



Post Graduate School
Indian Agricultural Research Institute, New Delhi
Examination for Admission to Ph.D. Programme 2011-2012

Discipline : Nematology

Discipline Code : 15

Roll No.

Please Note:

- (i) This question paper contains 13 pages. Please check whether all the pages are printed in this set. Report discrepancy, if any, immediately to the invigilator.
- (ii) There shall be **NEGATIVE** marking for **WRONG** answers in the Multiple Choice type questions (No. 1 to 130) which carry one mark each. For every wrong answer 0.25 mark will be deducted.

PART – I (General Agriculture)

Multiple choice questions (No. 1 to 30). Choose the correct answer (a, b, c or d) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

1. Which of the following crops have been approved for commercial cultivation in India?
 - a) Bt cotton and Bt brinjal
 - b) Bt cotton and Golden Rice
 - c) Bt maize and Bt cotton
 - d) Bt cotton only
2. This year (2010-11) the expected food grain production in India is
 - a) 212 million tonnes
 - b) 220 million tonnes
 - c) 235 million tonnes
 - d) 250 million tonnes
3. The genome of which of the following crops is still not completely sequenced?
 - a) Rice
 - b) Soybean
 - c) Sorghum
 - d) Wheat
4. According to the Approach Paper to the 12th Five Year Plan, the basic objective of the 12th Plan is
 - a) Inclusive growth
 - b) Sustainable growth
 - c) Faster, more inclusive and sustainable growth
 - d) Inclusive and sustainable growth
5. To address the problems of sustainable and holistic development of rainfed areas, including appropriate farming and livelihood system approaches, the Government of India has set up the
 - a) National Rainfed Area Authority
 - b) National Watershed Development Project for Rainfed Areas
 - c) National Mission on Rainfed Areas
 - d) Command Area Development and Water Management Authority
6. Which of the following sub-schemes are not covered under the Rashtriya Krishi Vikas Yojana?
 - a) Extending the Green Revolution to eastern India
 - b) Development of 60,000 pulses and oilseeds villages in identified watersheds
 - c) National Mission on Saffron
 - d) National Mission on Bamboo
7. The minimum support price for the common variety of paddy announced by the Government of India for the year 2010-11 was
 - a) ₹ 1030
 - b) ₹ 1000
 - c) ₹ 980
 - d) ₹ 950
8. According to the Human Development Report 2010 of the United Nations, India's rank in terms of the human development index is
 - a) 119
 - b) 134
 - c) 169
 - d) 182

9. Which of the following does not apply to SRI method of paddy cultivation?
- Reduced water application
 - Reduced plant density
 - Increased application of chemical fertilizers
 - Reduced age of seedlings
10. Which organic acid, often used as a preservative, occurs naturally in cranberries, prunes, cinnamon and cloves?
- Citric acid
 - Benzoic acid
 - Tartaric acid
 - Lactic acid
11. Cotton belongs to the family
- Cruciferae
 - Anacardiaceae
 - Malvaceae
 - Solanaceae
12. Photoperiodism is
- Bending of shoot towards source of light
 - Effect of light/dark durations on physiological processes
 - Movement of chloroplast in cell in response to light
 - Effect of light on chlorophyll synthesis
13. Ergot disease is caused by which pathogen on which host?
- Claviceps purpurea* on rye
 - Puccinia recondita* on wheat
 - Drechlera sorokiniana* on wheat
 - Albugo candida* on mustard
14. Rocks are the chief sources of parent materials over which soils are developed. Granite, an important rock, is classified as
- Igneous rock
 - Metamorphic rock
 - Sedimentary rock
 - Hybrid rock
15. Which one of the following is a *Kharif* crop?
- Pearl millet
 - Lentil
 - Mustard
 - Wheat
16. The coefficient of variation (C.V.) is calculated by the formula
- $(\text{Mean}/\text{S.D.}) \times 100$
 - $(\text{S.D.}/\text{Mean}) \times 100$
 - $\text{S.D.}/\text{Mean}$
 - $\text{Mean}/\text{S.D.}$
17. Which of the following is commonly referred to as muriate of potash?
- Potassium nitrate
 - Potassium chloride
 - Potassium sulphate
 - Potassium silicate
18. Inbred lines that have same genetic constitution but differ only at one locus are called
- Multi lines
 - Monohybrid
 - Isogenic lines
 - Pure lines
19. For applying 100 kg of nitrogen, how much urea would one use?
- 45 kg
 - 111 kg
 - 222 kg
 - 333 kg
20. The devastating impact of plant disease on human suffering and survival was first realized by epidemic of
- Brown spot of rice in Bengal
 - Late blight of potato in USA
 - Late blight of potato in Europe
 - Rust of wheat in India
21. The species of rice (*Oryza*) other than *O. sativa* that is cultivated is
- O. rufipugon*
 - O. longisteminata*
 - O. glaberrima*
 - O. nivara*
22. The enzyme responsible for the fixation of CO_2 in mesophyll cells of C-4 plants is
- Malic enzyme
 - Phosphoenol pyruvate carboxylase
 - Phosphoenol pyruvate carboxykinase
 - RuBP carboxylase
23. Which one of the following is a 'Vertisol'?
- Black cotton soil
 - Red sandy loam soil
 - Sandy loam sodic soil
 - Submontane (Tarai) soil
24. What is the most visible physical characteristic of cells in metaphase?
- Elongated chromosomes
 - Nucleus visible but chromosomes not
 - Fragile double stranded loose chromosomes
 - Condensed paired chromosomes on the cell plate

