorization of health facility waste streams: Non-hazardous vs. hazardous waste profiling
- Infectious, pathological, sharp, pharmaceutical, cytotoxic, chemical, and radioactive waste dynamics
- Environmental health impacts and occupational safety hazards associated with untreated healthcare waste
- Public health exposure pathways and disease transmission vectors in waste handling

Unit II: Segregation at Source, Containment, and Logistics

- Point-of-generation segregation principles and standardized color-coding container systems
- Safe containment, handling, interim storage norms, and intra-facility transport protocols
- Barcoding and digital tracking systems for biomedical waste monitoring
- Minimization, recycling, and source reduction strategies in healthcare facilities

Unit III: Treatment Technologies, CBWTF, and Environmental Protection

- Primary and secondary treatment modalities: Autoclaving, microwaving, hydroclaving, and incineration
- Liquid waste treatment: Effluent Treatment Plants (ETP) and chemical disinfection processes
- Common Bio-medical Waste Treatment Facilities (CBWTF) operations and final off-site disposal
- Environmental impact assessment, dioxin/furan emissions control, and green technology adoption

Unit IV: Regulatory Policies, Infection Control, and Biosafety Governance

- Biomedical Waste Management Rules and statutory compliance mandates in India
- Facility safety audits, environmental risk assessment, and green hospital initiatives
- Hospital Infection Control Committees (HICC) operations, spill management protocols, and cytotoxic safety
- Biosafety levels (BSL 1–4), post-exposure prophylaxis (PEP), emergency preparedness, and worker health safety

Suggested Readings

- Singh, A., & Kaur, S. *Biomedical Waste Management*. Jaypee Brothers.
- Ministry of Environment, Forest and Climate Change. *Bio-Medical Waste Management Rules*. Government of India.

Spatial Epidemiology and GIS Mapping

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain principles of spatial epidemiology, GIS data models, and geospatial data collection tools.
- Apply spatial analysis methodologies, disease mapping techniques, and spatial statistics to public health data.
- Analyze environmental, socio-demographic, and geographic risk factors associated with disease clustering and outbreak dynamics.

- Evaluate spatial health interventions, facility accessibility models, and geospatial surveillance systems for health planning.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain foundational concepts of spatial epidemiology, cartographic principles, and GIS vector/raster data models.
- **CO2:** Apply geospatial analysis tools, disease mapping techniques, and spatial clustering algorithms to health data.
- **CO3:** Analyze spatial variation, environmental exposures, and geographic accessibility to health services.
- **CO4:** Design GIS-enabled public health surveillance, outbreak mapping, and spatial intervention strategies.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of Spatial Epidemiology and GIS Data Models

- Introduction to spatial epidemiology: History, scope, and spatial concepts in disease distribution
- Geographic Information Systems (GIS) fundamentals: Spatial data structures, vector vs. raster data models
- Coordinate reference systems, map projections, georeferencing, and cartographic design principles
- Spatial health data collection: GPS, mobile GIS applications, open data platforms, and remote sensing imagery

Unit II: Spatial Data Visualization and Disease Mapping Methods

- Choropleth mapping, dot density maps, and proportional symbol techniques for public health indicators
- Standardized Mortality/Morbidity Ratios (SMR/SBR) and spatial smoothing techniques (e.g., Bayesian smoothing)
- Visualization of disease incidence, mortality, and environmental exposure metrics
- Practical applications of open-source GIS platforms (QGIS, R-spatial, or GeoDa) in health visualization

Unit III: Spatial Analysis, Clustering, and Environmental Epidemiology

- Spatial point pattern analysis: Kernel Density Estimation (KDE) and nearest-neighbor metrics
- Spatial autocorrelation: Global and Local Moran's I, Geary's C, and spatial cluster detection (Scan statistics / SaTScan)
- Spatial regression techniques: Spatial autoregressive models and Geographically Weighted Regression (GWR)
- Geospatial modeling of vector-borne diseases, environmental risk exposure, and air/water pollution distribution

Unit IV: Spatial Health Systems Planning, Emergency Response, and Governance

- Location-allocation modeling and healthcare accessibility metrics (Floating Two-Step Catchment Area methods)

- Geospatial surveillance in outbreak response, disaster management, and real-time epidemic tracking
- Spatial decision support systems for resource allocation, facility placement, and health service coverage
- Ethical considerations in spatial health data: Spatial confidentiality, geo-masking, and data privacy governance

Suggested Readings

- Pfeiffer, D.U., et al. *Spatial Analysis in Epidemiology*. Oxford University Press.
- Cromley, E.K., & McLafferty, S.L. *GIS and Public Health*. 2nd ed., Guilford Press.
- Waller, L.A., & Gotway, C.A. *Applied Spatial Statistics for Public Health Data*. Wiley-Interscience.

