

CURRICULUM of Ph.D. COURSE WORK



**HAMDARD INSTITUTE OF MEDICAL SCIENCES AND RESEARCH
JAMIA HAMDARD
(HAMDARD UNIVERSITY)
HAMDARD NAGAR, NEW DELHI – 110062
2021**

Bye Laws of Course work for Ph.D. Programme in HIMSR

Structure

In accordance with the University Grants Commission (Minimum Standards and Procedure for Award of Ph.D Degrees) Regulations, 2016/latest guidelines.

Procedure of Admission in Ph.D:

As per Jamia Hamdard by Laws

Course work for PhD Programme

(To be effective from the academic session -2021 and applicable for all PhD students of HIMSR)

1. **Programme:** Course work for PhDs in Biochemistry, Microbiology, Pharmacology, Physiology and Public Health

2. **Duration** One Semester (Six Months)

3. **Medium of Instruction and examination** English

4. **Course structure:**

The course work will be assigned credits. During one semester minimum 12 credits are required to be earned for a theory module of 4 credits each. This practically means $12(\text{hr}) \times 15 (15 \text{ wk/semester}) = 180 \text{ hrs}$ of teaching/ contact classes, equivalent to 2-2.5 hr of classes per day for 15 weeks in a 5 day/week classes of a semester. A student may be allowed to complete the course work in maximum one year's time (two semesters).

A candidate is required to complete following courses:

- a) **Compulsory module (one course of 4 credits)** Research Methodology, communication skills, copy rights and ethical issues in research etc (**Annexure-I**)
- b) **Core module (One course of 4 credit):** The student shall select the one core module from the courses offered by department where he/she is registered in Ph.D. program.
- c) **Elective/interdisciplinary module; (One course of 4 credits).** The student shall be given option to select the elective/interdisciplinary paper either from the Department where he/she is registered for Ph.D. or from other Department of the faculty (HIMSR) in consultation with SRAC.

5. The minimum attendance will be required in lectures/contact classes is 75% to participate in course work examination. The supervisor needs to submit an attendance record of student to Examination branch prior to course work exam.
6. Those institutions having MoUs with Jamia Hamdard for registration of Ph.D. students, shall either send their students to attend the Ph.D. course work classes in Jamia Hamdard or they may organize the classes in their own institutes. The syllabus will be sent to them. The students shall, however, appear in the examination conducted at Jamia Hamdard.

EXAMINATION BYE-LAWS FOR THE Ph.D. COURSE WORK

The Exam Bye-laws for Ph.D. Course work will be applicable to the candidates who will be admitted to Ph.D. programme in the academic year 2021-22 onwards until unless further revised.

Ph.D. in the following subjects:

Biochemistry
Microbiology
Pharmacology
Physiology
Public Health

Classification of Result:

Following grading system with 10 point scale shall be followed to represent performance of students in the examination:

%age marks	Grade	Grade Point	Performance level
≥80	A ⁺	10	Outstanding
75 ≤ 80	A	9	Excellent
70 ≤ 75	B ⁺	8	Very good
60 ≤ 70	B	7	Good
55 ≤ 60	C	6	Pass
45 ≤ 55	D	0	Fail
Absent	E	-	Incomplete

- A Ph.D. Scholar has to obtain a minimum of 55% of marks or grade of equivalent (minimum of 'C' grade or CGPA 6) to this in each course to qualify course work examination.

Earned Credits (EC)

The credits for the courses in which a student has obtained C (minimum passing grade for a course) or a higher grade in the semester exam shall be counted as credits earned by him/her. Any course in which a student has obtained “D” or “E” grade shall not be counted towards his/her earned credits.

Evaluation of Performance:

- SGPA (Semester Grade Point Average) shall be awarded on successful completion of each semester.
- CGPA (Cumulative Grade Point Average), which is the Grade Point Average for all the completed semesters at any point in time shall be awarded in each semester on successful completion of the current semester as well as all of the previous semester. In 1st semester, CGPA is not applicable.

Calculation of SGPA and CGPA of A Student in a Semester:

$$\text{SGPA} = \frac{\sum (\text{Earned Credits X Grade Point})}{\sum (\text{Total Course Credits in a Semester})}$$

$$\text{CGPA} = \frac{\sum_{j=1}^m (\text{Earned Credits X Grade Point})}{\sum (\text{Total Course Credits in a Semester})}$$

Where m is the number of papers passed in all semester.

Classification of Successful Candidates:

Classification shall be done on the basis of following criteria:

- He/She will be awarded “1st Division” if his/her final CGPA is 7 or above
- He/She will be awarded “2nd Division” if his/her final CGPA is 6 or above but less than 6.75
- He/She will be awarded “pass” if his/her final CGPA is 5.5 or above but less than 6
- He/She will be treated as “fail” if his/her final CGPA is less than 5.5

Format for Written Course work Examination:

Total Marks: 100

- Long essay question:** 3 segmented long question of 15 marks = 45 marks
- Descriptive question:** 3 questions of 10 marks each = 30 marks
- Short notes:** 5 questions of 5 marks each = 25 marks

Annexure-I

PCP 001 – Compulsory Paper
(Research Methodology, ethics and recent advances)

Credit: 4, Max. Marks: 100, Time: 60 hours

Unit-I Research Methodology

Research Aptitude, Research Meaning, Identifying a research problem
Steps of research, Types of Research Publications
Thesis writing
Information and Communication Technology (ICT) in Research
Basics of internet
Use of Internet in research works
Literature Search
Scientific presentations

