



Post Graduate School
Indian Agricultural Research Institute, New Delhi
Examination for Admission to Ph.D. Programme 2013-2014

Discipline : Nematology

Discipline Code : 16

Roll No.

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Please Note:

- (i) This question paper contains **12** 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. Who is the present Chairman of Protection of Plant Varieties and Farmers' Right Authority (PPV&FRA)?
 - a) Dr. R.R. Hanchinal
 - b) Dr. P.L. Gautam
 - c) Dr. S. Nagarajan
 - d) Dr. Swapan K. Datta
2. Which among the following is another name for vitamin B₁₂?
 - a) Niacin
 - b) Pyridoxal phosphate
 - c) Cobalamin
 - d) Riboflavin
3. The largest share in India's farm export earning in the year 2011-12 was from
 - a) Basmati rice
 - b) Non-basmati rice
 - c) Sugar
 - d) Guar gum
4. The National Bureau of Agriculturally Important Insects was established by ICAR in _____, was earlier known as _____.
 - a) Bangalore; PDBC
 - b) New Delhi; National Pusa Collection
 - c) Ranchi; Indian Lac Research Institute
 - d) New Delhi; NCIPM
5. The most important sucking pests of cotton and rice are respectively
 - a) *Nilaparvata lugens* and *Aphis gossypii*
 - b) *Aphis gossypii* and *Thrips oryzae*
 - c) *Amrasca biguttula biguttula* and *Scirtothrips dorsalis*
 - d) *Thrips gossypii* and *Orseolia oryzae*
6. Which of the following microorganism causes fatal poisoning in canned fruits and vegetables?
 - a) *Aspergillus flavus*
 - b) *Penicillium digitatum*
 - c) *Clostridium botulinum*
 - d) *Rhizoctonia solani*
7. The cause of the great Bengal Famine was
 - a) Blast of rice
 - b) Brown spot of rice
 - c) Rust of wheat
 - d) Karnal bunt of wheat
8. Actinomycetes belong to
 - a) The fungi
 - b) Eukaryote
 - c) *Mycelia sterilia*
 - d) None of the above
9. A virus-free clone from a virus infected plant can be obtained by
 - a) Cotyledonary leaf culture
 - b) Axenic culture
 - c) Stem culture
 - d) Meristem tip culture
10. Which of the following is not an objective of the National Food Security Mission?
 - a) Sustainable increase in production of rice, wheat and pulses
 - b) Restoring soil fertility and productivity at individual farm level
 - c) Promoting use of bio-pesticides and organic fertilizers
 - d) Creation of employment opportunities

11. Agmarknet, a portal for the dissemination of agricultural marketing information, is a joint endeavour of
 - a) DMI and NIC
 - b) DMI and Ministry of Agriculture
 - c) NIC and Ministry of Agriculture
 - d) DMI and Directorate of Economics and Statistics
12. The share of agriculture and allied activities in India's GDP at constant prices in 2011-12 was
 - a) 14.1%
 - b) 14.7%
 - c) 15.6%
 - d) 17.0%
13. The average size of land holding in India according to Agricultural Census 2005-06 is
 - a) 0.38 ha
 - b) 1.23 ha
 - c) 1.49 ha
 - d) 1.70 ha
14. 'Farmers First' concept was proposed by
 - a) Paul Leagans
 - b) Neils Rolling
 - c) Robert Chamber
 - d) Indira Gandhi
15. In the year 2012, GM crops were cultivated in an area of
 - a) 150 million hectare in 18 countries
 - b) 170 million hectare in 28 countries
 - c) 200 million hectare in 18 countries
 - d) 1.70 million hectare in 28 countries
16. The broad-spectrum systematic herbicide glyphosate kills the weeds by inhibiting the biosynthesis of
 - a) Phenylalanine
 - b) Alanine
 - c) Glutamine
 - d) Cysteine
17. At harvest, the above ground straw (leaf, sheath and stem) weight and grain weight of paddy crop are 5.5 and 4.5 tonnes per hectare, respectively. What is the harvest index of paddy?
 - a) 45%
 - b) 50%
 - c) 55%
 - d) 100%
18. Crossing over between non-sister chromatids of homologous chromosomes takes place during
 - a) Leptotene
 - b) Pachytene
 - c) Diplotene
 - d) Zygotene
19. The term 'Heterosis' was coined by
 - a) G.H. Shull
 - b) W. Bateson
 - c) T.H. Morgan
 - d) E.M. East
20. When a transgenic plant is crossed with a non-transgenic, what would be the zygosity status of the F₁ plant?
 - a) Homozygous
 - b) Heterozygous
 - c) Hemizygous
 - d) Nullizygous
21. The highest per capita consumption of flowers in the world is in
 - a) The USA
 - b) India
 - c) Switzerland
 - d) The Netherlands
22. Which of the following is a very rich source of betalain pigment?
 - a) Radish
 - b) Beet root
 - c) Carrot
 - d) Red cabbage
23. Dog ridge is
 - a) Salt tolerant rootstocks of mango
 - b) Salt tolerant rootstocks of guava
 - c) Salt tolerant rootstocks of grape
 - d) Salt tolerant rootstocks of citrus
24. Which of the following micronutrients are most widely deficient in Indian soils?
 - a) Zinc and boron
 - b) Zinc and iron
 - c) Zinc and manganese
 - d) Zinc and copper
25. Which of the following fertilizers is not produced in India?
 - a) DAP
 - b) Urea
 - c) Muriate of potash
 - d) TSP
26. What is the estimated extent of salt affected soils in India?
 - a) 5.42 mha
 - b) 7.42 mha
 - c) 11.42 mha
 - d) 17.42 mha
27. Which of the following is not a feature of watershed?
 - a) Hydrological unit
 - b) Biophysical unit
 - c) Socio-economic unit
 - d) Production unit