Tropical Diseases, Vector Control, and Zoonoses

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain the etiology, transmission dynamics, and global burden of major tropical, vector-borne, and zoonotic diseases.
- Analyze vector biology, ecology, insecticide resistance, and Integrated Vector Management (IVM) strategies.
- Evaluate One Health surveillance networks, outbreak detection, and zoonotic spillover mitigation frameworks.
- Design evidence-based prevention, control, and elimination programs for neglected tropical diseases (NTDs).

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the etiology, epidemiology, and socio-economic burden of major tropical and zoonotic infections.
- **CO2:** Analyze vector ecology, transmission dynamics, insecticide resistance, and integrated vector control modalities.
- **CO3:** Evaluate One Health surveillance, zoonotic spillover risks, and outbreak response mechanisms.
- **CO4:** Design population-level control, elimination, and eradication strategies for neglected tropical diseases.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Global Burden and Epidemiology of Major Tropical Diseases

- Overview and clinical epidemiology of key tropical diseases: Malaria, Dengue, Chikungunya, and Lymphatic Filariasis
- Neglected Tropical Diseases (NTDs): Leishmaniasis, Schistosomiasis, Rabies, Trachoma, and Soil-Transmitted Helminths
- Environmental, socio-economic, and climatic determinants of tropical disease persistence

- Global and national elimination targets, WHO roadmaps for NTDs, and progress metrics

Unit II: Vector Biology, Insecticide Resistance, and Integrated Vector Management

- Biology, breeding habitats, and behavior of major vectors (Mosquitoes, Sandflies, Ticks, Fleas, and Snails)
- Mechanisms of vector control: Chemical (insecticides, LLINs, IRS), biological, genetic, and environmental management
- Insecticide resistance mechanisms, resistance surveillance, and resistance management protocols
- Integrated Vector Management (IVM) frameworks: Policy integration, community participation, and inter-sectoral action

Unit III: Zoonotic Infections, One Health Paradigm, and Spillover Mechanics

- Epidemiology of major zoonotic diseases: Zoonotic Influenza, Leptospirosis, Brucellosis, Rabies, and Kyasanur Forest Disease (KFD)
- Drivers of zoonotic emergence: Deforestation, wildlife trade, land-use change, and livestock intensification
- The One Health approach: Inter-sectoral collaboration between human, animal, and environmental health domains
- Early warning systems, cross-species transmission modeling, and wildlife disease surveillance

Unit IV: Outbreak Response, Programmatic Interventions, and Health Systems

- Surveillance networks and emergency outbreak control strategies for tropical and zoonotic epidemics
- Mass Drug Administration (MDA) strategies for NTD control and community mobilization
- Case management, diagnostic innovations (RDTs, molecular tools), and vaccine development for tropical infections
- Policy initiatives: National Vector Borne Disease Control Programme (NVBDCP) and global funding mechanisms

Suggested Readings

- Cook, G.C., & Zumla, A. *Manson's Tropical Diseases*. 23rd ed., Elsevier Saunders.
- Awerbuch-Friedlander, T., et al. *Integrated Vector Management: Controlling Vector-Borne Diseases*. World Health Organization.
- Atlas, R.M., & Maloy, S. *One Health: People, Animals, and the Environment*. ASM Press.

Global Maternal Policy and Emergency Care

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain the global and national epidemiology of maternal mortality, morbidity, and quality of obstetric care.
- Analyze emergency obstetric and newborn care (EmONC) clinical pathways, infrastructure, and referral health systems.
- Evaluate international maternal health policies, rights-based frameworks, and quality improvement initiatives.

- Design health systems interventions to eliminate preventable maternal deaths and improve perinatal equity.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain epidemiology, causes, and determinants of maternal mortality, near-miss events, and severe maternal morbidity.
- **CO2:** Analyze Emergency Obstetric and Newborn Care (EmONC) packages, triage systems, and referral logistics.
- **CO3:** Evaluate global maternal health policies, rights-based quality frameworks, and maternal death surveillance systems.
- **CO4:** Design health system strategies to improve maternal survival, intrapartum quality of care, and health equity.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship)