Unit-II: Biostatistics

Introduction to biostatistics
Overview of data-types & presentation
Measures of disease frequency
Measurement of study variables
Sampling Methods
Overview of data analysis
Epidemiological consideration in designing research study
Selection of study population and sampling methods, sample size calculation
Study plan and project management
Principles of data collection and data collection tools
Graphical representation and mapping of data
Data management

Unit-II Copyright and Ethical Issues

Introduction to IPR patent laws
Process of patenting a research finding
Ethical issues in research, Professional ethics, publication ethics
Ethics involving use of animal and human subjects
Law on Protection of environment and biodiversity
Plagiarism
Ethical issues in research; ethical issues involving use of animal and human subjects;
Clinical trial rule 2019
Publication ethics
Introduction to patent laws, process of patenting a research finding, copyright cyber laws

Unit-III: Communication Skills

Introduction to Effective Communication
Components to effective communication

Types of Communication
Barriers to Communication
Channel of Communications
Communication Process
Overcoming Strategies
Miscommunication
Non-verbal communication
Listening Skills
Report Writing

Ph.D. Course work, HIMSR

Core/Elective papers: Department of Biochemistry, Hamdard
Institute of Medical Sciences and Research

CORE/ELECTIVE - 1: CHEMISTRY OF BIOMOLECULES and METABOLISM

UnitI: Chemistry of Biomolecules

Carbohydrate: classification: monosaccharides, disaccharides: reducing and non-reducing disaccharides, homo and hetero polysaccharides mucopolysaccharides. Proteoglycans and glycoproteins. **Lipids:** Fatty acids: nomenclature, definition, function, classification saturated and unsaturated Physical and chemical properties, simple Lipids. Fats, Triacylglycerols: structure, function. Stereochemical numbering, prochirality, and waxes, complex lipids, derived lipid. **Amino Acids:** classification, structure and nomenclature. **Proteins:** Definition, classification, functions, properties and their higher orders of structure. Introduction of enzymes.

UnitII: Metabolism of carbohydrates

Glucose transporters, glycolysis, oxidation of pyruvate, TCA cycle, gluconeogenesis, Cori's cycle .Metabolism of glycogen (glycogenesis, glycogenolysis, storage disorders), HMP shunt pathway. Metabolism of fructose, galactose, uronic acid pathway, inborn Errors associated with carbohydrate metabolism. Glycemic index. Blood glucose regulation. Glucose tolerance test and glucose challenge test.

UnitIII: Metabolism of lipids

Oxidation of fatty acids—alpha, beta, omega – beta oxidation of odd chain and even chain fatty acids along with metabolic disorders. Formation and utilization of ketone bodies and ketosis. *De novo* synthesis of fatty acids, elongation and desaturation. *De novo* synthesis of cholesterol. Metabolism of cholesterol and compounds derived from cholesterol. Lipoproteins – classification, metabolism, functions and disorders. Atherosclerosis and role of PUFA in preventing atherosclerosis

UnitIV: Metabolism of amino acids and proteins

Metabolism of amino acids; Transamination, deamination, transmetylation. Formation, transport and disposal of ammonia (urea cycle). Inborn errors; Porphyrins: Chemistry, properties and porphyrias. Biosynthesis of heme, breakdown & its regulation. Hemoglobin degradation. Jaundice, different types of Jaundice and biochemical investigations

Unit V: Integration and regulation of metabolism

Integration of carbohydrate, protein and lipid metabolisms. Role of transaminases. Metabolic regulation by hormones in starvation, well fed state and diabetes mellitus.

Ph.D Course Work
PMBC 102- Core/Elective Paper: BIOCHEMISTRY
Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE- 2: MOLECULAR BIOLOGY

Unit I: DNA and RNA

DNA as genetic material; primary, secondary and three dimensional structure of DNA; supercoiling; forms of DNA; properties of DNA in solution; reassociation reactions: COT curves; types of RNAs and their primary and secondary structure; role of RNA; unusual bases in RNA, Nucleosome, Histone proteins, Hetrochromatin, Euchromatin. Physical and chemical properties of nuclic acid. Prokaryotic and eukaryotic gene structure; transposable elements in bacteria; mobile elements in eukaryotes; regulatory region. Prokaryotic and eukaryotic gene structure; transposable elements in bacteria; mobile elements in eukaryotes;

Unit II: Replication

Central dogma of molecular biology .Replication, transcription & translation in prokaryotes and eukaryotes. Post transcriptional and post translation modification. Topoisomerases, telomeres, repair mechanism in prokaryotes and eukaryotes; role of methylation; replication of viral RNA viruses.

Unit III: Gene and mutations

Classification and genetic basis of mutation; site directed mutagenesis.

Unit IV: Gene expression & regulation

Gene expression in prokaryotes; enzyme induction and repression; negative and positive control; concept of operon; regulation of gene expression in eukaryotes; promoters, enhancers and response elements; regulation at transcriptional level; role of chromatin structure in gene expression; cytoplasmic regulation of gene expression.

Unit V: PCR and DNA fingerprinting

Polymerase chain reaction: principles, process, design and optimization; Taq DNA polymerase; types of PCR; application of PCR; ligase chain reaction; SNP and the application in molecular diagnostics; DNA fingerprinting: applications and prospects; restriction fragment length polymorphism (RFLP) and its uses; FISH; prenatal diagnosis.

