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PART-A

The Common Recruitment Test (CRT) will be of 02 hours duration & will be of 100 marks. It will contain multiple choice questions (MCQs)

- 60 Marks from the core subject related to the post and of the level of the qualifications required.
- 10 Marks on General English.
- 10 Marks on general Knowledge.
- 10 Marks on Reasoning.
- 10 Marks on Mathematical Aptitude.

Indicative Syllabus: For General Aptitude

A] Reasoning: It would include questions of nonverbal type. This component may include questions on analogies, similarities and differences, spatial orientation, problem solving, Analysis, judgement, decision making, discrimination, observation, relationship concepts, arithmetical reasoning and figural classification, arithmetic number series, non verbal series, coding and decoding, statement conclusion, etc the topics are, symbolic/ number analogy, figural analogy semantic classification, symbolic/Number Classification, Figural Classification, semantic series, number series, Figural series, problem solving, word building, coding & decoding, Numerical operations, symbolic operations Trends, space orientation, space Visualization, Venn diagrams, Drawing inferences, Punched hole/pattern-folding & unfolding. Figural pattern- Folding and completion, indexing. Address matching, Date & city matching, Classification of centre codes/roll numbers, small & capital letters/numbers coding, decoding and classification, Embedded Figures, Critical thing, Emotional Intelligence, Social Intelligence, Other sub-topics, if any.

B] General Knowledge: Questions in this component will be aimed at testing the candidate's general awareness of the environment around him and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in the scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighboring countries especially pertaining to history, culture, geography, economic scene, general policy & scientific research.

C] Mathematics Aptitude: The questions will be designed to test the ability of appropriate use of numbers and number sense of the candidate. The scope of the test will be computation of whole numbers, decimals, fractions and relationship between numbers percentage, Ration & Proportion, Square roots, Averages, Interest, Profit & Loss, Discount, Partnership, Elementary Surds, Graphs of Linear Equation, Triangle and its various kinds of centers, Congruence and similarity of triangles, Circle and its chords, tangents, angles subtended by chords of a circle

common tangents to two or more circles, Triangle, Quadrilaterals, Regular polygons, Circle, Right Prism, Right circular cone, Right circular cylinder, Sphere, Hemispheres, Rectangular Parallel piped, Regular right pyramid with triangular or square base, Trigonometric ration, Degree and radian Measures, Standard Identities, Complementary Angles, Heights and Distances, Histogram, Frequency, polygon, Bar diagram & pie chart.

D] General English: Candidates ability to understand correct English, his basic comprehension and writing ability would be tested, Questions will be designed to test the candidates understanding and knowledge of English language and will be based on spot the error, fill in the blanks, synonyms, antonyms, spelling/detecting mis-spelt words, idioms and phrases. One word substitution, improvement of sentences, active/passive voice of verbs, conversion into direct/indirect narration, shuffling of sentence parts, shuffling of sentences in a passage, comprehension passage and any other English Language questions at the Level of Matriculation /Higher Secondary.

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PART-B

Syllabus of Community Medicine (Core Subject)

1. Conceptual (and applied) understanding of Public Health, Community Medicine, clinical disease-oriented approach, Preventive approach & Health promotion, disease control & promotion.

i. Understand and explain the concept & application and give suitable analogies/examples related to Public Health/Community Medicine (with differences), Disease-oriented v/s Preventive approach, health promotion disease control & prevention.
ii. Explain correlation between health and human development with analogies/ examples.
iii. Explain concept of Primordial, Primary, Secondary and Tertiary prevention with examples.
iv. Evolutionary History and mile-stones in Public Health – National and International levels.