Unit I: Global Epidemiology of Maternal Health and Morbidity

- Global and national maternal mortality trends, SDG 3.1 targets, and progress metrics
- Direct and indirect causes of maternal mortality: Postpartum hemorrhage, pre-eclampsia/eclampsia, sepsis, obstructed labor, and unsafe abortion
- Maternal near-miss events, severe acute maternal morbidity (SAMM), and long-term obstetric sequelae
- Social, structural, and gender determinants of maternal outcomes and healthcare seeking behaviors

Unit II: Emergency Obstetric and Newborn Care (EmONC) and Referral Systems

- Basic and Comprehensive Emergency Obstetric and Newborn Care (BEmONC and CEmONC) signal functions
- Obstetric triage, emergency response protocols, and intrapartum clinical decision support
- Referral networks, emergency transport systems, and overcoming the Three Delays Model
- Blood banking, essential obstetric drug availability, and facility infrastructure standards

Unit III: Quality of Care, Rights-Based Frameworks, and Maternal Audits

- WHO Quality of Care Framework for maternal and newborn health: Experience of care and clinical safety
- Respectful Maternity Care (RMC), human rights in childbirth, and addressing obstetric violence
- Maternal Death Surveillance and Response (MDSR) and Perinatal Death Audit systems
- Clinical audits, maternal care quality improvement (QI) cycles, and clinical practice guidelines

Unit IV: Global Policies, Health System Integration, and Program Evaluation

- Global strategic initiatives: Ending Preventable Maternal Mortality (EPMM) and Every Newborn Action Plan (ENAP)
- National policies and schemes in India: Janani Suraksha Yojana (JSY), SUMAN, LaQshya, and PMSMA

- Health workforce strategies: Midwifery-led care models, task-sharing, and emergency obstetric training
- Monitoring, evaluating, and financing maternal health programs in low- and middle-income country settings

Suggested Readings

- World Health Organization. *Trends in Maternal Mortality*. WHO Publications.
- Macfarlane, A., et al. *Maternal and Infant Health: Care, Policy, and Practice*. Routledge.
- World Health Organization. *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities*. WHO.

Behavioural Health Epidemiology

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain behavioral theories, epidemiology, and population distribution of lifestyle risk factors and mental disorders.
- Apply epidemiological study designs to evaluate health behaviors, addiction patterns, and psychological health determinants.
- Analyze social, environmental, and structural influences on behavioral risk factors and mental health outcomes.
- Evaluate behavioral health interventions, stigma-reduction programs, and community mental health policies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain epidemiological principles, concepts, and measurement frameworks of behavioral and mental health.
- **CO2:** Apply epidemiological methodologies to quantify health-compromising behaviors, substance use, and mental illness.
- **CO3:** Analyze socio-ecological determinants, structural drivers, and biological interactions of behavioral health outcomes.
- **CO4:** Evaluate evidence-based behavioral health interventions, suicide prevention programs, and mental health policy implementations.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship)

Unit I: Foundations of Behavioural Health Epidemiology

- Scope and definitions of behavioral health, health-related behaviors, and psychiatric epidemiology
- Measurement tools and psychometric validation of behavioral health surveys and mental health screeners
- Theoretical models of health behavior: Health Belief Model, Theory of Planned Behavior, Transtheoretical Model, and Social Cognitive Theory
- Descriptive epidemiology of key behavioral risks: Physical inactivity, poor dietary patterns, sleep disruption, and screen habits

Unit II: Epidemiology of Substance Use, Addiction, and Harm Reduction

- Global and national epidemiology of tobacco use, alcohol misuse, illicit drug use, and prescription drug abuse
- Mechanisms of addiction, risk/protective factors, and life-course trajectories of substance dependency
- Epidemiological impact of substance use on chronic disease, injury, mental health, and social outcomes
- Harm reduction strategies, addiction treatment paradigms, and public health policy interventions

Unit III: Mental Health Epidemiology, Stress, and Socio-Ecological Determinants

- Epidemiology of common mental disorders (Depression, Anxiety), severe mental illness (Psychosis), and suicide rates
- Allostatic load, chronic stress, trauma, adverse childhood experiences (ACEs), and mental health pathways
- Social determinants of mental health: Poverty, discrimination, marginalization, conflict, and urban stress
- Stigma, mental health literacy, and barriers to mental healthcare utilization across diverse populations

Unit IV: Interventions, Community Mental Health, and Policy Evaluation

- Multi-level behavioral health interventions: Individual, community, organizational, and structural approaches
- Community Mental Health Programmes: Task-shifting, integration into Primary Healthcare, and Tele-MANAS initiatives
- Policy frameworks: Mental Healthcare Act (India), WHO Comprehensive Mental Health Action Plan, and suicide prevention strategies
- Evaluation of digital behavioral health tools, school-based mental health programs, and workplace wellness initiatives

Suggested Readings

- Tsuang, M.T., Tohen, M., & Zahner, G.E.P. *Textbook in Psychiatric Epidemiology*. 3rd ed., Wiley-Blackwell.
- Glanz, K., Rimer, B.K., & Viswanath, K. *Health Behavior: Theory, Research, and Practice*. 5th ed., Jossey-Bass.
- World Health Organization. *Comprehensive Mental Health Action Plan 2013–2030*. WHO Publications.