Ph.D Course Work
PMBC 103 – Core/Elective Paper: BIOCHEMISTRY

Credit: 4, Max. Marks: 100, Time: 50 hours

CORE/ELECTIVE 3: CLINICAL BIOCHEMISTRY

Unit I: Quality assurance in clinical biochemistry

Anticoagulants, Biological samples: types, collection, processing, stability and storage; chemical composition of biological fluids: blood, urine and cerebrospinal fluid; reference range; quality control and quality assurance; accuracy and precision; factors influencing the accuracy of results; Levy-Jennings's chart; reliability of laboratory methods, Westgard quality control rules, Automation in Biochemistry, Preanalytical, analytical and post analytical errors in clinical biochemistry laboratory.

Unit II: Biochemical tests and diseasediagnosis

Biochemical tests in clinical medicine: basic concepts, criteria for selecting a method for biochemical analysis; enzymes and isoenzymes as diagnostic tool; methods for the detection of isoenzymes; Clinical presentation and diagnosis of liver and kidney.

Unit III: Organ functions tests

Liver function tests; Hepatitis, cirrhosis; jaundice, hepatic coma. Tests for the assessment of liver functions. Kidney functions and kidney function tests: Urea, Creatinine, GFR, Creatinine clearance and inulin clearance. Cardiac function tests: Enzymatic and non-enzymatic markers. Thyroid function test; T3, T4, TSH, FT3, FT4, hypothyroidism, hyperthyroidism, and subclinical hyper and hypothyroidism. Gastric function test, pancreatic function test, and tests for adrenal insufficiency.

Unit IV: Inborn errors of Metabolism

Phenylketonuria, alkaptonuria, homocystinuria and albinism, Hartnup's disease, galactosemia, TaySach's disease and Niemann Pick's disease, Hunter and Hurler Syndrome, Lesch-Nyhan syndrome,



Core/Elective papers: Department of Microbiology, Hamdard
Institute of Medical Sciences and Research

Ph.D Course Work
PMMB 101 – Core/Elective Paper: MICROBIOLOGY

Credit: 4, Max. Marks: 100, Time: 50 hours

CORE/ELECTIVE 1: IMMUNOLOGY

1. Immunity.
 2. Antigens.
 3. Immunoglobulin.
 4. Complement
 5. Antigen and antibody reactions
 6. Hypersensitivity
 7. Structure and function of immune system
 8. Immune response: Humoral and Cell mediated immunity.
 9. Immuno-deficiency.
 10. Autoimmunity and Immune tolerance.
 11. Tumour immunity.
 12. Prophylaxis and immunotherapy.
 13. Molecular Biology techniques.
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Ph.D Course Work
PMMB 102 – Core/Elective Paper: MICROBIOLOGY

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 2: GENERAL BACTERIOLOGY

1. Microscopy
 2. Bio-safety including universal precautions
 3. Physical and biological containment
 4. Sterilization and disinfection
 5. Morphology of bacteria and other microorganisms
 6. Normal flora of human body
 7. Growth & nutrition of bacteria
 8. Bacterial metabolism
 9. Bacterial toxins
 10. Bacteriocins
 11. Microbiology of hospital environment
 12. Microbiology of air, milk and water
 13. Antibacterial substances and drug resistance
 14. Bacterial genetics & bacteriophages
 15. Molecular genetics relevant for medical microbiology
 16. Quality assurance & quality control in microbiology
 17. Accreditation of laboratories
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Ph.D Course Work
PMMB 103 – Core/Elective Paper: MICROBIOLOGY

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 3: GENERAL VIROLOGY

1. The nature of viruses.
2. Classification of viruses
3. Morphology: virus structure
4. Virus replication
5. The genetics of viruses
6. The pathogenicity of viruses
7. Epidemiology of viral infections
8. Vaccines and antiviral drugs
9. Bacteriophages
10. DNA & RNA virus
11. Prion diseases

Ph.D. Course work, HIMSR

Ph.D Course Work
PMMB 104 – Core/Elective Paper: MICROBIOLOGY

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 4: GENERAL PARASITOLOGY

1. Host-parasite relationship
 2. Protozoan parasites of medical importance:
(Entamoeba, Giardia, Trichomonas, Leishmania, Plasmodium, Toxoplasma, Cryptosporidium, Balantidium, Isospora, Cyclospora, Microsporidium etc.)
 3. Helminthology: All medically important helminths belonging to Cestoda, Trematoda and Nematoda.
 4. Ectoparasites: Common arthropods and other vectors .
 5. laboratory Diagnosis of Parasitic Diseases
 6. Concentration and other techniques
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Ph.D Course Work
PMMB 105 – Core/Elective Paper: MICROBIOLOGY

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 5: GENERAL MYCOLOGY

1. General characteristics & classification of fungi
 2. Morphology & reproduction of fungi
 3. Isolation & identification of fungi
 4. Tissue reactions to fungi
 5. Yeasts and yeast like fungi of medical importance including Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces etc.
 6. Mycelial fungi of medical importance
 7. Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffeii etc.
 8. Dermatophytes
 9. Pneumocystis carinii infection
 10. Common laboratory contaminant fungi
 11. Antifungal agents & invitro antifungal susceptibility tests.
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CORE/ELECTIVE PAPER: Department of Pharmacology, Hamdard
Institute of Medical Sciences and Research