2. Communicable and Non-Communicable diseases, emerging and re-emerging diseases Learning objectives:

    i. Understand and explain Epidemiology of Communicable/Non-communicable diseases- its causes, precipitating factors, social & other non- health causes, mechanisms of transmission, signs/systems, management, control & prevention measures, related national Health Programs & national Guidelines, Directives, special projects, if any.
    ii. Explain application of Disease surveillance system in control of Communicable/Non- communicable diseases.
    iii. Explain & undertake steps to investigate & control outbreaks, epidemics and take measures to prevent the same
    iv. Evolve prevention & control measures based on local & regional epidemiological funding, synchronizing with National guidelines

3. Applied Epidemiology, Health research, Bio-statistics

i. Explain the concept & application of Epidemiology of Disease and Health giving suitable examples.
ii. Explain Epidemiological approach, the terms Distribution & Determinants, uses, types of Epidemiological studies, interpretation, merits/demerits and limitations, odds ratio, relative risk, attributable & population attributable risks, Hybrid designs (with examples), validity of Epidemiological Data and application in practice at field level.
iii. Explain Epidemiological Research methods, Research related protocols, Literature review, estimating sample size, data collection/ compilation/Analysis/ Research, interpretation.
iv. Develop Health interventional programs based on Epidemiological Finding & create evidence for Public Health action.
v. Understand difference between data, information & intelligence, types of data, survey methods, formulating questionnaires, interview schedule, data presentation types & analysis.
vi. Apply computer based software application for data designing, data management & collation analysis e.g. SPSS, Epi-info, MS office and other advanced versions.

4. Nutrition Learning objectives:

i. Identify various nutritional problems in the region, state and country and contributing factors for the same, with due emphasis on ecology perspectives.
ii. Explain importance of various nutrients (including micronutrients) in health, their sources, requirements and problems associated with their deficiencies as well as over consumption.
iii. Plan balanced diet and dietary requirements of various age and sex groups.
iv. Dietary/nutritional concerns of vulnerable groups – young children, adolescents, ANC/PNC/Lactating mothers/senior citizens/individuals with various health problems e.g hypertension, diabetes, renal problems etc.
v. Classification of food, food additives, food fortification, food enrichment, food toxins and food adulteration.
vi. Explain Food production, Food hygiene and safety, food storage, food preparation, food wastage and feeding practices.
vii. Assessment of nutritional status of a community by adopting different

methodologies.

viii. Nutritional supplementation, surveillance, education and rehabilitation.

ix. National programs in nutrition and their evaluation

x. National nutrition policy.

5. Environmental health Learning objectives:

i. Highlight importance of external environment (air, water, noise, radiation, temperature, ventilation, solid waste disposal, insects and vectors, domestic and country yard pests, industrial waste disposal etc. and its impact on ecology and human health.

ii. Elaborate on health issues related to housing, air, water, noise, radiation pollution i.e. size of problems, area and specific groups affected, measurement of pollution levels and health impact of the same, corrective measures

iii. Elaborate on requirements of water, water chlorination and household purification measures, measurement of chlorine demand, Break-point chlorination levels, water quality.

iv. Assessment of quality of water and air, control of air pollution

v. Explain environmental sanitation and control measures (including appropriate technologies) – modern methods of sewage disposal, mechanical ventilation, soakage pits, gobar gas plants, smokeless Chula, solar energy, rainwater harvesting, sewage water recycling plants at society level etc.

vi. Explain global warming and its health impact.

vii. Elaborate on forest reserves, social forestry and health

viii. Study vectors of medical importance and integrated control measures against them.

ix. Explain dynamics of transmission of vector borne diseases

x. Explain pest control measures

xi. Explain environmental health issues in urban and rural areas

xii. Understand functioning of public sector measures to safeguard environmental health e.g water purification plant

xiii. Explain Legislative measures for protection of environmental health

6. Primary Health Care System, Panchayat Raj, National Health Programmes including RCH, Demography & Family Welfare:

i. Explain the meaning of Primary Health Care with suitable analogies with reference to India, and be able to define the systems approach for implementation of Primary Health Care.
ii. Enumerate the elements, principles, population coverage norms, staff patterns, day to day activities, programme schedule, stakeholders at PHC level.
iii. Explain the scope and implications of 3-tier system of Primary Health Care.
iv. Understand functioning of Rural Panchayat Raj system of development and its co-relation with health.
v. Promote community participation in Primary Health Care programme and motivate various stakeholders for the same.