Sustainable Cities and Urban Environmental Health

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain concepts of urban health, sustainable urban planning, built environment exposures, and urban environmental hazards.
- Analyze urban health inequities, slum dynamics, air/water pollution burdens, and urban heat island effects.
- Apply Health Impact Assessment (HIA) tools to urban development projects, transport policies, and green space initiatives.
- Evaluate sustainable city frameworks, urban resilience strategies, and smart city health governance.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain concepts of urban environmental health, urban planning paradigms, and built environment determinants.
  CO2: Analyze urban health inequities, environmental hazards, slum conditions, and climate exposures in cities.
- **CO3:** Apply Health Impact Assessment (HIA) tools to urban master plans, transport systems, and housing policies.
- **CO4:** Evaluate urban health governance frameworks, smart city initiatives, and sustainable urban resilience strategies.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Fundamentals of Urban Health and Built Environments

- Introduction to urban health: Rapid urbanization trends, urban penalty vs. urban advantage, and demographic shifts
- Built environment components: Housing quality, land use, active transportation, green/blue infrastructure, and walkability
- Urban eco-systems approach: Metabolic flows of water, energy, waste, and food in urban systems
- Sustainable Development Goal 11 (Sustainable Cities and Communities) and Planetary Health integration

Unit II: Urban Environmental Hazards, Pollution, and Social Equity

- Urban air pollution (ambient and indoor PM2.5, NOx), industrial emissions, traffic exposures, and respiratory health
- Urban climate hazards: Urban heat island (UHI) effect, urban flooding, extreme weather vulnerabilities, and extreme heat action plans
- Slum epidemiology: Informal settlements, overcrowded housing, water and sanitation (WASH) deficits, and infectious disease risk
- Urban health equity: Environmental justice, spatial segregation, vulnerable groups, and occupational risks in urban informal sectors

Unit III: Health Impact Assessment (HIA) and Urban Planning Tools

- Principles and methodology of Health Impact Assessment (HIA) in urban policy and spatial development
- Evaluating health co-benefits of urban climate mitigation: Active transport, urban re-greening, and clean energy adoption
- Healthy urban planning models: 15-minute city concept, transit-oriented development (TOD), and healthy housing standards
- Geospatial techniques and urban health metrics for assessing environmental exposures and spatial equity

Unit IV: Urban Health Governance, Smart Cities, and Policy Resilience

- Urban health governance: Multi-sectoral action, municipal administration structures, and health in all urban policies (HiAP)

- National urban initiatives in India: Smart Cities Mission, AMRUT, Swachh Bharat Mission-Urban, and National Urban Health Mission (NUHM)
- Building climate-resilient cities: Disaster preparedness, urban health emergency management, and green infrastructure
- Case studies of innovative sustainable cities and healthy urban transformation interventions globally

Suggested Readings

- Galea, S., Freudenberg, N., & Vlahov, D. *Cities and the Health of the Public*. Vanderbilt University Press.
- Duhl, L.J., & Sanchez, A.K. *Healthy Cities and the City Planning Process*. World Health Organization.
- Rydin, Y., et al. *Shaping Cities for Health: Complexity and the Planning of Urban Environments*. The Lancet Commissions.

Micronutrient Deficiencies and Malnutrition Programmes

Category: Major Core (MC) | **L-T-P:** 2-1-0 | **Credits:** 3

Course Objectives

- Explain the physiological roles, metabolism, and epidemiology of essential micronutrients and hidden hunger.
- Analyze assessment methodologies, biochemical markers, and field indicators for micronutrient deficiencies.
- Evaluate food fortification, biofortification, supplementation, and dietary diversification interventions.
- Evaluate national and global public health nutrition programs, policy frameworks, and programmatic coverage monitoring.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the physiological functions, etiology, and global burden of key micronutrient deficiencies and hidden hunger.
- **CO2:** Analyze diagnostic, clinical, and biochemical assessment techniques for measuring population micronutrient status.
- **CO3:** Evaluate food-based and medical strategies including fortification, biofortification, and mass supplementation programs.
- **CO4:** Assess national and global public health nutrition schemes, monitoring frameworks, and policy implementations.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Biology, Epidemiology, and Burden of Micronutrient Deficiencies