Ph.D. Course work, ICMASR



Ph.D Course Work
PMPH 101 – Core/Elective Paper: Medical Pharmacology

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 1: GENERAL AND SYSTEMIC PHARMACOLOGY

Unit	Content
Unit-1 General Pharmacology	General principles pharmacodynamics and pharmacokinetics – drug receptor interactions, modes of drug action, receptor agonists and antagonists, dose response; drug-receptor interactions, drug-disease interactions, etc. Pharmacokinetic principles: absorption, distribution, metabolism, excretion of drugs. Drug evaluation methods; Pharmacogenetics; .
Unit-2 ANS Pharmacology	Drugs acting on cholinergic and adrenergic systems; Agonists and antagonists; Modes of action, uses and adverse effects; Drug interactions, Contraindications, etc. Anticholinergic drugs and their pharmacology;
Unit-3 CVS Pharmacology	Antihypertensive drugs, Anti-anginal drugs, Drugs in heart failure; anti-arrhythmics drugs; antiplatelet drugs, Fibrinolytic agents; anti-coagulants; anti-dyslipidemics drugs; RAAS, Nitric oxide; Pharmacokinetics and pharmacodynamics of CVS drugs; adverse effects; links with ANS; Evaluation methods of CVS drugs; analytical methods for biomarkers and drugs.
Unit-4 CNS Pharmacology	Neurotransmitters and their receptors in the CNS; Role of neurotransmitters in CNS disorders; Anxiolytics and Hypnotics; Anti-epileptics; Anti-psychotics; Anti-depressants; Drug therapy of neurodegenerative disorders; Evaluation methods for CNS drugs; analysis of drugs/biomarkers – methods.
Unit-5 Respiratory and Immune Pharmacology	Respiratory drugs; Drugs in bronchial asthma and COPD; Anti-tussives; Mucolytics; Modes of drug administration; Evaluation of drugs in bronchial asthma.

Ph.D Course Work
PMPH 102 – Core/Elective Paper: Medical Pharmacology

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 2: DRUG DISCOVERY/DEVELOPMENT and CLINICAL PHARMACOLOGY CONCEPTS

Unit	Content
Unit-1 <i>Drug discovery and pre-clinical development</i>	<ul style="list-style-type: none">• Drug discovery process: compounds centered drug design, target centered drug design, high throughput screening, combinatorial chemistry, structure based drug design, lead optimization and formulation design.• Role of genomics, pharmacogenomics, toxicogenomics, proteomics, biotechnology and bioinformatics in drug development process.• Pre-clinical testing, introduction to certain animal models, preclinical toxicity testing as per OECD guidelines and Schedule Y
Unit-2 <i>Clinical Trial Design and Conduct</i>	<ul style="list-style-type: none">• Phases of clinical trials: phases 0, I, II, III, IV and designs of clinical trials: parallel, crossover, factorial etc.• Clinical trial documents• Clinical trial process• Design of clinical trials in some disease conditions, including, cancer, diabetes, hypertension, dementia.• Budgeting, making budget and budget selection, contingency planning of unexpected condition, handling of missing data.• Responsibilities of sponsor, institution, clinical trial coordinator, monitor, auditor, inspector• Monitoring visits, audits and inspections, IDMC• Suspending and premature termination of clinical trial
Unit-3 <i>Roles and Responsibilities of Stake Holders in Clinical Trials</i>	<ul style="list-style-type: none">• An introduction to biomarkers, different types of biomarkers, use of biomarkers and surrogate end points, biomarker development• Biomarkers related to diseases of the cardiovascular and central nervous system• Concept of essential medicines, WHO and Indian list of essential medicines• Drug utilization studies and its impact on rational drug use• Basic concepts of GLP and GCLP
Unit-4 <i>Biomarkers in clinical drug development</i>	
Unit-5 <i>Essential Medicines/Rational Drug Use</i>	

Ph.D Course Work
PMPH 103 – Core/Elective Paper: Medical Pharmacology

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 3: PHYSIOLOGY

Unit	Content
Unit-1 General Physiology	Structure and Function of cell; Transport across cell membrane; Apoptosis, Homeostasis; Body water and body fluid; Membrane potential
Unit-2 Blood and CVS Physiology	Composition and Function; Plasma proteins; Cellular components; Haemoglobin; Coagulation of blood; Fibrinolytic mechanisms; Blood group; Immunity; Applied concepts
Unit-3 Respiratory Physiology	Mechanics of respiration; Transport of gases; Regulation of Respiration; Hypoxia; Physiology of High altitude; Effect of High atmospheric pressure; Physiology of Exercise; Applied concepts
Unit-4 Endocrine Physiology	General principles; Pituitary gland; Thyroid, Parathyroid & Calcium metabolism; Pancreas; Adrenal cortex; Adrenal medulla; Pineal gland; Local hormones; Applied concepts
Unit-5 Renal Physiology	Physiological Anatomy; Mechanism of formation of urine; Renal clearance; Counter current System; Acidification of urine; Regulation of volume; Physiology of micturition; Applied concepts

CORE/ELECTIVE paper: Department of Physiology, Hamdard
Institute of Medical Sciences and Research