vi. Understand and comply with medico-legal procedures related to Primary Health Care activities.
vii. Integrate, coordinate both health and non-health sectors for implementing various national health programs.
viii. Deliver the provisions of various health schemes to eligible be beneficiaries such as Janani Suraksha Yojana, Rashtriya Swasthya Beema Yojana, Rajiv Gandhi Jeevandayi ArogyaYojana etc.
ix. Impart training in health programmes for paramedical workers, lab technicians, community health volunteer's, interns and provide health education in the community.
x. Implement Public Health Skills for investigations and containment of outbreaks & epidemics.
xi. Understand history of evolution of public health, important milestones in the world and in India.
xii. Enumerate the various health committees established and their major recommendations since 1947-48 to till date.

7. Health Care Administration, Health Management and Public Health Leadership

i. Explain the conceptual difference between Administration and Management, Power and Authority with reference to health care.
ii. Explain the role of fundamental principles of constitution, principles of Democracy and its correlation with health care administration.
iii. Explain the role of Bureaucracy, Technocracy, Political system, Judiciary,

Media and people in health care administration.

iv. Explain and identify the key positions and their role in health administration at State, District, Taluka (Tehsil block) and village level.

v. Explain the frame work of health care system at State, District, Taluka & village level and understand the mechanism of coordination between bureaucrats, technocrats, political, judiciary and media at each of these levels.

vi. Enumerate functions of a manager, explain concepts of management and leadership styles, various management techniques, planning process, monitoring & evaluation skills.

vii. Should be sensitive to quality issues in health care management and comply with relevant quality management techniques.

viii. Formulate and manage team approach for implementing health programs.

ix. Apply skills of effective human resource management and identify relevant roles, responsibilities and duties of functionaries.

x. Implement skills of motivation, communication, negotiation and conflict management at PHC level.

xi. Develop budgetary statements based on evidence of needs assessment and be able to maintain account of expenditure as per norms.

xii. Undertake community health needs survey, conduct training & communication needs assessment of paramedical and health workers, identify vulnerable, underprivileged communities, implements high risk approach.

8. Health Policy, Medical Education, Integrating Alternative system of Medicine

i. Understand and elaborate implications of the policy provision with reference to the current health scenario in the country.

ii. Explain the role of health policy in promotion of Primary Health care, ensuring equity, inter- sectoral co-ordination, appropriate technology and community participation.

iii. Explain the various provisions for promotion of preventive and curative health services including National Health Mission, National Health Programs, and Quality Hospital based services, Medical Education and AYUSH.

iv. Critically appreciate merits and demerits of the Health Policy.

v. Explain SWOT analysis of the policy and debate on evidence based recommendations, additions, deletions.

vi. Debate on suggestions or recommendations for future inclusions.

9. Social and behavioral sciences Learning objectives:

   i. Understand influence of social and behavioral practices on health.
   ii. Understand principles of behavior change of an individual and community. Clearly understand difference between knowledge, attitude and practices.
   iii. Understand importance of social medicine and health.
   iv. Importance of behavior change communication (BCC).
   v. Socio-cultural factors influencing behavior change.
   vi. Formal and informal organizations in the community.
   vii. Influence of peer pressure.
   viii. Know the health problems, where BCC interventions are necessary.
   ix. Understand factors promoting and detrimental to BCC.

10. Public Health Legislations Learning objectives:

   i. Explain public health legislations and need for the same.
   ii. Know in detail each public health law – when, why, implementation, impact, issues etc.

   iii. Enforcement of various public health laws.
   iv. Judiciary mechanism for ensuring proper implementation of public health laws.
   v. Scope for integrated approach for implementation of public health laws.

11. International Health Learning Objectives:

   i. Understand the need and scope for international health measures.
   ii. Enlist and understand functioning of various UN agencies (including WHO) playing key role in international health.
   iii. Enlist and understand functioning of bilateral vs multilateral international donor agencies.
   iv. Provide advice to international travelers and vaccination requirements,
   v. Understand International health control measures e.g. quarantine, airport management etc.

vi. Understand the management of international ports from health perspectives.