- Concept of "hidden hunger" and global/national epidemiology of micronutrient deficiencies across the life course
- Iron deficiency anemia: Physiology, etiology, prevalence, health consequences, and developmental impacts
- Vitamin A Deficiency (VAD) and Iodine Deficiency Disorders (IDD): Metabolism, clinical spectrum, and burden

- Zinc, Vitamin D, Vitamin B12, and Folate deficiencies: Functions, deficiency syndromes, and public health relevance

Unit II: Assessment and Diagnostics of Micronutrient Status

- Biochemical indicators and laboratory methods for assessing iron, vitamin A, iodine, zinc, and B-vitamin status
- Clinical signs, physical examination techniques, and functional tests for micronutrient deficits
- Dietary intake estimation methods: 24-hour dietary recall, food frequency questionnaires, and nutrient adequacy scores
- Population-level surveillance, survey designs, and interpreting national micronutrient survey data

Unit III: Intervention Strategies: Fortification, Supplementation, and Diversification

- Large-Scale Food Fortification (LSFF): Salt iodization, double fortified salt, fortified rice, oil, and wheat flour
- Biofortification of staple crops: Agronomic and breeding strategies, biofortified crops (iron pearl millet, zinc rice)
- Targeted and universal supplementation programs: Iron-folic acid supplementation, high-dose Vitamin A prophylaxis
- Dietary diversification, kitchen gardening, behavior change communication, and food safety integration

Unit IV: Programmatic Architecture, Policy, and Monitoring Systems

- National nutrition policy programs in India: Anemia Mukt Bharat strategy, National Iodine Deficiency Disorders Control Programme (NIDDCP)
- Integration with flagship schemes: POSHAN Abhiyaan, ICDS, PM-POSHAN, and Food Fortification Resource Centre (FFRC)
- Quality control, supply chain logistics, coverage monitoring, and programmatic bottleneck analysis
- Global guidelines, WHO micronutrient frameworks, and scaling up nutrition (SUN) movement initiatives

Suggested Readings

- Allen, L., et al. *Guidelines on Food Fortification with Micronutrients*. World Health Organization and FAO.
- Kraemer, K., & Zimmermann, M.B. *Nutritional Anemia*. Sight and Life Press.
- Semba, R.D., & Bloem, M.W. *Nutrition and Health in Developing Countries*. 2nd ed., Humana Press.

Semester VIII

One Health and Sustainable Development Goals

Category: Multidisciplinary (MD) | **L-T-P:** 2-0-0 | **Credits:** 2

Course Objectives

- Explain fundamental principles of the One Health approach and its direct connections to the Sustainable Development Goals (SDGs).
- Analyze multi-sectoral strategies to address complex health challenges at the human-animal-environment interface.
  Evaluate global health security, climate impacts, and antimicrobial resistance through a unified systems-thinking paradigm.
- Apply One Health field strategies, policy formulation, and inter-agency collaboration models to advance sustainable development.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the fundamental principles of the One Health approach and its direct connections to the Sustainable Development Goals (SDGs).
- **CO2:** Analyze multi-sectoral strategies to address complex health challenges at the human-animal-environment interface.

Graduate Attributes Addressed: GA1 (Disciplinary & Interdisciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship), GA10 (Lifelong Learning & Self-Directed Growth)

Unit I: Foundations of One Health and Sustainable Development Goals

- Transition from MDGs to SDGs, the 5 Ps (People, Planet, Prosperity, Peace, Partnership), and placing health at the core of global development strategies
- Historical evolution, concepts, and scope of the One Health paradigm
- Operationalizing One Health within the framework of Sustainable Development Goal targets
- Interconnections across human health, animal health, and environmental sustainability ecosystems

Unit II: Zoonotic Diseases, Global Health Security, and Planetary Health

- Epidemiology and surveillance of emerging and re-emerging zoonotic infections
- Global threat of Antimicrobial Resistance (AMR) and One Health mitigation pathways
- Food safety, food security, and agricultural practices at the human-animal interface
- Climate change impacts, biodiversity loss, environmental degradation, and planetary health dynamics

Unit III: Multi-Sectoral Governance and Systems Thinking

- Application of systems thinking to address complex transnational health challenges
- Quadripartite inter-agency collaboration frameworks (WHO, WOAH, FAO, UNEP)
- Integrated surveillance systems bridging human, livestock, wildlife, and environmental sectors
- Institutional mechanisms for multi-sectoral policy harmonization and SDG alignment