25. All weather phenomena like rain, fog and mist occur in
 a) Troposphere
 b) Mesosphere
 c) Ionosphere
 d) Ozonosphere
26. Which of the following elements is common to all proteins and nucleic acids?
 a) Sulphur
 b) Magnesium
 c) Nitrogen
 d) Phosphorous
27. Silt has intermediate characteristics between
 a) Sand and loam
 b) Clay and loam
 c) Loam and gravel
 d) Sand and clay
28. Certified seed is produced from
 a) Nucleus seed
 b) Breeder seed
 c) Foundation seed
 d) Truthful seed
29. Seedless banana is an
 a) Autotriploid
 b) Autotetraploid
 c) Allotriploid
 d) Allotetraploid
30. Which one of the following is used to test the goodness-of-fit of a distribution?
 a) Normal test
 b) t-test
 c) Chi-square test
 d) F-test
33. Morphology of nematodes can best be studied by
 a) TEM
 b) SEM
 c) EM
 d) Confocal microscope
34. The third edition of International Code of Zoological Nomenclature was adopted by
 a) International Congress of Zoological Nomenclature
 b) International Union of Biological Sciences
 c) International Zoologist Association
 d) British Council of Natural Sciences
35. Lowest category recognised by International Code of Zoological Nomenclature is
 a) Species
 b) Subspecies
 c) Race
 d) Pathotype
36. Excretory system in Tylenchida is
 a) Canalicular
 b) Glandular
 c) Vesicular
 d) H-shaped
37. The chitin in nematodes is present in
 a) Cuticle
 b) Egg shell
 c) Spicule
 d) Setae
38. Lactotype is a specimen designated by
 a) Original author
 b) Subsequent author
 c) Any specialist
 d) Authority on that particular field
39. Mitochondria lies above nucleus in
 a) Platymyarian type of musculature in nematodes
 b) Circomyarian type of musculature in nematodes
 c) Coelomyarian type of musculature in nematodes
 d) Holomyarian type of musculature in nematodes
40. In *Anquina tritici*, the oocytes are aggregated around a central protoplasmic structure, called as
 a) Growth zone
 b) Germinal zone
 c) Ripening zone
 d) Rachis

PART – II (Subject Paper)

Multiple choice questions (No. 31 to 130). Choose the correct answer (a, b, c or d) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

31. *Radopholus similis* infecting banana was first time authentically reported in India from
 a) Tamil Nadu
 b) Karnataka
 c) Kerala
 d) Maharashtra
32. For assessment of crop losses against phytonematodes under field conditions, the experimental design generally used is
 a) CRD
 b) RBD
 c) LSD
 d) Paired plot design