12. Occupational Health Learning Objectives:

i. Understand the concept of occupational health and its importance, Occupational environment and work dynamics.
ii. Know different types of occupational exposures at various settings.
iii. Enlist various occupational hazards and their relative magnitude.
iv. Understand measurement of exposure levels to harmful influences during occupation.
v. Understand preventive and control measures against various occupational hazards – global, national and local level measures.
vi. Understand individual and community responses towards preventing exposure to occupational hazards.
vii. Understand and advise occupational safety measures.
viii. Understand legislative measures to prevent exposures to occupational hazards.
ix. Advice compensation provisions to persons exposed to various occupational hazards.
x. Understand occupational health problems amongst people in unorganized sector
xi. Understand and advise social security and welfare provisions for workers – ESIS, Factory's Act, Role of ILO, Ministry of Labor, DGFASLI.

13. The recent advances in Public Health & miscellaneous issues Learning Objectives:

i. Identify & enlist events at local, district, national & global levels influencing or adversely affecting health /medical issues of the population.
ii. Adopt &practice skills related to utilization of modern technology, software, IT application in the interest of health promotion & disease prevention.

14. Health Economics Learning Objectives:

i. Describe the scope of health economics.
ii. Understand health market & its characteristics.
iii. Understand & apply economic evaluation techniques.
iv. Assess the mechanism of Funding Health Care services, especially health insurance.
v. Advise on allocation of resources appropriately in their work area.

LIFESCIENCES

1. Molecules and their Interaction Relevant to Biology
2. Cellular Organization
3. Fundamental Processes
4. Cell Communication and Cell Signaling
5. Developmental Biology
6. System Physiology– Plant
7. System Physiology– Animal
8. Inheritance Biology
9. Diversity of Life Forms
10. Ecological Principles
11. Evolution and Behavior
12. Applied Biology
13. Methods in Biology

1. MOLECULES AND THEIR INTERACTION RELAVENT TO BIOLOGY

A. Structure of atoms, molecules and chemical bonds.
B. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
C. Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
D. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

E. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.

F. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes

G. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

H. Conformation of nucleic acids (helix(A, B,Z), t-RNA, micro-RNA).

I. Stability of proteins and nucleic acids.

J. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

2. CELLULAR ORGANIZATION

A) **Membrane structure and function**
(Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes).

B) **Structural organization and function of intracellular organelles** (Cell wall, nucleus,
mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility).

C) **Organization of genes and chromosomes (**Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, hetero chromatin, euchromatin, transposons).

D) **Cell division and cell cycle** (Mitosis and meiosis, their regulation, stepsin cell cycle, regulation and control of cell cycle).

E) **Microbial Physiology** (Growth yield and characteristics, strategies of cell division, stress response)

3. FUNDAMENTALPROCESSES

A) **DNA replication, repair and recombination**(Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).

B) **RNA synthesis and processing** (transcription factors and machinery, formation of

initiation complex, transcription activator and repressor ,RNA polymerases, capping, Elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).

C) **Protein synthesis and processing** (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, amino acylationo ftRNA, tRNA-identity, aminoa cylt RNA synthetase, and translational proof-reading, translation alinhibitors, Post-translational modification of proteins).

D) **Control of genee xpression attranscription and translation level** (regulating the expression of phages, viruses, prokaryotic and eukaryoticgenes, role of chromatining eneexpression and genesilencing).

4. <u>Cell communication and cellsignaling</u>

A) **Host parasite interaction** Recognition and entry processes of different pathogens like bacteria, viruses into anima land plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

B) **Cell signaling** Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two- component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

C) **Cellular communication** Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

D) **Cancer**
Genetic rearrangements in progenitor cells, on cogenes, tumor suppress orgenes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

E) **Innate and adaptive immune system** Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. Band T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of BandTcells, Band T cell receptors, humoral and cell- mediated immune responses,

primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and auto immunity, immune response during bacterial (tuberculosis), parasitic(malaria) and viral(HIV) infections, congenital and acquired immune deficiencies, vaccines.