28. Correlation coefficient 'r' lies between
 a) 0 and 1
 b) -1 and 1
 c) -1 and 0
 d) 0 and ∞
29. For the data 1, -2, 4, geometric mean is
 a) 2
 b) 4
 c) $-\frac{7}{3}$
 d) -2
30. The relationship between Arithmetic mean (A), Harmonic mean (H) and Geometric mean (G) is
 a) $G^2=AH$
 b) $G=\sqrt{A+H}$
 c) $H^2=GA$
 d) $A^2=GH$

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. The three dimensional rings formed by the fungus to trap nematode is
 a) *Fusarium oxysporum*
 b) *Trichoderma viride*
 c) *Arthrobotrys oligospora*
 d) *Catenaria vermicola*
32. The size of egg sac bigger than the cyst size is found in
 a) *Heterodera zeae*
 b) *Heterodera sorghi*
 c) *Heterodera moths*
 d) *Heterodera cajani*
33. Which one of the following is not correct?
 a) Deeper transverse striae visible with light microscope are annule
 b) Transverse striae not universal among nematode
 c) Incisures involve epicuticle and only part of exocuticle
 d) Overlapping annulation is not always posteriorly directed
34. The caudal alae are greatly reduced or degenerate in
 a) *Rotylenchus*
 b) *Rotylenchulus*
 c) *Pratylenchus*
 d) *Tylenchorhynchus*
35. Which one of the following is not correct?
 a) Germinal zone is always relatively longer
 b) Hologonic ovaries are restricted to a few parasitic groups
 c) Majority of nematodes have telogonic ovaries
 d) Central protoplasmic core around which germ cells are aggregated is called rachis
36. Which one of the following is not correct?
 a) Largest size egg is encountered in *Placentonema gigantissima*
 b) In some nematodes, egg shell may be four layered
 c) Most nematodes contain chitin in egg shell
 d) The largest size nematode egg measures 0.87-1.1 mm \times 0.24-0.35 mm
37. In *Tylenchulus semipenetrans*, the excretory pore is located at about
 a) 25% of body length
 b) 45% of body length
 c) 80% of body length
 d) 95% of body length
38. Males consistently with degenerate feeding apparatus and reduced stylet are found in
 a) *Radopholus*
 b) *Pratylenchus*
 c) *Nacobbus*
 d) *Hirschmanniella*
39. Which one of the following sugar residues is not detected on cuticular receptor sites of nematodes?
 a) Galactose
 b) Mannose
 c) Glucose
 d) Maltose
40. Which of the following is the enzyme of pentosephosphate pathway encountered in nematodes?
 a) Fumerase
 b) Lactate dehydrogenase
 c) 6-phosphogluconic dehydrogenase
 d) Enolase
41. The principal nitrogenous excretory product in nematode is
 a) NH_3
 b) Urea
 c) Peptides
 d) Uric acid
42. Which of the following nematodes is cortical tissue feeder?
 a) *Heterodera*
 b) *Meloidogyne*
 c) *Rotylenchulus*
 d) *Pratylenchus*