Unit IV: One Health Field Interventions and Policy Implementation

- Evaluation of real-world One Health field programs and community engagement models
- Outbreak response coordination, rapid response teams, and cross-sectoral communication protocols
- Translating One Health research into evidence-based policy and national action plans
- Sustainable intervention strategies, resource allocation, and program scalability

Suggested Readings

- Park, K. *Park's Textbook of Preventive and Social Medicine*. Latest Edition, Banarsidas Bhanot.
- Detels, R., Gulliford, M., Karim, Q.A., & Tan, C.C. *Oxford Textbook of Global Public Health*. Latest Edition, Oxford University Press.

Corporate Social Responsibility

Category: Value Added Course (VAC) | **L-T-P:** 2-0-0 | **Credits:** 2

Course Objectives

- Explain theoretical, empirical, and political economy aspects of Corporate Social Responsibility (CSR) in global and Indian contexts.
- Analyze global standard practices, corporate governance mechanisms, and non-strategic vs. strategic CSR frameworks.
- Evaluate stakeholder expectations (State, Community, Civil Society/NGOs) and align enterprise problems with pressing social challenges.
- Formulate, implement, monitor, evaluate, and audit CSR projects through structured reporting and social audit methodologies.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain fundamental theories, political economy arguments, and global standard practices of Corporate Social Responsibility (CSR).
- **CO2:** Analyze roles and expectations of diverse stakeholders (State, Community, Civil Society) in driving CSR initiatives.
- **CO3:** Distinguish between strategic and non-strategic CSR applications in addressing enterprise and social problems.
- **CO4:** Design, implement, evaluate, and audit CSR project frameworks using standardized social reporting tools.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA6 (Entrepreneurial Mindset & Innovation), GA7 (Ethical Reasoning & Professional Integrity), GA8 (Social Responsibility & Global Citizenship)

Unit I: Political Economy, Theories, and Global Practices of CSR

- Political economy of CSR: Scholarly arguments pro and against CSR practices (Milton Friedman vs. Michael Porter models)
- Global standard practices in Corporate Social Responsibility; globalization dynamics and its implications on corporate ethics
- CSR as a strategic tool in corporate governance, risk mitigation, and brand equity
- Non-strategic CSR vs. strategic alignment with core business models and Sustainable Development Goals

Unit II: Stakeholder Ecosystem and CSR Landscape in India

- Role of diverse stakeholders: State, local communities, civil society organizations, and NGOs/NPOs

- Managing and balancing expectations of internal and external stakeholders through structured CSR engagements
  Overview of CSR in India: Regulatory frameworks (Companies Act Mandates) and comparative analysis of Public vs. Private sector enterprises
- Identifying target interventions: Deciding where to start by evaluating Social Problems vs. Enterprise Problems

Unit III: CSR Project Formulation and Implementation Architecture

- Strategic planning and formulation of CSR projects: Needs assessment, baseline surveys, and target setting
- Implementation models: In-house CSR foundations, NGO partnerships, and public-private community initiatives
- Operational planning, resource allocation, risk management, and timeline management in CSR execution
- Alignment of corporate health and social initiatives with national public health priorities

Unit IV: CSR Project Evaluation, Reporting, and Social Auditing

- Monitoring and Evaluation (M&E) frameworks tailored for corporate social investments
- Social Return on Investment (SROI) assessment and outcome mapping techniques
- Social auditing processes, transparency metrics, and ethical accountability standards
- CSR reporting standards (GRI guidelines, Business Responsibility and Sustainability Reporting - BRSR) and stakeholder communications

Suggested Readings

- Nelson, K.A., & Trevino, L.K. *Managing Business Ethics: Straight Talk About How to Do It Right*. John Wiley & Sons.
- Tencati, A., & Perrini, F. *Business Ethics and Corporate Sustainability*. Edward Elgar Publishing.
- Brejning, J. *Corporate Social Responsibility and the Welfare State*. Ashgate Publishing.
- Agarwal, S.K. *Corporate Social Responsibility in India*. SAGE Publications.
- Chakrabarty, B. *Corporate Social Responsibility in India*. Routledge.
- Coombs, W.T., & Holladay, S.J. *Managing Corporate Social Responsibility: A Communication Approach*. Wiley-Blackwell.
- Idowu, S.O., & Louche, C. (Eds.). *Theory and Practice of Corporate Social Responsibility*. Springer.