Ph.D. Course work, IMSR



Ph.D Course Work
PMPHY 101 – Core/Elective Paper: Medical Physiology

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 1: PHYSIOLOGY

I. General Physiology

- Structure and Function of cell
- Transport across cell membrane
- Apoptosis, Homeostasis
- Body water and body fluid
- Membrane potential

II. Blood

- Composition and Function
- Plasma proteins
- Haemoglobin
- RBC
- Jaundice
- WBC
- Platelets
- Coagulation of blood
- Fibrinolytic mechanisms
- Blood group
- Immunity

III. Nerve Muscle Physiology

- Structure and Function
- Physiological properties of nerve fiber
- Nerve fiber -Types & Function
- Degeneration & Regeneration in peripheral nerves
- Neuromuscular Junction
- Skeletal Muscle
- Cardiac and smooth muscle

IV. GIT

- Anatomy & Innervation
- Salivary secretion
- GI Motility
- Gastric motility & emptying
- Peptic ulcer
- Exocrine functions of Pancreas
- Liver -Structure and function
- Small and large intestine
- Secretions and movements
- Digestion & absorption in GIT
- GIT hormones

V. Kidney

- Physiological Anatomy
- Mechanism of formation of urine

- Renal clearance
- Counter current System
- Acidification of urine
- Regulation of volume
- Physiology of micturition

VI. Respiration

- Physiological Anatomy
- Mechanics of respiration
- Transport of gases
- Regulation of Respiration
- Hypoxia
- Physiology of High altitude
- Effect of High atmospheric pressure
- Physiology of Exercise

VII. CVS

- Physiological Anatomy
- Properties of cardiac muscle
- Cardiac cycle
- ECG
- General principles of Circulation
- Cardiovascular regulatory mechanisms
- Cardiac output
- Blood pressure
- Regional circulation
- Cardiovascular homeostasis in health & disease

VIII. Endocrine

- General principles
- Pituitary gland
- Thyroid
- Parathyroid & Calcium metabolism
- Pancreas
- Adrenal cortex
- Adrenal medulla
- Pineal gland
- Local hormones

IX. Reproduction

- Physiology of Reproduction
- Sex differentiation & development
- Puberty
- Male reproductive system
- Female reproductive system
- Pregnancy, lactation & maternal changes during pregnancy
- Physiology of Foetus & new-born
- Foetus circulation
- Family planning measures

X. Special Senses

- Vision
 - Hearing including vestibular system
-
- Smell
 - Taste

XI. CNS – I

- ANS – Organisation of CNS
- Synapse & its properties

- Neurotransmitters
- Sensory Receptors
- Reflexes
- Muscle spindle
- Ascending tracts
- Sensory Modalities including pain
- Descending tracts
- Spinal cord & its lesions

XII. CNS – II

- Basal ganglia
- Cerebellum
- Control of posture & movement
- Thalamus
- Cerebral circulation, CSF
- Reticular Formation
- EEG, Sleep
- Hypothalamus
- Regulation of body temperature

XIII. CNS – III

- Limbic system
- Higher Functions of CNS
- Learning, memory & speech

XIV. SPACE PHYSIOLOGY

Space Physiology (e.g., space environment, musculo-skeletal system, cardiovascular system, exercise and research methods and techniques), Space Nutrition (e.g., nutritional requirements, ground based research models, effect of microgravity on specific requirements, role of nutrition in mediating bone and muscle wasting and radiation exposures), and Space Radiation (e.g., complex radiation environment, detection, biological effects of low- and high-LET radiation, countermeasures).

XV. ENVIRONMENTAL PHYSIOLOGY

1. Introduction to environmental physiology
 - b) Body temperature regulation
 - c) Man in cold environment
 - d) Man in hot environment
 - e) Hypothermia and its clinical applications
 - f) Physiological responses to high altitude
 - g) Physiological responses to high atmospheric pressure
 - h) Radiation biology: Introduction to ionizing radiation,
 - i) Biological effects of radiation
- Bioinstrumentation

XVI. CLINICAL APPLIED ASPECTS OF SYSTEMIC PHYSIOLOGY

- a) Applied systemic physiology – assessment, diagnosis and pathophysiology
 - b) Recent advances in physiology
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Ph.D Course Work
PMPHY 102 – Core/Elective Paper: Medical Physiology

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 2: SPORTS AND EXERCISE PHYSIOLOGY

