05 NEMATOLOGY

Unit 1: History and Economic Importance

History and development of Nematology at National and International level. Position of nematodes in animal kingdom. Economic importance of nematology; distribution of economically important nematodes (*Pratylenchus, Radopholus, Hirschmanniella, Meloidogyne, Heterodera, Globodera, Rotylenchulus, Tylenchulus, Ditylenchus, Anguina, Aphelenchoides, Tylenchorhynchus, Helicotylenchus, Hoplolaimus, Scutellonema, Paratylenchus*, etc.). Beneficial nematodes. (entomopathogenic nematodes – *Steinernema* and *Heterorhabditis*), Parasites of insects (*Mermis, Agamermis, Romanomermis)*. Entomopathogenic nematodes. Importance of saprophytes in organic matter recycling. Nematodes as indicators of pollution and toxicity. Predacious Nematodes.

Unit 2 : Nematode Taxonomy and Morphology

Principles and concepts of taxonomy. Rules of nomenclature. Nematode phylogeny and systematics. Classification of soil and plant-parasitic nematodes and their relationships with other related phyla. Detailed classification of plant - parasitic nematodes up to generic level with emphasis on genera of economic importance. General morphology and anatomy of nematodes (cuticle, hypodermis, sense organs, pseudocoelem). Various systems: digestive, excretory, nervous, reproductive etc., developmental biology of nematodes.

Unit 3 : Nematological Techniques

Different methods of sampling for nematodes. Methods of extraction of nematodes from soil and plant material. Extraction of cysts nematodes. Microscopy - principles and types including electron microscopes. Methods of killing, fixing, preserving, staining, mounting and measuring of nematodes. Techniques for histopathology, Microtome techniques and culturing of nematodes - plant parasitic and entomophilic and saprophytic including axenic methods. Experimental techniques for proving pathogenicity, estimation of crop losses, nematicide screening, screening and evaluation for nematode resistance in crops. Molecular technique for nematode diagnostics. Techniques for mass culturing of entomopathogenic nematode antagonistic bioagents.

Unit 4 : Nematode Ecology

Ecological classification and distribution of nematodes. Mode of nematode dispersal. Adaptations to parasite mode of life. Soil as environment for nematodes. Effect of biotic and abiotic factors on nematode survival, activity and reproduction. Nematode population dynamics. Nematode -induced plant damage and modelling. Community analysis.

Unit 5 : Plant Nematode Relationships

Types of parasitism in nematodes. Classification of nematodes based on feeding habit. Nature of damage caused by various groups of plant parasitic nematodes and mechanisms involved.

Pathotypes and races of root knot, cyst and burrowing nematodes. Histopathological changes due to root knot and cyst nematode infestation including syncytia, giant cell formation and their modification etc. Mechanism of nematode resistance and tolerance in plants and its assessment. Physiological, biochemical and molecular changes in plants due to nematode infections.

Unit 6 : Nematode Physiology and Cytology

Chemical composition of nematodes. Principles of nematode physiology. Physiological functions of cell; organelles. Physiology of respiration, digestion, excretion, reproduction, growth and development. Physiology of moulting, hatching and nematode survival. Chemoreception in nematodes. Biology of root knot, cyst, Reniform, citrus, burrowing and lesion nematodes. Nematode as biological models - *Caenorhabditis elegans*. Cytological changes in plants due to infection including syncytia, giant cell formation and their modification etc.

Unit 7: Nematode pests of crops

Major nematode parasites and management in cereals (rice, wheat and barley), millets (sorghum, and maize), pulses (redgram, blackgram, greengram cowpea and chickpea),oilseeds (castor, groundnut and gingely), fibre crops (cotton and jute), vegetables (tomato, brinjal, bhendi, chilli and potato), cole crops (cabbage, carrot, cauliflower), beet root, sugarbeet, tapioca, tobacco, tuber crops (yam, dioscorea), fruits (banana, citrus, grapevine, guava, papaya, pomegranate), spices and plantation crops (turmeric, pepper, betelvine, arecanut and coconut), flower crops (crossandra, jasmine, carnation, rose, gerbera, chrysanthemum, eustoma and tuberose) and medicinal and aromatic plants, (medicinal coleus, geranium and patchouli), mushroom.

Unit 8 : Nematode Management

Principles and methods of nematode management - physical, cultural biological, chemical and legislative (plant quarantine), Nematicides (including those of biological origin) - history, classification, formulations, application and mode of action. Host resistance for nematode management. Resistance sources for different nematodes. Integrated nematode management. Nematode management in protected cultivation.

Unit 9: Interactions of Nematodes with Soil Organisms

Importance of interactions (interrelationships) of nematodes with soil organisms. Interactions of nematodes with bacteria, fungi, viruses, mycorrhizae and other nematodes. Nematodes as vectors of viruses and other microorganisms.

Unit 10 : Statistics

Frequency distribution. Measures of central tendency and dispersion: mean, median, mode, standard deviation etc. Population distributions: normal, binomial and Poisson. Correlations:

regression, partial and multiple. Tests of significance: t, F and Chi square and randomized block, Latin square and split plot designs, their analysis and interpretation.