5. DEVELOPMENTAL BIOLOGY

A) Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morpho genetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development

B) Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals ;embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

C) Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in *Dictyostelium*;axesandpatternformationin*Drosophila*,amphibiaandchick;organogenesis– vulva formation in *Caenorhabditiselegans*, eyelens induction, limb development and regeneration invertebrates; differentiation of neurons ,post embryonic development-larval formation, metamorphosis; environmental regulation of normal development sex determination.

D) Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis*and *Antirrhinum*

E) Programmed cell death, aging and sesenescence

6. SYSTEMPHYSIOLOGY-PLANT

A. **Photosynthesis**-Light harvesting complexes; mechanisms of electron transport; photo protective mechanisms; CO_2 fixation-C_3, C_4 and CAM pathways.

B. **Respiration and photo respiration**–Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photo respiratory pathway.

C. **Nitrogen metabolism** -Nitrate and ammonium assimilation; amino acid biosynthesis.

D. **Plant hormones**– Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

E. **Sensory photobiology**- Structure, function and mechanisms of action of phyto chromes, crypto chromes and photo tropins; stomatal movement; photo periodism and biological clocks.

F. **Solute transport and photo assimilate translocation–**uptake, transport and translocation of water, ions, solute sand macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photo assimilates.

G. **Secondary metabolites**-Bio synthes isofterpenes, phenols and nitrogenous compounds and their roles.

H. **Stressphysiology**–Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

7. SYSTEM PHYSIOLOGY- ANIMAL

A. **Blood and circulation**- Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, hemoglobin, immunity, haemostasis.

B. **Cardiovascular System:** Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG–its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

C. **Respiratory system**- Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

D. **Nervous system**-Neurons, action potential, gross neuro anatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.

E. **Sense organs**-Vision, hearing and tactile response.

F. **Excretory system**- Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

G. **Thermoregulation**- Comfort zone, body temperature–physical, chemical, neural regulation, acclimatization.

H. **Stress and adaptation**

I. **Digestive system** - Digestion, absorption, energy balance, BMR.

J. **Endocrinology and reproduction**- Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuro endocrine regulation

8. INHERITANCE BIOLOGY

A) Mendelian principles: Dominance, segregation, independent assortment.

B) Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests

C) Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

D) Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

E) Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

F) Microbial genetics: Methods of genetic transfers–transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.

G) Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

H) Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

I) Mutation: Types, causes and detection, mutant types–lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

J) Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

K) Recombination: Homologous and non-homologous recombination including trans position.

9. DIVERSITYOFLIFEFORMS:

A. **Principles & method soft axonomy:**

Concepts of species and hierarchical taxa, biological nomenclature, classical & quantititative methods of taxonomy of plants, animals and micro-organisms.

B. **Levels of structural organization:**
Unicellular, colonial and multi cellular forms. Levels of organization of tissues, organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications.

C. **Outline classification of plants, animals & micro organisms:**
Important criteria used for classification in each taxon. Classification of plants, animals and microorganisms. Evolutionary relationships among taxa.

D. **Natural history of Indian subcontinent:**

Major habitat types of the subcontinent, geographic origins and migrations of species. Comman Indian mammals, birds. Seasonality and phenology of the subcontinent.

E. **Organisms of health & agricultural importance:**
Common parasites and pathogens of humans, domestic animals and crops.

F. Organisms of conservation concern:
Rare, endangered species. Conservation strategies.

10. ECOLOGICAL PRINCIPLES

The Environment: Physical environment; biotic environment; biotic and abiotic interactions.

Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (*r*and*K*selection);concept of meta population–demes and dispersal, interdemic extinctions, age structured populations.

Species Interactions: Types of interactions, inter specific competition, herbivory, carnivory, pollination, symbiosis.

Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling(C,N,P);primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic(fresh water, marine, eustarine).

Biogeography: Major terrestrial biomes; theory of island biogeography; bio geographical zones of India.

Applied Ecology: Environmental Pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management

approaches.

Conservation Biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (ProjectTiger,Biosphere reserves).

11. EVOLUTION AND BEHAVIOUR

A. Emergence of evolutionary thoughts

Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis.

B. Origin of cells and unicellular evolution:

Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiement of Miller (1953); The first cell;
Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.

C. Paleontology and Evolutionary History:

The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multicellular organisms; Major groups of plants and animals; Stages in primate evolution including Homo.