- UNIT 1: Origins of Exercise Physiology; Scope, Importance; Application in Competitive sports, Recreation sports, Medical rehabilitation; Human energy transfer in rest and exercise; Concept of Aerobic and anaerobic energy production; Energy expenditure in different activities;
- UNIT 2: Physiological Adaptations to exercise and training; measurement of exercise and training related changes
- UNIT 3: History, Importance, Aim and objectives of sports training; Characteristics of sports training; biological process in training; Components of physical fitness (motor abilities)– endurance, strength, speed, flexibility, co-ordination; agility Principles of training - Overload, specificity, progression and reversibility; Meaning and concept of Training load; Adaptation and Recovery, supercompensation, training structure - volume, intensity, frequency; Peaking, errors in training,
- UNIT 4: Physiology of Endurance Performance: Cardiovascular control during exercise, cardiovascular response to endurance exercise, Respiratory regulation during exercise, Cardiovascular and respiratory adaptation to training
- UNIT 5: Physiology of Strength Performance : Types of muscle fibers, Generation of muscle force, Factors influencing force generation, Strength curve and rate of force development for various muscles , Measuring muscular performance, Muscle size, Muscle hypertrophy and hyperplasia,
- UNIT 6: Concept of athlete support, Athlete development stages - child, pre-adolescent, adolescent and adult. Human growth and development. Age related development in performance. Concept of talent in sports. Talent identification.
- UNIT 7: Physiological testing of athletes Maximal aerobic capacity- Explanation of result, its implication in sports, Training intensity and improvement in VO₂max , Limitations of assessing VO₂max, Indirect assessment of VO₂max Multi-stage shuttle run test, Cooper test, Queens College Step test. Submaximal aerobic test- Astrand nomogram, PWC 170. Assessment of strength- Dynamometers, 1 repetition maximum (1RM). Assessment of dynamic strength; Assessment of muscular endurance; Assessment of flexibility; Assessment of anaerobic power- Mergaria power test, de Bruyn Prevoost test; Wingate test- Peak power output, Relative peak power output, Anaerobic fatigue, Anaerobic capacity/power. Running based Anaerobic Sprint Test (RAST)- Maximum power, Minimum power, Fatigue index. Peak lactate and its importance- Talent selection and transfer of talent, Changes of lactate peak during season, Lactate peak and training,
- UNIT 8: Disease, exercise and health- Exercise, fitness and health, Physiological benefits of exercise, Exercise and disease.
- UNIT 9: Principle of exercise testing in cardiac rehabilitation, exercise prescription of cardiac patients, weight training for cardiac rehabilitation. Exercise prescription for pulmonary diseases, neuromuscular diseases, and renal disorders. Unit 4 Exercise for diabetic patients. Exercise prescription for pregnancy. Effect of exercise on cancer.
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- ~~Demonstrating Functional Outcomes for Health and Fitness.~~

Ph.D Course Work
PMPHY 103 – Core/Elective Paper: Medical Physiology

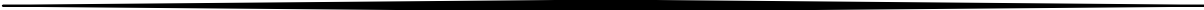
Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 3: IMMUNOLOGY

1. Introduction to Blood
 2. The normal immune system.
 3. Innate immunity.
 4. Antigens
 5. Immunoglobulins.
 6. Complement
 7. Antigen and antibody reactions
 8. Hypersensitivity
 9. Cell mediated immunity.
 10. Immunodeficiency.
 11. Autoimmunity
 12. Immune tolerance.
 13. Transplantation immunity.
 14. Tumour immunity.
 15. Prophylaxis and immunotherapy.
 16. Measurement of immunity.
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Core/Elective Paper: Department of Community Medicine (Public Health), Hamdard Institute of Medical Sciences and Research

Ph.D. Course work HIMSR



Ph.D Course Work
PMPHC 101 – Core/Elective Paper: Public Health

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 1: PUBLIC HEALTH BASICS

1. Basic Epidemiology:

- History of Epidemiology
- Measurements in Epidemiology
- Incidence and prevalence
- Rates and Ratios
- Causation and association
- Measures of association
- Outline of study designs (including cross sectional study design, case control study design, cohort study design and randomized control trials)
- Introduction to confounding and bias
- Screening tests- validity and reliability methods
- Sensitivity, Specificity and Predictive value
- Disease surveillance
- Outbreak investigation
- Public Health Action
- Communicable and non-communicable diseases

2. Basic Biostatistics:

- Types of variables
- Scales of measurement
- Measures of central tendency
- Measures of dispersion
- Types of distribution
- Baye's theorem
- Sample/sampling and population distribution
- Central limit theorem
- Type1 and type 2 error and power calculation
- P-value and 95% confidence Interval
- Parametric and non-parametric test
- How to choose the statistical test?
- Correlation
- Basics of regression
- One statistical software (SPSS/Stata)

3. Introduction to health economics:

- Key concepts of economics, micro and macro economics
 - Strategizing and prioritizing within scarce resources (decision making)
 - Determinants of demand, supply and costs of production
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- Concepts of efficiency, effectiveness, equity, elasticity of demand, costing, production, marginal cost analysis, and opportunity cost
- Market model, market failure, and the roles and limitations of markets in health care
- Universal health coverage and role of health care financing
- Principles and application of economic evaluation in health care including Cost Benefit Analysis (CBA) and Cost Effective Analysis (CEA)

4. Law and ethics in public health

- Public Health laws and ethics
 - Human rights in public health
 - Role of governments in managing health of people
 - Public health regulations in Indian context
 - Public health information and privacy
 - Research ethics in public health
 - Regulations during emergencies and outbreaks
 - Addressing newer challenges: Bioterrorism, conflicts and emerging infectious diseases
 - Public Health laws in global economy
 - Global health hazards and security
 - Different forms of power, influential to policy making
 - Concept of governance and institutions
 - Different theories useful in policy analysis
 - Political nature of evidence for policy making in health
 - Written and verbal competence in communicating evidence to inform policy
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Ph.D Course Work
PMPHC 102 – Core/Elective Paper: Public Health

Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 2: EPIDEMIOLOGY

Advanced Biostatistics:

- Principles of regression
- Methods of regression
- Linear regression
- Logistic regression
- Poisson regression
- Cox proportional hazards regression
- Regression diagnostics
- Introduction to multilevel modelling
- Introduction to data imputation
- Choosing the best models

Advanced Epidemiology:

- Directed acyclic graphs and conceptual framework
- Confounding bias and methods to reduce confounding
- Selection bias
- Information bias
- Measures of validity and reliability
- Nested study designs
- Advanced designs in clinical trials
- Systematic reviews and meta-analysis overview
- Epidemiology and management of Vector Borne Diseases
- Health measures following disasters
- Various public data sources: CRS, SRS, Census, NFHS, DLHS, HMIS, MCTS, etc.

