Tripura University

(A Central University)

Suryamaninagar

West Tripura

Syllabus for

Four Years Undergraduate Programme Subject:

Human Physiology

(As per NEP-2020)

5th Semester (Major)

Revised as on October, 2025

3RD YEAR
SEMESTER-V
HP-501C
Paper-9 (Theory)
Total Mark = 100 (IA = 40 + ESE = 60) Credit = 04

Unit-I (Molecular Biology-I)

1. Nucleic acid: Chemical composition of DNA, RNA and DNA structure, detailed account of double stranded DNA, B-DNA, Z-DNA.
2. DNA the genetic material (Experimental proof-Griffith and Harshey and Chase Experiments).
3. Replication: Semi-conservative model of DNA replication.
4. Prokaryotic DNA replication, replication origin, role of primase, DNA polymerases, helicase, topoisomerase, gyrase, ligase, and the mechanism of replication, leading strand and lagging strand synthesis. Functions of DNA polymerases-I, exonuclease activity.
5. Telomere, telomerase and mode of action.

Unit-II (Molecular Biology-II)

1. Transcription: Types of RNA, characteristics of prokaryotic and eukaryotic promoters, Coding region and noncoding region of genes, subunits of prokaryotic RNA polymerase and their functions, eukaryotic RNA polymerase
2. Transcription, initiation, elongation and termination (rho dependent and rho independent mechanism).
3. Post-transcriptional processing of mRNA – capping, poly A tailing and splicing.
4. Translation: t RNA structure, Genetic code, degeneracy of genetic code, Wobble hypothesis. Mechanism of translation.
5. Regulation genes expression and operon concept, regulation of Lac operon and Tryptophan operon.

Unit-III (Human Genetics-I)

1. Chromosomal organization – chromosomal packaging, role of histones and other proteins.
2. Concept of gene and genome sizes. Gene structure: structural organization of prokaryotic and eukaryotic genes, repetitive DNA, DNA fingerprint
3. Regulatory elements of eukaryotic genes, (proximal or internal including promoter, operator, suppressor and enhancers).
4. Eukaryotic transcription factors – structure and function- concise account of helix turn helix proteins, helix loop helix proteins, helix turn beta, zinc finger protein; mode of action.
5. Epigenetic modifications – DNA and chromosomal proteins, micro-RNA.

Unit-IV (Human Genetics-II)

1. Mendelian genetics- Mendel's experiments, monohybrid crosses, principles of dominance, dihybrid crosses, incomplete dominance, co-dominance. Gene polymorphism, Pedigree analysis,
2. Karyotyping, polyploidy, aneuploidy
3. Inborn errors of biochemical metabolism Inborn errors of carbohydrate metabolism: glycogen storage disease, essential pentosuria, fructosuria, galactosemia, inborn errors of protein and amino acid metabolism: phenyl ketonuria, alkeptonuria, albinism, cystinuria, hypertyrosinemias, homocystinuria, inborn errors of lipid metabolism: Gaucher's disease, Fabry's disease, Taysach's disease, Niemann pick disease Human Genetical Disorders –autosomal (Phenylketonuria, albinism), sex-linked (hemophilia, red green color blindness), diseases with abnormal chromosome numbers and examples.
4. Hardy Wein-berg principle and population genetics. Genetic drift and genetic shift.

Paper-10A (Theory)

HP-502C

Total Mark = 60 (IA = 24+ ESE = 36) Credit = 02

Unit-I (Cell Signaling)

1. General principles of signal transduction, Ligand receptors interaction
2. Signal amplification, integration, and feedback regulation,
3. Types – autocrine, paracrine and endocrine cell signalling.
4. Second messenger- cAMP & phospholipid, Calcium Ion Signals, electrical signaling, synthesis of cAMP from AMP.
5. G-Protein Coupled Receptors (GPCRs)- structure, GPCR mediated cAMP–PKA pathway and GPCR mediated Phospholipase Cβ–IP3–DAG–PKC pathway; G protein inhibitory pathway - the acetylcholine signaling pathway

Unit – II (Cell Signaling)

1. Receptor Tyrosine Kinases (RTKs) – general Structure and examples
2. RTK mediated PI3K–Akt–mTOR pathway
3. RTK mediated Ras–Raf–MEK–ERK (MAPK) pathway
4. Non receptor tyrosine kinase mediated Jak/ stat pathway.
5. Nuclear Hormone Receptors (Intracellular Receptors) Estrogen receptor (ER), Androgen receptor (AR), Glucocorticoid receptor **-** Ligand-activated transcriptional signaling through nuclear receptor.