D. Molecular Evolution:

Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence.

E. The Mechanisms:

Population genetics – Populations, Genepool, Gene frequency; Hardy-Weinberg Law; concepts andrate of change in gene frequency through natural selection, migration and randomgenetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

F. Brain, Behavior and Evolution:

Approaches and methods in study of behavior; Proximate and ultimate causation; Altruisman devolution-Group selection, Kinselection, Reciprocal altruism; Neural basis of learning, memory, cognition, sleep and arousal; Biological clocks; Development of behavior; Social communication; Social dominance; Use of space and territoriality; Mating systems, Parental investment and Reproductive success; Parental care; Aggressive behavior; Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioral changes.

12. APPLIED BIOLOGY:

A. Microbial fermentation and production of small and macro molecules.

B. Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for plants and animals.

C. Transgenic animals and plants, molecular approaches to diagnosis and strain identification.

D. Genomics and its application to health and agriculture, including gene therapy.

E. Bio resource and uses of biodiversity.

F. Breeding in plants and animals, including marker– assisted selection

G. Bioremediation and phytoremediation

H. Biosensors

13. METHODSINBIOLOGY

A. Molecular Biology and Recombinant DNA methods:

Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods.
Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Iso electric focusing gels.
Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems.
Expression of recombinant protein susing bacterial, animal and plant vectors.
Isolation of specific nucleic acid sequences
Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.
In vitro mutagenesis and deletion techniques, gene knock outin bacterial and eukaryotic organisms.

Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing.
Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques
Isolation, separation and analysis of carbohydrate and lipid molecules
RFLP, RAPD and AFLP techniques

B. **Histochemical and Immuno techniques**

Antibody generation, Detection of molecules using ELISA, RIA, western blot, immune precipitation, fluo cytometry and immune fluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

C **Biophysical Method:**

Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

D **Statisitcal Methods:**

Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance; X^2 test;; Basic introduction to Muetrovariate statistics, etc.

E. **Radio labeling techniques:**

Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guide lines.

F. **Microscopic techniques:**

Visualization of cells and sub cellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission

microscopes, different fixation and staining techniques for EM, freeze-etc hand freeze-fracture methods for EM, image processing methods in microscopy.

G. **Electrophysiological methods:**

Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT

H. **Methods in field biology:**

Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization: ground and remote sensing methods.

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Syllabus of Physiotherapy (Core Subject)

Biomechanics & Kinesiology

1. Concepts in Biomechanics: Kinematics ad Kinetics
2. Joint structure and Function
3. Muscle structure and function
4. Biomechanics of the Thorax and Chest wall
5. The Temporo mandibularJoint-
6. Biomechanics of the vertebral column
7. Biomechanics of the peripheral joints- Structure and components
8. Analysis of Posture and Gait

Exercise Therapy

1. Introduction to Exercise Therapy
2. Methods of Testing
   - Functional tests
   - Measurement of Join trange: Goniometer
   - Tests for neuro muscular efficiency
   - Electrical tests, Manual Muscle Testing, Anthropometric Measurements:Musclegirth, Static power Test, Dynamic powerTest, Endurance test, Speed test
   - Tests for Co-ordination
   - Tests for sensation
   - Pulmonary Function tests
   - Measurement of Limb Length
   - Measurement of the angle of Pelvic Inclination
3. Relaxation
4. Passive Movements
5. Active Movements
6. Free exercise
7. Technique of Massage Manipulations
8. Physiological and Therapeutic Uses of Specific Manipulations
9. Specific exercise regimens -Isotonic, Isometric, Isometric sIsokinetic regimens
10. Proprioceptive Neuromuscular Facilitation
11. Suspension Therapy
12. Functional Re-education.
13. Aerobic Exercise

14. Stretching
15. Manual Therapy & Peripheral Joint Mobilization
16. Balance-Definition
17. Co-ordination Exercise
18. Posture
19. Walking Aids
20. Basics in Manual Therapy & Applications with Clinical reasoning
    a. Contractile tissues, Non contractile tissues
    b. Mobility
    c. Myofascial assessment, Acute & Chronic muscle hold, Tightness, Pain-original & referred
    d. Mobilization skills for joints & soft tissues-Maitland, Mulligan, Mckenzie, MET, Myofascial stretching, Cyriax, Neuro Dynamic Testing