Interprofessional Practice in Public Health

Category: Multidisciplinary (MD) | **L-T-P:** 1-1-0 | **Credits:** 2

Course Objectives

- Explain principles, concepts, and significance of interprofessional education and collaborative practice in public health.
- Describe roles, responsibilities, and contributions of healthcare and public health professionals within interdisciplinary teams.
- Apply effective communication, teamwork, leadership, and ethical principles to foster collaborative healthcare practice.
- Evaluate collaborative approaches to healthcare delivery and identify strategies to strengthen interprofessional collaboration for improved health outcomes.

Course Outcomes: On completion, students will be able to:

- **CO1:** Explain the principles, concepts, and significance of interprofessional education and collaborative practice in public health.
- **CO2:** Describe the roles, responsibilities, and contributions of various healthcare and public health professionals within interdisciplinary teams.
- **CO3:** Apply effective communication, teamwork, leadership, and ethical principles to foster collaborative healthcare practice.
- **CO4:** Evaluate collaborative approaches to healthcare delivery and identify strategies to strengthen interprofessional collaboration for improved health outcomes.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA5 (Communication & Interpersonal Skills), GA7 (Ethical Reasoning & Professional Integrity), GA9 (Leadership & Teamwork)

Unit I: Foundations of Interprofessional Practice and Team Roles

- Concept and evolution of interprofessional education (IPE) and collaborative practice
- WHO Framework for Action on Interprofessional Education and Collaborative Practice
- Core competencies, principles, and value of collaborative practice in healthcare and public health
- Roles, scopes of practice, and contributions of multidisciplinary health team members (Physicians, Nurses, Public Health Professionals, Pharmacists, Social Workers, CHWs)

Unit II: Interprofessional Communication, Team Dynamics, and Ethics

- Principles of effective interpersonal and patient/community-centred communication
- Active listening, collaborative decision-making, information sharing, and cross-cultural competence
- Characteristics of high-performing teams, stages of team development, and collaborative leadership
- Conflict resolution, negotiation techniques, professional ethics, confidentiality, and mutual respect

Unit III: Collaborative Healthcare Delivery and Care Coordination

- Integrated healthcare delivery models, referral mechanisms, and continuity of care
- Care coordination strategies across primary, secondary, tertiary, and community settings
- Intersectoral collaboration for addressing broader social determinants of health
- Institutional roles, quality improvement initiatives, and patient safety in team-based practice

Unit IV: System Challenges, Digital Collaboration, and Future Directions

- Professional, cultural, and organizational barriers to interprofessional collaboration
- Managing role ambiguity, power dynamics, and inter-professional communication breakdowns
- Digital health platforms, EHRs, and technology-enabled interprofessional collaboration
- Collaborative practice strategies for achieving Universal Health Coverage (UHC) and Sustainable Development Goals (SDGs)

Suggested Readings

- Reeves, S., Lewin, S., Espin, S., & Zwarenstein, M. *Interprofessional Teamwork for Health and Social Care*. Wiley-Blackwell.
- Institute of Medicine. *Interprofessional Education and Collaborative Practice: Creating a Blueprint for Nurse Educators*. National Academies Press.

Monitoring and Evaluation in Health Systems

Category: Major Core (MC) | **L-T-P:** 2-0-0 | **Credits:** 2

Course Objectives

- Understand the basic concepts, purpose, and key frameworks of monitoring and evaluation in public health.
- Identify health indicators and sources of routine data used to track health program progress.
- Understand basic evaluation methods used to assess health program performance and outcomes.
- Explain the principles of data quality, clear reporting, ethical data use, and evidence-based decision-making.

Course Outcomes: On completion, students will be able to:

- **CO1:** Understand the basic concepts, purpose, and key framework of monitoring and evaluation in public health.
- **CO2:** Identify health indicators and sources of routine data used to track health program progress.
- **CO3:** Understand basic evaluation methods used to assess health program performance and outcomes.
- **CO4:** Explain the principles of data quality, clear reporting, ethical data use, and evidence-based decision-making.