41. Source of inoculum of white tip disease of rice is
 a) Soil population of nematodes
 b) Seed
 c) Seed gall
 d) Crop residue
42. Carbamate group of nematicides are the esters of
 a) Phosphoric acid
 b) Formic acid
 c) Phenols
 d) Carbamic acid
43. Dazomet a soil fumigant belongs to the group of nematicides
 a) Organophosphates
 b) Aliphatic hydrocarbons
 c) Alkyl halides
 d) Methyl isothiocyanates
44. The custodian of DIP Act in India is
 a) Plant Protection Commissioner
 b) Director General, ICAR
 c) Plant Protection Advisor to Govt. of India
 d) Deputy Chairman, Planning Commission
45. Post infectional low molecular weight antimicrobial compounds produced as a result of interaction between host and parasite are
 a) Enzymes
 b) Phytoalexins
 c) Toxins
 d) Fatty acids
46. The eggs of root-knot nematodes can be extracted by dissolving the gelatinous matrix in
 a) 1% H₂O₂
 b) 1% NaCl
 c) 1% sodium PO₄ buffer
 d) 1% NaOCl
47. Which of the following is not a solvent of paraffin wax used in microtomy study?
 a) Xylene
 b) Butanol
 c) Ethanol
 d) Water
48. The organ cell that has dual role of osmoregulation and elimination of ammonia is
 a) Pylorus
 b) Cardia
 c) Secretary granule
 d) Renette
49. The cephalic sensory organs are innervated by
 a) 3 papillary nerves
 b) 6 papillary nerves
 c) 9 papillary nerves
 d) 12 papillary nerves
50. Movement in nematodes is by the alternate contraction of which muscles?
 a) Dorso - lateral & ventrolateral
 b) Dorsal & ventral
 c) Sub-dorsal & sub-ventral
 d) Rectal
51. A non-directional response in which the speed/frequency of activity depends on the intensity of stimulation
 a) Klinokinesis
 b) Orthokinesis
 c) Klinotaxis
 d) Tropotaxis
52. The nematode juveniles are unable to hatch until the osmotic pressure of the egg fluid is
 a) Increased
 b) Equals with outer region
 c) Reduced
 d) Dried up
53. Once the nematode is in food vicinity, they use mechano receptors such as
 a) Phasmids
 b) Amphids
 c) Labial papillae
 d) None of the above
54. The most common mechanism for sex determination ascribed for nematodes is that of:
 a) XX-XX
 b) XO-XX
 c) XY-XY
 d) XO-XY
55. The nematode inhabiting forage grasses can be fatal to grazing livestock in presence of bacterium
 a) *Anguina tritici*
 b) *Nothanguina* spp.
 c) *Anguina funesta*
 d) *Anguina agrostis*
56. Nematode able to attack aerial parts of plants provided that humidity is high enough:
 a) *Aphelenchoides besseyi*
 b) *Anguina tritici*
 c) *Hirschmanniella oryzae*
 d) *Heterodera trifolii*

57. Which of the following is not a cuticular ornamentation?
- Spines
 - Rugae
 - Warts
 - Bursa
58. Epigenesis is common in
- Meloidogyne* spp.
 - Xiphinema* spp.
 - Heterodera* spp.
 - Hoplolaimus* spp.
59. Packages for manipulation and alignment of sequences are
- Bio Edit and Chromas
 - PAUP & PHILIP
 - Model test and F test
 - Tree map and component
60. Which of the following is not responsible for the gall formation in *Meloidogyne* infected plants?
- Auxin
 - Cytokinin
 - Ethylene
 - ABA
61. The eggs of which nematode are deposited in the root a few days after invasion and hatching occurs 4-6 days after deposition in rice?
- Heterodera oryzicola*
 - Meloidogyne graminicola*
 - Hirschmanniella oryzae*
 - Ditylenchus angustus*
62. An allelochemical involving a negative response by the receiver is
- Apeneumone
 - Synomone
 - Kairomone
 - Allomone
63. Root diffusates induce/increase hatch following quiescence is common in
- Heterodera* spp.
 - Meloidogyne* spp.
 - Rotylenchulus* spp.
 - Tylenchorhynchus* spp.
64. Which of the following have the most primitive mode of parasitism?
- Migratory ectoparasites
 - Sedentary ectoparasites
 - Migratory endoparasites
 - Sedentary endoparasites
65. Which of the following is used to silence specific gene expression in a variety of eukaryotes including nematodes?
- dsRNA
 - Lectins
 - Protease inhibitor
 - Plantibodies
66. Which of the following is not a limitation of using *Pasteuria* against nematodes?
- In vitro* production
 - Limited spread in soil
 - Narrow host range
 - Resting spores with long shelf life
67. *Crotolaria* and *Sesbania* used for nematode management are
- Trap crops
 - Cover crops
 - Antagonistic crops
 - Host crops
68. DiTera® is a natural nematicide extracted from
- Plant
 - Fungi
 - Bacteria
 - Virus
69. Which of the following is not a characteristic of 'ideal' nematicide?
- Rapid degradation to harmless molecule
 - Detectable residue in plants
 - Very effective at low rate
 - Compatibility with control components
70. How much chemical would be required to apply in one acre field for carbofuran (3G) @ 2 kg ai/ha?
- 13.2 kg
 - 26.4 kg
 - 39.6 kg
 - 52.8 kg
71. If a 40 ppm solution is diluted to 25 ppm, the dilution factor would be
- 1:1.5
 - 1:1.6
 - 1:2.0
 - 1:2.5
72. Which of the following is associated with citrus?
- Meloidogyne indica*
 - Meloidogyne exigua*
 - Meloidogyne brevicauda*
 - Meloidogyne arenaria*