Electro Therapy

Low frequency Currents

1. Basic types of current
    a. Direct Current: types, physiological & therapeutic effects.
    b. Alternating Current
2. Types of Current used in Therapeutics
    a. Modified D.C
        i. Faradic Current
        ii. Galvanic Current
    b. Modified A.C
        i. Sinusoidal Current
        ii. Diadynamic Current.
3. Galvanic Current
4. Sinusoidal Current & Diadynamic Currentin Brief.
5. HVPGS–Parameters & its uses
6. Ionization/ Iontophoresis
7. Cathodal/ Anodal galvanism.
8. Micro Current & Macro Current
9. Types of Electrical Stimulators
    a. NMES-Construction component.
    b. Neuromuscular diagnostic stimulator-construction component.
    c. Components and working Principles
10. Principles of Application: Electrode tissue interface, Tissue Impedance, Types of Electrode, Size & Placement of Electrode–Water bath, Unipolar, Bi-polar, Electrode coupling, Current flow in tissues, Lowering of Skin Resistance.
11. Nerve Muscle Physiology
12. TENS
13. Pain: Define Pain, Theories of Pain (Outline only), Pain Gate Control theory in detail.

B-Electro-diagnosis

1. FG Test
2. SD Curve: Methods of Plotting SD Curve.
3. Nerve conduction velocity studies
4. EMG: Construction of EMG equipment.
5. Bio-feedback.

C-Medium Frequency

1. Interferential Therapy
2. Russian Current
3. Rebox type Current

Thermo & Actino therapy (High Frequency Currents)

1. Electro Magnetic Spectrum.
2. SWD
3. Pulsed Electro Magnetic Energy
4. Micro Wave Diathermy
5. Ultrasound IRR

6. Pulsed Electro Magnetic Energy: Principles, Production & Parameters of PEME, Uses of PEME.
7. Micro Wave Diathermy
8. Ultrasound IRR
9. UVR
10. LASER

Superficial heating Modalities

1. Wax Therapy
2. Contrast Bath
3. Cyclotherm
4. Fluidotherapy
5. Whirl Pool Bath
6. Magnetic Stimulation,
7. Cryotherapy

Physiotherapy in Orthopedics & Sports

1. PT assessment for Orthopedic conditions Fractures
2. Specific fractures and dislocations
3. Principles of various schools of thought in manual therapy. (Briefly Maitland and Mckenzie).
4. Degenerative and inflammatory conditions
5. Infective conditions

6. Review the postural abnormalities of spinal column.
7. Deformities
8. Cerebral palsy
9. Poliomyelitis
10. Leprosy
11. Amputations
12. Spinal conditions
13. Effects of spinal traction, types of traction, modes of application, indications for spinal traction, contraindications, precautions, limitations of traction.
14. Osteoporosis
15. Orthopedic surgeries: Pre and post-operative
16. Shoulder joint
17. Arthroplasty
18. Introduction to Bio-Engineering; Orthoses and prostheses;
19. Sports Physiotherapy: Physical fitness. Stages of soft tissue healing. Treatment guidelines for soft tissue injuries

    bursitis. Tennis and Golfer's elbow. Hamstring strains, Quadriceps contusion, TA rupture. Dequervain 'stenosynovitis. Trigger and Mallet finger. Plantar fasciitis. Wrist sprains.
20. Applied Yoga in orthopedic conditions.