Graduate Attributes Addressed: GA1 (Disciplinary Knowledge), GA2 (Critical Thinking & Problem Solving), GA3 (Digital & Technological Literacy), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA7 (Ethical Reasoning & Professional Integrity)

Unit I: Introduction to M&E and Program Logic Models

- Basic definitions, principles, and distinction between monitoring and evaluation
- Significance and operational purpose of M&E in public health service delivery
- Developing and applying program logic models: Inputs, processes, outputs, outcomes, and impact
- Establishing baseline metrics and designing M&E frameworks for health interventions

Unit II: Health Indicators and Data Collection Sources

- Definition, criteria, and selection of robust public health indicators
- Characteristics of good indicators (SMART, validity, reliability, feasibility)
- Sources of routine health data: Health Management Information Systems (HMIS), surveys, disease registries, and surveillance data
- Basic data collection tools, tracking methods, and operational protocols for ongoing health monitoring

Unit III: Fundamental Evaluation Designs and Methods

- Main types of program evaluation: Process evaluation, outcome evaluation, and impact evaluation

- Quantitative evaluation approaches and sampling considerations
- Qualitative data collection methods (focus groups, key informant interviews, observations) in evaluation
- Key operational steps in planning, designing, and executing a simple public health evaluation project

Unit IV: Data Quality Assurance, Reporting, and Ethics

- Data quality assessment: Principles of accuracy, completeness, timeliness, and verification techniques
- Data visualization, clear reporting formats, and tailoring M&E findings for diverse stakeholders
- Translating evaluation evidence into health service improvement and evidence-based decision-making
- Research and evaluation ethics: Informed consent, confidentiality, data security, and ethical data handling

Suggested Readings

- Edberg, M. *Public Health Program Planning and Evaluation*. Jones & Bartlett Learning.
- Centers for Disease Control and Prevention. *Framework for Program Evaluation in Public Health*. CDC.

Research Project / Dissertation

Category: Research Project (RP) | **L-T-P:** 0-0-24 | **Credits:** 12

Course Objectives

- Design and execute an independent, evidence-based research project addressing a significant public health challenge.
- Apply comprehensive literature review techniques to identify research gaps and formulate valid research hypotheses or questions.
- Implement rigorous epidemiological, biostatistical, or qualitative methodologies for data collection and analysis.
- Synthesize research findings into a formally structured dissertation and defend the scientific validity of the conclusions.

Course Outcomes: On completion, students will be able to:

- **CO1:** Formulate a scientifically sound research question, hypothesis, and structured protocol aligned with public health priorities.
- **CO2:** Obtain necessary ethical approvals and independently execute appropriate data collection methodologies in a field, clinical, or laboratory setting.
- **CO3:** Analyze quantitative or qualitative data using relevant software, accurately interpreting the results within the broader context of existing literature.
- **CO4:** Author a comprehensive academic dissertation adhering to institutional guidelines and effectively defend the research outcomes in a viva voce.

Graduate Attributes Addressed: GA2 (Critical Thinking & Problem Solving), GA4 (Practical & Health Assessment Skills / Research Aptitude), GA5 (Communication & Interpersonal Skills), GA7 (Ethical Reasoning & Professional Integrity), GA10 (Lifelong Learning & Self-Directed Growth)

Phase I: Research Conceptualization and Protocol Development

- Identifying a research problem, defining objectives, and conducting a systematic literature review
- Developing a conceptual framework and selecting an appropriate epidemiological or qualitative study design
- Drafting the research protocol: Methodology, sampling strategy, data collection tools, and timeline
- Submission to and defense before the Institutional Ethics Committee (IEC) / Institutional Review Board (IRB)

Phase II: Fieldwork, Data Collection, and Project Management

- Pre-testing and validating data collection instruments (questionnaires, interview guides, clinical tools)
- Recruiting participants, obtaining informed consent, and ensuring ethical compliance during fieldwork
- Executing primary data collection or abstracting secondary data while ensuring data quality and integrity
- Data management: Cleaning, coding, and entering data into statistical databases (e.g., SPSS, R, STATA, NVivo)

Phase III: Data Analysis, Synthesis, and Interpretation

- Conducting descriptive and inferential statistical analyses or thematic qualitative coding
- Interpreting findings in relation to the original research objectives and hypotheses
- Evaluating the study's strengths, limitations, biases, and potential confounding factors
- Developing evidence-based recommendations for public health policy, practice, or future research

Phase IV: Dissertation Writing, Dissemination, and Viva Voce

- Structuring the dissertation: Introduction, Literature Review, Methodology, Results, Discussion, and Conclusion
  Academic formatting, accurate citation management (e.g., APA, AMA), and plagiarism checking
- Drafting a research manuscript suitable for submission to a peer-reviewed public health journal
- Preparing the final presentation and completing the formal oral defense (Viva Voce) before a panel of examiners

Suggested Readings

- Hulley, S.B., Cummings, S.R., Browner, W.S., Grady, D.G., & Newman, T.B. *Designing Clinical Research*. Lippincott Williams & Wilkins.
- Creswell, J.W., & Creswell, J.D. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.
- American Psychological Association. *Publication Manual of the American Psychological Association*. APA.