43. Root-knot disease was first recorded in
 a) 1850
 b) 1855
 c) 1865
 d) 1875
44. Which one of the following root-knot nematodes is cryophilic?
 a) *Meloidogyne exigua*
 b) *Meloidogyne chitwoodi*
 c) *Meloidogyne oryzae*
 d) *Meloidogyne brevicauda*
45. Uninucleate giant cell is observed in the case of
 a) *Rotylenchulus parvus*
 b) *Rotylenchulus borealis*
 c) *Rotylenchulus macrodoratus*
 d) *Rotylenchulus anamictus*
46. "Akiochi" disease of rice is associated with
 a) *Pratylenchus*
 b) *Aphelenchoides*
 c) *Ditylenchus*
 d) *Hirschmanniella*
47. Duration of life cycle of *Xiphinema index* is
 a) 21-27 days
 b) 4-7 months
 c) 1 year
 d) 4 years
48. Specific gravity of solution used in centrifugation floatation for extraction of nematode is
 a) 1.15 - 1.18
 b) 1.90 - 1.95
 c) 2.0 - 2.1
 d) 2.2 - 2.5
49. Phloxine is used to stain
 a) Root material
 b) Leaf material
 c) For determining viability of cyst content
 d) To detect nematode within root
50. The enzyme that dissolves middle lamella causing fluffiness of tissues of the plants infected with *Ditylenchus dipsaci* is
 a) Amylase
 b) Pectinase
 c) Carboxylase
 d) Dehydrogenase
51. Importance value can be calculated by
 a) Relative frequency + relative density + relative biomass
 b) No. of samples containing a species \times 100/ No. of samples collected
 c) Density frequency
 d) Density per unit area
52. Which of the following nematode prefers wet and heavy soils?
 a) *Hirschmanniella mucronata*
 b) *Meloidogyne exigua*
 c) *Globodera rostochiensis*
 d) *Tylenchorhynchus nudus*
53. Which of the following nematode can kill mosquito?
 a) *Macroposthonia* sp.
 b) *Romanomermis* sp.
 c) *Helicotylenchus dihystra*
 d) *Haemonchus contortus*
54. Which of the following is a fumigant nematicide?
 a) Carbofuran
 b) Thimet
 c) Metham sodium
 d) Phenamiphos
55. The distribution of nematodes in field generally follows the following frequency distribution
 a) Normal
 b) Skewed
 c) Negative binomial
 d) Aggregated
56. ATP molecules required for synthesis of a glucose molecule in Calvin-Benson cycle are
 a) 12
 b) 18
 c) 37
 d) 38
57. Pathogenicity islands is a term given to
 a) Genes in plants complimentary to virulence genes of pathogens
 b) Cluster of heterogenous genes of pathogens of plants and animals
 c) Cluster of highly homologous genes in microbial pathogens involved in pathogenicity and virulence of both animals and plants
 d) Cluster of virulence genes in nematodes which are responsible for nematode feeding on plants
58. Which of the following nematode occurring in micro-aerobic habitats in estuarine mud possess large amount of haemoglobin?
 a) *Enoplus communis*
 b) *Enoplus brevis*
 c) *Caenorhabditis elegans*
 d) *Rhabditis terrestris*
59. The efficiency of aerobic respiration is
 a) 8 mol ATP mol⁻¹ glucose
 b) 18 mol ATP mol⁻¹ glucose
 c) 28 mol ATP mol⁻¹ glucose
 d) 38 mol ATP mol⁻¹ glucose