Physiotherapy in General Medicine & General Surgery

1. Physiotherapy in mother and child care–ante and post-natal management, early intervention and stimulation therapy in childcare (movement therapy)
2. Applied Yoga in Obstetric and Gynecological conditions
3. Geriatrics–handling of old patients and their problems.
4. Complication common to all operations
5. Abdominal incisions.
6. Physiotherapy in pre and post-operative stages.
7. Operations on upper G.I.T.-oesophagus, stomach, duodenum
8. Appendisectomy, cholecystectomy, partial colectomy, ileostomy, hernia and herniotomy, hernioraphy, hernioplasty.
9. Physiotherapy in dentistry
10. Burns and its treatment
11. Physiotherapy intervention in the management of Medical, Surgical and Radiation Oncology Cases.
12. Physiotherapy in dermatology
13. ENT

Physiotherapy in Neurology & Psychosomatic Disorder-

1. Neurological Assessment
2. Neuro physiological Techniques

3. Paediatric Neurology Evaluation and Management of Brain and Spinal Cord Disorders
4. Evaluation and Management of Cerebellar, Spinal Cord and Muscle Disorders
5. Evaluation and Management of Peripheral Nerve Injuries and
6. Assessment and management of Neurological gaits
7. Pre and post-surgical assessment and treatment following conditions - Spinal disc herniation, Spinal stenosis, Spinal cord trauma, Head trauma, Brain tumors, Tumors of the spine, Spinal cord and peripheral nerves, Cerebral aneurysms, Subarachnoid hemorrhages, epilepsy, Parkinson's disease, Chorea, Hemiballism, Psychiatric disorders, Malformations of the nervous system, Carotid artery stenosis , Arteriovenous malformations, and Spina bifida.
8. Applied Yoga in Neurological conditions.

Physiotherapy In Cardiovascular, Pulmonary

1. Anatomical and Physiological differences between the Adult and Pediatric lung.
2. Bedside assessment of the patient-Adult & Pediatric.
3. Investigations and tests – Exercise tolerance Testing – Cardiac & Pulmonary, Radiographs, PFT, ABG, ECG, Hematological and Biochemical Tests.
4. Physiotherapy techniques to increase lung volume
5. Physiotherapy techniques to decrease the work of breathing
6. Physiotherapy techniques to clear secretions
7. Drug therapy
8. Neonatal and Pediatric Physiotherapy
9. Physiotherapy in Obstructive lung conditions.
10. Physiotherapy in Restrictive lung conditions.
11. Management of breathlessness.
12. Pulmonary Rehabilitation.
13. Physiotherapy following Lung surgeries
14. Respiratory failure–Oxygen Therapy and Mechanical Ventilation.
15. Introduction to ICU
16. Physiotherapy management cardiac surgeries.
17. Cardiac Rehabilitation.
18. Physiotherapy management following PVD.
19. Management of Pulmonary Restorative Dysfunction following surgical procedures on Abdomen and Thorax.
20. Management of Amputations following Diabetes, PVD-Prosthesis in amputations of lower limbs following ulcers and gangrenes.
21. Treatment, Response to exercise and Implications of Physiotherapy in the following disease conditions: Hypertension, Diabetes, Renal Failure and Obesity.
22. Applied Yoga in Cardio-respiratory conditions

Community Physiotherapy & Rehabilitation-

1. Rehabilitation: Definition, Types.
2. Community Based Rehabilitation
3. Planning and management of CBR Programs
4. Disability Evaluation
5. Role of Government in CBR
6. Role of Social work in CBR

7. Role of Physiotherapy in CBR
8. Screening and rehabilitation of pediatrics disorders in the community
9. Extension services and mobile units: Introduction, Need, Camp approach.
10. Vocational training in rehabilitation Geriatrics Rehabilitation
11. Industrial Health & Ergonomics-Occupational Hazards in the industrial area-Accidents due to
    a. Physicalagents-e.g.-Heat/cold,light,noise,Vibration,U.V.radiation,Ionizingradiation,
    b. Chemical agents-Inhalation, local action, ingestion,
    c. Mechanical hazards-overuse/fatigue injuries due to ergonomic alteration & ergonomic evaluation of workplace-mechanical stresses per hierarchy–
        i. Sedentary table work–executives, clerk,
        ii. Inappropriate seating arrangement-vehicle drivers
        iii. Constant standing-watchman-Defense forces, surgeons,
        iv. Over-exertion in laborers,-common accidents –Role of P.T.-Stress management.
    d. Psychological hazards
    Biological Hazards

Exam Cell
SGPGIMS