Unit-III (Cell cycle)

1. Mammalian cell cycle, phases
2. Cell cycle- check points,
3. CDK and cyclins
4. Role of different factors and proteins inhibiting cell cycle - p21, etc., p53 and Rbp

Unit-IV (Apoptosis and autophagy)

1. Apoptosis – difference from necrosis
2. Mechanism- extrinsic pathway
3. Intrinsic/mitochondrial pathway of apoptosis
4. Inhibitors of apoptosis
5. Autophagy - mechanism.

Paper-10B (Practical)

HP-502C

Total Mark = 40 (IA = 16 + ESE = 24) Credit = 02

CONTENTS:

1. Cell cycle chart study
2. Signaling pathways chart study
3. Mitosis and meiosis chart study
4. Karyotyping and chromosomal anomaly chart study.
5. DNA isolation from bacteria/blood/any suitable source
6. Agarose electrophoresis of DNA
7. DNA estimation
8. Pedigree analysis study

Paper-11 (Theory)

HP-503C

Total Mark = 100 (IA = 40 + ESE = 60) Credit = 04

Unit-I (Immunology-I)

1. Immune system, Innate and acquired immunity - their components, functions of T cells, B cells, neutrophil, basophil, eosinophil, NK cells, RE cells, TLR receptors
2. Primary and secondary lymphoid organs
3. Antigen, Immunogen, Epitope, Hapten, Paratope,
4. Complement components of classical and alternative pathways, their activation, and physiological function of complement system, complement deficiencies.

Unit-II (Immunology-II)

1. Humoral immunity - General structure of IgG antibody, Classification of antibodies, functions.
2. Clonal selection theory of antibody production, Monoclonal and polyclonal antibody,
3. Class I & II MHC molecules, structure and functions
4. Antigen presentation, T and B cell cooperation in antibody production.

Unit-III (Immunology-III)

1. Antigen antibody interaction.
2. Clonal selection theory of antibody production.
3. Cell mediated immunity - role of T-cytotoxic cell (CTL) and TH in Cell mediated immunity.
4. Hypersensitivity Type-I and Type-II.

Unit-IV (Immunology-IV)

1. T cell, B cell ontogeny and activation
2. Inflammation, mediators
3. Types of HLA, Graft rejection
4. Primary and secondary immune responses, Passive and active immunization, Vaccination - types and uses of vaccine, adjuvants, DNA, RNA vaccine.

Paper-12A (Theory)

HP-504C

Total Mark = 60 (IA = 24 + ESE = 36) Credit = 02

Unit-I (Molecular physiological basis of cancer)

1. Definition and hallmarks of cancer.
2. Tumour initiation, promotion, and progression.
3. Different causes of cancer – role of oncogenes – mechanism and types; mutation in suppressor genes- mechanism; Chromosomal instability in cancer with example – structural and numerical, epigenetic changes in cancer.
4. Altered metabolic changes in cancer cells – Warburg effect, altered lipid metabolism.

Unit – II: (DNA mutation and cancer)

1. Molecular changes in cancer: Mutation: Spontaneous and induced mutation, mechanism of transition and transversion, Point mutation-deletion, insertion, Frame shift; Functional - Non-sense, mis-sense, silent, null mutation;
2. Chemical and physical agents inducing mutation, mutagen and carcinogen, Ame's test,
3. Repair mechanism of Mutation: direct repair, excision repair, mismatch repair, UVr A, B and C mechanism.
4. Role of P53 in DNA repair in cancer, mechanism

Unit-III (Role of major Signaling Pathways in Cancer)

1. Growth factor signalling - EGFR/Ras/MAPK and PI3K/Akt/mTOR pathway in cancer JAK/STAT signalling
2. Developmental and morphogen pathways - Wnt/β-catenin signalling, Hedgehog signalling, Notch signalling
3. Stress signaling - NF-κB pathway
4. Anti-apoptotic proteins and apoptotic pathways regulation in cancer.

Unit IV (Cancer Immunology and Immune Signaling)

1. Immune surveillance and evasion mechanisms
2. Immune checkpoint signalling (PD-1/PD-L1, CTLA-4)
3. Cytokine signalling in tumour immunity
4. Small-molecule inhibitors, Targeted therapies (EGFR inhibitors, BRAF inhibitors, PARP inhibitors) and monoclonal antibodies.

Paper-12B (Practical)

HP-504C

Total Mark = 40 (IA = 16 + ESE = 24) Credit = 02

CONTENTS:

1. Blood group determination.
2. Ouchterlony double diffusion assay.
3. Bacterial culture in nutrient agar plate (by streak and spread method).
4. Bacteria culture in nutrient broth (LB media).
5. Study of bacterial growth curve taking O.D. at different time point.
6. Different sterilization methods.
7. Single colony isolation.
8. Gram staining of bacteria.