Survey design and methods:

- Pre survey formative research
- Sampling and sample size calculations
- Ethical issues in surveys

- Tool development
- Conduct of surveys
- Quality control and assurance in surveys Survey data analysis
- Identify appropriate research designs for a range of questions in health
- Describe the steps involved in planning and conducting a research project
- Evaluate the strengths and weaknesses of various data collection methods

Communicable disease epidemiology:

- Recognize the burden of communicable diseases (CD) affecting the population
- Examine factors contributing to the persistence of infectious diseases
- Understand reasons for emergence and re-emergence of infectious diseases
- Key concepts covered are:
 - Incubation periods,
 - Epidemic patterns,
 - Modes of transmission
 - Transmission dynamics
 - Measures of infectiousness
 - Secondary attack rates
- Analyze the transmission dynamics of diseases and design appropriate control measures
- Apply basic infectious diseases epidemiological skills to address major emerging and re-emerging communicable diseases
- Surveillance: Case in point: Integrated Disease Surveillance Program (IDSP)
- Epidemiology of common communicable diseases like TB, Malaria, COVID-19, Leprosy, Polio, STIs, AIDS, Meningococcal meningitis, Hepatitis B, and Measles (mathematical models of infection dynamics, outbreak investigation and surveillance, schedules, adverse reactions, contraindications, vaccine efficacy, impact assessment)
 - Live outbreak investigation (e.g. COVID-19)
 - Adverse Event Following Immunization (AEFI) investigation
 - Covid Vaccination Programme
 - Digital support of Immunization like EVIN and CoWin

Non-communicable diseases (NCD) epidemiology:

- Describe and understand the epidemiology of NCDs: Cardiovascular diseases, Hypertension, Diabetes mellitus, Cancers, Mental health, Stroke, Burns/trauma/accidents, Long Covid etc.
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- Comprehend the upstream and downstream determinants of NCDs

- Understand the Individual approaches/or high-risk approaches and population based/ or public health approaches to prevent NCDs
Recognize the risk factor approach to prevent non-communicable diseases
- Comprehend the Population based/public health approaches to prevention of common NCD risk factors (physical inactivity, tobacco and unhealthy diet)
Familiarize with the current projects on targeting the prevention of NCDs, including, innovations in prevention
How prevention of NCDs interlinks with Communicable diseases? How women and child health, health of the girl child links to prevention of NCDs?
- Recognize Economic burden of NCDs and benefits of prevention
- Comprehend how sustainable development and prevention of NCDs go hand in hand
- Comprehend the power of policy and role of environment in the prevention of NCDs
- Population-based screening
- Surveillance of cancers including cancer registry

Ph.D. Course work, HIMSR

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CORE/ELECTIVE 3: HEALTH PROGRAMMES, POLICY AND PLANNING

Health policy, process and planning:

- Policy making: key components
- Policy framework
- Stake holders in policy making
- Effects of different interest and advocacy groups in influencing health policy
- Translating research in policy making
- Effects of national and international affairs on health policy
- Introduction to different national health, population, disease control, tobacco control, nutrition, maternal and child health policies
- Short term versus long term policies
- Resources allocation to optimize health
- Using research and data to drive good policy making
- NITI Aayog

Design and evaluation of public health programs (including current NHPs):

- Concepts underlying the design of health programs;
- Basic approaches to the design in health programmes, with a focus on low resource settings
- analysis and interpretation of studies/programs;
- Communication in conducting public health research
- National health programmes in India (including goals, objectives, purposes, organization, man power, sources, activities, roles and responsibilities)
- Health Insurance including PM-JAY

Translating research for Health Policy and Advocacy:

- Different forms of power influential to policy making
- Concepts of Governance and Institutions

Different theories useful in policy analysis

- Political nature of evidence for policy making in health
- Written and verbal competence in communicating evidence to inform policy
- Critical appraisal of issues in health policy and financing

Current issues in health policy: National and Global perspective:

- Theory explaining public health action, its evolution and application in health policy
- Methods of assessing the health impact of different types of policy; national and global perspective
- Assessing health impacts of different policies across sectors
- Impact of health threats and interventions to counter health threats including crisis management

Role of Non-governmental Organizations (NGOs) in health care:

- Health service delivery and program Implementation
 - Research and evidence generation
 - Training and education
 - Inter-sectoral coordination in health including Public Private Partnership
 - Advocacy and planning in health care
 - International Health Agencies including International Health regulations
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CORE/ELECTIVE 4: RMNCH+A

Reproductive and Sexual Health

- Fundamentals of reproductive biology
- Adolescent Sexual and Reproductive Health
- RMNCH+A Family Welfare and Reproductive Health measures
- RMNCH+A programs in India

Maternal, Newborn and Child Health (MNCH):

- Introduction to maternal, new-born and child health programs and their behavioural basis
- Historical developments in MCH in India
- Reproductive & Perinatal Epidemiology
Prenatal and Infant Growth and Development
- Issues in the Reduction of Maternal and Neonatal Mortality
- Preventing peri-natal and infant mortality
- Infectious Disease and Child Survival
- Nutrition and Growth in Maternal and Child Health
- Legislations and programs in RMNCH+A
- MIYCN

Adolescent Health:

- Overview of population health approaches for adolescents
- Adolescent Health and Development
- The Social Context of Adolescent Health and Development
- International Adolescent Health
- Adolescent Health status in India
- Adolescent Health Development - policy and systems
- Health issues specific to adolescents: anaemia, teenage pregnancy, menstrual hygiene, obesity, mental health promotion and illness prevention, substance use prevention, violence, media, internet addiction, etc.