73. Which is considered economically important on bulbous ornamentals?
- Ditylenchus dipsaci*
 - Ditylenchus destructor*
 - Aphelenchoides fragariae*
 - Aphelenchoides ritzemabosi*
74. Which of the following causes superficial lesions on banana roots?
- Pratylenchus coffeae*
 - Radopholus similis*
 - Helicotylenchus multicinctus*
 - Hoplolaimus seinhorsti*
75. A seed-borne disease *sensu stricto* is
- Ear cockle
 - Urea
 - White tip
 - Tundu
76. Nematode oesophagus shows
- Asymmetry
 - Radial symmetry
 - Bilateral symmetry
 - Triradiate symmetry
77. Ancestral nematodes are presumed to have
- 16 cephalic papillae in 2 circles
 - 16 cephalic papillae in 3 circles
 - 16 cephalic setae in 2 circles
 - 16 cephalic setae in 3 circles
78. Criconematids are named after
- Slow and sluggish movement
 - Coarse ring-like annules
 - Criconemoid type of oesophagus
 - Presence of spines and scales
79. A peloderan bursa covers
- Only tail tip
 - Only cloacal opening
 - Entire tail up to tip
 - Two-thirds of tail
80. Two species are sibling if they are
- Occupying adjacent geographical areas
 - Occupying different geographical areas
 - Occupying same geographical area
 - Morphologically similar but reproductively isolated
81. The common species of *Meloidogyne* can be most accurately characterized by
- Stylet size
 - En-face views
 - Esterase enzyme profiles
 - Host differential tests
82. Juvenile and adult nematode can be distinguished by
- Difference in size
 - Retention of shed cuticle in juveniles
 - Presence of stylet in adults
 - Appearance of genital openings in adults
83. Nematodes are fixed in hot formalin primarily to
- Stretch them
 - Preserve their life-like form
 - Stretch and preserve life-like form
 - Facilitate clearing in glycerol
84. Nematodes are cleared in glycerol because
- They do not take stains
 - Internal structures become clearly visible
 - Glycerol removes the intestinal contents
 - Sclerotized structures appear refractile
85. A pure culture of *Pratylenchus* raised on alfalfa callus is
- Axenic
 - Monoaxenic
 - Oligoxenic
 - Synxenic
86. Why is it necessary to embed plant tissues in paraffin wax for histopathological studies using microtomy?
- To facilitate section cutting
 - To obtain ribbon of serial sections
 - To prevent displacement of cell/cell organelles in tissues
 - To facilitate staining
87. What is the best option among the listed to concentrate nematode suspension without affecting their quantity and quality?
- Use of a Millipore filter
 - Passing through a 500 BSA mesh sieve
 - Centrifugation
 - Leaving the suspension undisturbed for sometime and removing the supernatant
88. What is the most accurate way of expressing nematode population densities?
- No. of nematodes per g dried soil
 - No. of nematodes per ml soil
 - No. of nematodes per g soil
 - No. of nematodes per cc soil
89. In the equation $\frac{dN}{dt} = rN \cdot \frac{K-N}{K}$, K denotes
- Intrinsic growth rate
 - Asymptote
 - Natality
 - Mortality