60. Individual pore size of 200 mesh sieve is
 a) 750 μm
 b) 250 μm
 c) 150 μm
 d) 75 μm
61. Kalahasti malady of groundnut is caused by
 a) *Meloidogyne arenaria*
 b) *Pratylenchus brachyurus*
 c) *Helicotylenchus dihystera*
 d) *Tylenchorhynchus brevilineatus*
62. Relative density of reniform nematode population in vegetable plot is 75/200 cc soil, while relative frequency is 64%. Calculate the prominence value of reniform nematode
 a) 6
 b) 12
 c) 24
 d) 48
63. Quantity of water required to prepare 500 ml F.A 4:10 fixative
 a) 350 ml
 b) 400 ml
 c) 450 ml
 d) 460 ml
64. Considering the time scale on evolution of an organism, nematodes are presumed to have originated during
 a) Jurassic period
 b) Cambrian period
 c) Oligocene period
 d) Devonian period
65. Ventrally lobed oesophagus, position of vulva equatorial, Didelphic prodelphic coiled ovary and males not having any caudal alae refer to the identify of nematode genus/genera
 a) *Rotylenchulus*
 b) *Meloidogyne*
 c) *Tylenchulus*
 d) All of the above
66. Nematode cuticle lacks in
 a) Collagen
 b) Cuticulins
 c) Chitin
 d) Mucin
67. Immediately after the *Meloidogyne* J2 establishes feeding site and increases in body width
 a) Subventral glands increase while dorsal gland decrease in size
 b) Subventral gland decrease while dorsal gland increase in size
 c) Both the glands increase in size
 d) Both the glands decrease in size
68. During anhydrobiotic survival of nematodes, the bound water is replaced by
 a) Glycogen
 b) Glycerol
 c) Galactose
 d) Trehalose
69. Survival of *Hirschmanniella* in flooded condition is due to the conversion of glucose to
 a) Pyruvic acid
 b) Lactic acid
 c) Acetic acid
 d) Ethanol
70. Maggenti referred the 'bowl skin' bursa as
 a) Arakoderan
 b) Peloderan
 c) Leptodera
 d) Boloderan
71. Hemizonions are present
 a) 10-15 annules ahead hemizonid
 b) 10-15 annules behind hemizonid
 c) On the same annule as hemizonid
 d) Two annules behind excretory pore
72. During anhydrobiosis when glycerol levels are low, the bound water is replaced by
 a) Inositol
 b) Trehalose
 c) Maltose
 d) Glycogen
73. *Heterorhabditis* can evade encapsulation in insects due to the presence of
 a) Lipids on the cuticle
 b) Mural tooth
 c) *Photorhabdus*
 d) Lectins on the cuticle
74. 'Rosette' formation is seen in juveniles of
 a) *Steinernema*
 b) *Heterorhabditis*
 c) *Ditylenchus*
 d) *Aphelenchoidea*
75. Excretory system without lateral canals, consisting of one or rarely two cells is found in the members of
 a) Secernentea
 b) Adenophorea
 c) Tylenchida
 d) Both in Secernentea and Adenophorea
76. Dorsal oesophageal gland duct opening within the median oesophageal bulb is found in
 a) Neotylenchoidea
 b) Tylenchida
 c) Aphelenchida
 d) Hoplolaimoidea

77. Head with four distinct setae are found in
 a) Aphelenchidae
 b) Dorylaimidae
 c) Tylenchidae
 d) Atylenchidae
78. First report of existence of potato cyst nematode in India infecting potato crops in Nilgiri Hills in Tamil Nadu was made by
 a) Koshy & Swarup
 b) Siddiqi & Khan
 c) F.G.W. Jones
 d) B. Weischer
79. *Bursaphelenchus xylophilus* is causal organism of
 a) Toppling disease of banana
 b) Wilt of pines
 c) Red ring disease of coconut
 d) White tip of rice
80. Ovary with multiple row of oocytes is found in
 a) *Hirschmanniella*
 b) *Anguina*
 c) *Criconemoides*
 d) *Rotylenchus*
81. Formula " $\text{Density} \sqrt{\text{Frequency}}$ " calculates
 a) Importance value
 b) Density per unit volume
 c) Prominence value
 d) Relative frequency
82. Nema-cur is registered trade name of
 a) Fenamiphos
 b) Aldicarb
 c) Ethoprop
 d) Oxamyl
83. The paired lateral sensory organs located in the cephalic region of nematodes are known as
 a) Phasmids
 b) Deivids
 c) Hemizonids
 d) Amphids
84. *Hirschmanniella* show maximum activity under
 a) High atmosphere humidity
 b) Sandy soil
 c) High soil moisture
 d) Water logging condition
85. Natality is the
 a) Time taken in the multiplication of nematodes
 b) Time taken in the emergence of nematodes from eggs
 c) Time taken in infecting the host plant
 d) Time taken to complete the life cycle
86. *Ditylenchus dipsaci* was described by
 a) Schacht (1859)
 b) Kuhn (1857)
 c) Neal (1889)
 d) Berkeley (1855)
87. Stippling in the tail tip area in the perineal pattern is diagnostic character of
 a) *Meloidogyne javanica*
 b) *Meloidogyne hapla*
 c) *Meloidogyne incognita*
 d) *Meloidogyne arenaria*
88. One giant cell is generally produced by
 a) *Meloidogyne javanica*
 b) *Meloidogyne floridensis*
 c) *Meloidogyne graminicola*
 d) *Meloidogyne mayagenensis*
89. Reproduction in cyst forming nematodes is generally
 a) Mitotic parthenogenetic
 b) Meiotic parthenogenetic
 c) Unisexual
 d) Bisexual
90. Corpus in two parts with narrow isthmus and basal bulb without valve is present in
 a) Rhabditoids
 b) Tylenchids
 c) Diplogasteroids
 d) Dorylaimoids
91. Cone tops with Mulvey's bridge is found in
 a) *Heterodera avenae*
 b) *Heterodera graminis*
 c) *Heterodera trifolii*
 d) *Globodera pallida*
92. The stain used to distinguish live from dead nematode is
 a) Crimson red
 b) Silver nitrate
 c) New blue R
 d) Acid-fuchsin
93. Formaldehyde is used a constituent of fixative of nematodes because it
 a) Kills nematodes faster than other chemicals
 b) Penetrates in all parts of the body
 c) Fixes fats present in the nematodes
 d) Preserves protein and glycogen and work as hardening reagent
94. Baermann funnel technique is best used for
 a) Isolation of nematodes from soil samples
 b) Isolation of cysts of nematodes from soil samples
 c) Removing soil particles from nematode suspension
 d) Separating large size nematodes from small size nematodes