Gender and Health:

- Define concepts - Gender, vulnerable populations, gender equality and equity and emerging issues
- Understand the difference between equity and equality
- Understand different forms of social exclusion
- Explain the difference between sex and gender and how these variables, combined with other forms of social exclusion impacts on health
- To increase understanding of the importance, benefits and urgency to identify and reduce barriers and address the needs of women and socially excluded groups, and promote their agency in the context of accessing health care and related information
- To increase understanding of the inter- sectionalism between gender and other types of social exclusion/inclusion and patients' experiences in accessing and utilizing health services and the impacts on uptake and utilization of services
- To increase understanding of the realities of discrimination from the grass root perspective
- To identify good practices in Gender and Social Inclusion (GSI) within India

- To become familiar with toolkits for including GSI in public health research, programs, policies and advocacy

Public Health Nutrition

- Appreciate the basic concepts and principles of foods and nutrition relevant to human health
 - Summarize population based dietary and nutritional recommendations
 - Define the concept, purpose and scope of Public Health Nutrition
 - Understand the definition, utility and applications of epidemiology in nutritional sciences
 - Recognize the role of community nutrition in improving human health
Utilize suitable data and assessment methodologies to conduct community needs assessment
 - Recognize the pillars of a healthy community
 - Identify the most relevant nutrition concerns in the community at present and enlist strategies for their prevention and management (Adolescent, Women, Maternal and child under-nutrition, nutrition transition, over-nutrition and chronic diseases)
 - Demonstrate an understanding of principles of nutrition education and enlist the steps of developing nutrition education programs
 - Demonstrate an understanding of project planning and management in nutrition Programmes
 - Appreciate inter-sectoral nature of nutrition and food policy
 - Enlist the features of various ongoing nutrition programs
 - Under/over nutrition
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Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 5: DISASTER MITIGATION & MANAGEMENT

- UNIT 1 **Introduction to Disaster Management & Mitigation:**
Definition, National proneness to disaster, History of disasters and their repercussions, precessions, Preparedness, Mitigation, Risk management and assessment.
- UNIT 2 **Impact of a disaster, Types of disaster:**
Man made and Natural, Disaster, Management Cycle, Differences from a hazard and catastrophe, Short term and long term risk, Health risk Assessment
- UNIT 3 **National Disaster Management Act:**
National Disaster Management Act, Epidemic Diseases Act, Role of National Institute of Disaster Management, Role of State and districts in Disaster Preparedness. Chapters I – X in the Disaster Management Act consisting of the various basics, legal issues, punishments and liabilities.
- UNIT 4 **Role of NDMA in dealing with Disasters** with examples and BEST Practices.
- UNIT 5 **Role of a Public Health Expert during Disaster and the expectations**
Role of a Public Health Expert during Disaster and the expectations – at various Levels, Triage, Secondary attacks, education, sanitation, communication and Secondary infection control
- UNIT 6 **Challenges and barriers in the mitigation strategies:**
Challenges and barriers in the mitigation strategies – Unified Command, Systematic Rehabilitation, Control of NGOs, Response tools. Preparedness strategies – Mock drill, simulation exercises, indigenous clues and future ahead, Reconstruction and Rehabilitation
- UNIT 7 **Bioterrorism**
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Credit: 4, Max. Marks: 100, Time: 60 hours

CORE/ELECTIVE 6: NUTRITION

UNIT 1 Basics and Physiology of Nutrition, Dietetics, Principles and type of nutrients, Requirements, Health aspects and benefits

UNIT 2: Malnutrition::

Undernutrition during infancy and Malnutrition in young children, Measuring Child Nutrition, Prevention and Control of Protein Energy Malnutrition, Growth monitoring and Nutrition Surveillance. Obesity and its implications.

UNIT 3: Micronutrient Deficiency

Micronutrient Deficiency Disorders, Malnutrition in Adolescents, Nutritional Anemia, Iodine Deficiency Disorders, Zinc Nutrition.

UNIT 4: Dietary Surveys and methods for nutritional assessment

UNIT 5: Nutritional Programmes & Policies

Nutrition Interventional Programmes, National Nutrition Policies, FSS Act and other legislations. FSSAI and Community level nutritional Programmes and other aspects of Public Health Nutrition

UNIT 6: Food fortification, Food poisoning and intoxication.

Food fortification, Food poisoning and intoxication Safety of food and food handling. Genetically modified food and crops, Challenges and the future ahead. Nutrition in special age groups and conditions: Infant and young child nutrition, Geriatric nutrition, nutrition during pregnancy, lactation and illnesses.

UNIT 7: Field Visit: Field visits to AWC, SC, PHCs