90. Which of the following factors affect the life cycle duration the most?
- Soil temperature
 - Soil moisture
 - Plant host
 - Soil texture
91. Taylor's power law pertains to
- Sampling scheme for nematode population estimations
 - Community analysis of nematode populations
 - Crop performance and nematode population densities
 - Nematode management optimization
92. A single uninucleate giant cell is induced by
- Hemicyclophora*
 - Cryphodera*
 - Xiphinema*
 - Punctodera*
93. The function of feeding tubes is speculated to be
- Partial digestion of plant cell cytoplasm
 - Release of dorsal oesophageal gland secretions
 - Ingestion of cell cytoplasm
 - Cytoplasm filters to avoid cell organelles
94. Which of the following species/races of root-knot nematode attacks cotton?
- Meloidogyne incognita* race 1
 - Meloidogyne incognita* race 2
 - Meloidogyne incognita* race 3
 - Meloidogyne javanica*
95. Which nematode should have the lowest 'a' value?
- Hoplolaimus indicus*
 - Xiphinema index*
 - Pratylenchus zaeae*
 - Criconemoides* sp.
96. The different symptoms produced by races of *Ditylenchus dipsaci* are attributed to qualitative and quantitative differences in
- Pectinases
 - Amylases
 - Cellulases
 - Proteases
97. A general phenomenon exhibited by many cryptobiotic anhydrobiotes is the storage of
- Ribitol
 - Myo-inositol
 - Trehalose
 - Glycerol
98. Stephamocysts are
- Endoparasitic encysting species of oomycetes
 - Nematode parasitic fungi
 - Protozoan parasitic of nematodes
 - Nematodes trapping devices
99. In most cases involving nematode and pathogenic fungal interactions, what is the most plausible role of nematodes?
- Mechanical wounding agents
 - Physiological modification of host plant
 - Vector
 - Resistance breakers
100. *Rhizoctonia solani* is able to attack root-knot infected plants because
- Galled tissues exude more carbohydrates
 - Nematodes rupture galled tissues for egg laying
 - J₂ leave micropunctures on roots while invading
 - Nematodes carry fungus spores on their surface
101. Split-root technique which was employed to demonstrate that nematodes bring about physiological modifications in plants to render them more susceptible to other pathogens used the crop
- Tomato
 - Peppermint
 - Cotton
 - Tobacco
102. Tobra viruses are transmitted by
- Trichodorus* spp.
 - Tylenchorhynchus* spp.
 - Xiphinema* spp.
 - Longidorus* spp.
103. Mulveys Bridge is found in
- Heterodera cajani*
 - Heterodera zaeae*
 - Heterodera trifolii*
 - Heterodera mothi*
104. Spindle shaped muscle cells wherein the contractile elements are arranged along the epidermis and sides of flattened spindle are called
- Coelomyarian
 - Circomyarian
 - Meromyarian
 - Polymyarian
105. The hatching of *Globodera pallida* is stimulated by
- CO₂ gradient
 - Rise in soil temperature
 - Host root diffusate
 - Soil microflora

106. *Tylenchorhynchus* spp. cause damage to which of the following root tissues?
- Endodermis
 - Epidermis and cortex
 - Xylem and cambium
 - Phloem
107. The function of circulatory system in nematodes is performed by
- Hypodermis
 - Intestinal fluids
 - Pseudocoelomic fluid
 - Cytoplasm
108. Different molecular forms of an enzyme having the same substrate specificity are called
- Isomers
 - Allosteric enzymes
 - Co-enzymes
 - Isoenzymes
109. When the nematodes are protandric, it means that
- Their gonads function only as ovaries
 - Their gonads first function as testes and later as ovaries
 - Their gonads first function as ovaries and later as testes
 - Their gonads function simultaneously as ovaries and testes
110. Lateral lines are absent from the perineal patterns of
- Meloidogyne incognita*
 - Meloidogyne javanica*
 - Meloidogyne arenaria*
 - Meloidogyne hapla*
111. Which life stage of *Bursaphelenchus xylophilus* is transported by long horn beetles?
- Second stage
 - Adult
 - Fourth stage dauer larva
 - Egg
112. The carbamate nematicides suppress which of the following enzyme?
- Acetyl cholinesterase
 - Superoxidase
 - Protease
 - Chitinase
113. Which of the following compounds from safflower roots has been found to have nematicidal properties?
- α -terthienyls
 - Polyacetylenes
 - Pyrocatechol
 - Glyceollin
114. Which of the following compounds in the roots of tobacco is involved in resistance against root-knot nematodes?
- Pyrocatechol
 - Chlorogenic acid
 - Pyruvic acid
 - Methoxygossypol
115. The number of eggs found in each egg sac of root-knot nematode may range from
- 1000-1500
 - 2000-5000
 - 200-500
 - 50-100
116. Head with four distinct setae are found in
- Aphelenchidae
 - Dorylaimidae
 - Tylenchidae
 - Atylenchidae
117. Cuticular lining of the oesophageal lumen retains virus particles in
- Tylenchid nematodes only
 - Aphelenchid nematodes only
 - Few genera of Dorylaimid nematodes only
 - All genera of Dorylaimid nematodes only
118. Opisthodelphic monodelphic condition is found in
- Heterodera* sp.
 - Pratylenchus* sp.
 - Trophurus* sp.
 - Tylenchorhynchus* sp.
119. The first formal nematology course was offered at
- University of California, Davis
 - University of Florida, Tampa
 - University of California, Berkeley
 - Rutgers University
120. Stichosome is present in
- Camallanida
 - Diplogasterida
 - Aphelenchida
 - Mermithida
121. CO₂ gradient in soil
- Helps nematodes to locate other nematodes
 - Helps nematodes to escape unfavourable conditions
 - Helps nematodes escape high temperature stress
 - Helps nematodes locate food source

122. Pathogenicity Islands is a term given to
- Genes in plants complimentary to virulence genes of pathogens
 - Cluster of heterogenous genes of pathogens of plants and animals
 - Cluster of highly homologous genes in microbial pathogens involved in pathogenicity and virulence of both animals and plants
 - Cluster of virulence genes in nematodes which are responsible for nematode feeding on plants

123. Which one among the following is not a vital stain?

- New blue R
- Potassium permanganate
- Hydrogen peroxide
- Chrysoidin

124. Genus *Meloidogyne* was proposed by

- Emilo Augusto Goeldi
- Joseph Berkeley
- Kati Marcinowsky
- Skarbilovich

125. Larval stage of *Caenorhabditis elegans*, where it can stand on its tail is

- Infective stage
- Mating stage
- Dauer stage
- Probing stage

126. The principal structural component of nematode cuticle is

- Chitin
- Cellulose
- Pectin
- Collagen

127. The practice of incorporating brassicaceous plant material into the soil to control soilborne organisms has been coined

- Bioremediation
- Bioincorporation
- Biofumigation
- Composting

128. Surface moieties of *Pasteuria* which play an important role in attachment to host cells prior to infection are

- Collagen-like proteins
- Lectins
- Proteases
- Integrases

129. The specificity factor that Grapevine fanleaf virus (GFLV), is transmitted specifically by the ectoparasitic nematode *Xiphinema index* is because of

- Lectin moiety on the cuticle of *X. index*
- Coat protein subunits in the icosahedral capsid of GFLV
- Collagen type protein in the midgut of *X. index*
- Attachment factor produced by *X. index*

130. Touch receptors consist of processes that are embedded in the epidermis and surrounded by a matrix termed as

- Mantle
- Deirids
- Phasmid
- Male bursal rays

Matching type questions (No. 131 to 140); all questions carry equal marks. Choose the correct answer (a, b, c, d or e) for each sub-question (i, ii, iii, iv and v) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

131.

- | | |
|-------------------------|--|
| i) Coelomyarian cells | a) Muscles cell is flat |
| ii) Meromyarian cells | b) Sarcoplasm surrounded by contractile elements |
| iii) Platymyarian cells | c) >6 rows per quadrant |
| iv) Circomyarian cells | d) Bulge into pseudocoel |
| v) Polymyarian cells | e) Few rows of muscles/quadrant |

132.

- | | |
|---------------------------|------------------------|
| i) <i>Meloidogyne</i> | a) Dried tanned uterus |
| ii) <i>Tylenchulus</i> | b) Rectal gland |
| iii) <i>Heteroderidae</i> | c) Excretory gland |
| iv) <i>Meloidoderita</i> | d) Tanned cuticle |
| v) <i>Nacobbus</i> | e) False galls |

133.

- | | |
|------------------------------|---------------------------|
| i) <i>Bursaphelenchus</i> | a) Parasitism |
| ii) <i>Rhadinaphelenchus</i> | b) Symbiotic |
| iii) <i>Fergusobia</i> | c) Facultative parasitism |
| iv) <i>Steinernema</i> | d) External phoretic |
| v) <i>Deladenus</i> | e) Internal phoretic |

134.

- | | |
|---|----------------------------|
| i) Oesophageal gland overlap dorsal | a) <i>Tylenchorhynchus</i> |
| ii) Oesophageal gland overlap ventral | b) <i>Pratylenchus</i> |
| iii) Oesophageal gland overlap appendage-like | c) <i>Hirschmanniella</i> |
| iv) Oesophageal gland overlap long, ventral | d) <i>Hoplolaimus</i> |
| v) No gland overlap | e) <i>Aphelenchoides</i> |

135.

- | | |
|-------------------|--|
| i) r-strategists | a) <i>Pseudomonas fluorescens</i> |
| ii) k-strategists | b) <i>Rhabditis</i> |
| iii) Commensalism | c) Dorylaimids |
| iv) Predation | d) <i>Rhabditida</i> , <i>Diplogasterida</i> and <i>Aphelenchida</i> |
| v) Antibiosis | e) <i>Aporcelaimus</i> spp. |

136.

- | | |
|-----------------------------------|--|
| i) Damping off | a) <i>Pythium debaryamion</i> + <i>Meloidogyne</i> |
| ii) Black shank | b) <i>Rhizoctonia solani</i> + <i>Meloidogyne</i> |
| iii) Net negative change | c) RNAi |
| iv) Inhibition of gene expression | d) DNA |
| v) Cortical rot | e) <i>Rhizoctonia solani</i> + <i>V. dahliae</i> |

137.

- | <u>Gene loci</u> | <u>Crop</u> |
|------------------|--------------|
| i) mj | a) Sugarbeet |
| ii) Mi | b) Cowpea |
| iii) Gro1 | c) Cucumber |
| iv) Hs1pro-1 | d) Tomato |
| v) Rk | e) Potato |

138. Match the type of symmetry generally seen in nematodes

- | | |
|-------------------|------------------------------------|
| i) Bilateral | a) Arrangement of epidermal chords |
| ii) Triradial | b) Nematode body |
| iii) Tetra radial | c) Lips |
| iv) Hexaradial | d) Oesophagus |
| v) Asymmetry | e) Nervous/excretory/reproductive |

139.

- | | |
|-----------------------------------|----------------------------------|
| i) <i>Rhodococcus fasciens</i> | a) <i>Rhadinaphelenchus</i> spp. |
| ii) <i>Rhynchophorus palmarum</i> | b) <i>Anguina tritici</i> |
| iii) TOBRA virus | c) <i>Caenorhabditis elegans</i> |
| iv) <i>E. coli</i> | d) <i>Trichodorus</i> spp. |
| v) <i>Clavibacter tritici</i> | e) <i>Aphelenchoides</i> spp. |

140.

- | | |
|-----------------------|--|
| i) Maturity index | a) Ability to withstand perturbations without large changes in composition |
| ii) Trophic structure | b) Measure of the variety of species in a community that takes into account the relative abundance of each species |
| iii) Stability domain | c) Position in the food chain determined by the number of energy-transfer steps to that level |
| iv) Diversity index | d) Nematode community indicator of ecological succession |
| v) Trophic level | e) Organization of the community based on feeding relationships of populations |

Short questions (No. 141 to 146); each question carries FIVE marks. Write answers, including computation / mathematical calculations if any, in the space provided for each question on the question paper itself.

141. Why molecular Koch postulates are more accepted now a days?

142. You encounter high incidence of J₂ of "cyst nematode" on a crop in soil, but there are no cysts in the soil. How will you solve the mystery?

143. The eggs of *Meloidogyne incognita* hatch profusely in water but this does not happen with *Globodera rostochiensis* eggs. Give reason.

144. Flooding is one of the means to reduce nematode population in the soil, but standing water doesn't affect survival of *Hirschmaniella* in rice fields. Give reasons. Δ

145. *Globodera* spp. is viewed as more advanced in host-parasite relationship. Give reasons.

146. Why do nematodes have cylindrical body?