95. Stylet knobs are virtually absent in
 a) *Tylenchorhynchus*
 b) *Radopholus*
 c) *Aphelenchus*
 d) *Criconebella*
96. Female body saccate, sausage or kidney shape, vulva sub-median large with protuberant vulval lips are present in
 a) *Verutus*
 b) *Sarisodera*
 c) *Atalodera*
 d) *Punctodera*
97. *Hirsutella rhossiliensis* has shown the ability to
 a) Suppress nematode density
 b) Increase nematode density
 c) Completely eliminate the nematodes
 d) Rear the nematodes for their culturing
98. Which of the following genera is cyst forming nematode?
 a) *Atalodera*
 b) *Cactodera*
 c) *Sarisodera*
 d) *Cryptodera*
99. A paratenic host is one in which a
 a) Parasite is carried on its body
 b) Parasite survives without undergoing further development
 c) Parasite reaches maturity and reproduces
 d) Parasite reaches maturity but does not reproduce
100. The permeability characteristics of the nematode eggshell are derived mainly from the
 a) Lipid layer
 b) Chitinous eggshell
 c) Lectin residues
 d) Bi-polar proteins
101. The following pigment is characteristic of nematode senescence
 a) Acidfuschin
 b) Lipofuscin
 c) Oxytocin
 d) Nematicidin
102. In an ecosystem, nematodes function as
 a) Primary decomposers
 b) Secondary decomposers
 c) Tertiary decomposers
 d) Do not decompose
103. *Clavibacter toxicus* is carried by *Anguina funesta* attached to
 a) Stylet
 b) Inner walls of esophagus
 c) Cuticle
 d) Inner walls of intestine
104. *Macroposthonia xenoplax* can be differentiated from *Hemicriconemoides mangiferae* on the basis of
 a) Size of stylet
 b) Cuticular sheath
 c) No. of ovaries
 d) Annulations
105. Which of the following chemicals can induce hatching of several cyst nematode species?
 a) Ethyl-propyl ester
 b) Flavianic acid
 c) Aspartic acid
 d) Asparagusic acid
106. Sphingomyelin is a
 a) Polypeptide in ribosomes of nematodes
 b) A phospholipid constituting cellular membranes
 c) A chemical inhibiting hatching of *Heterodera glycines*
 d) A plant derived hatching stimulant for *Heterodera goettingiana*
107. In aerobic conditions, fatty acids are broken down to Acetyl-Co-A, NADH and reduced flavoprotein by
 a) β -oxydation
 b) Carboxylic substitution
 c) Hexose monophosphate shunt
 d) Decarboxylation reactions
108. The major energy reserve in plant parasitic nematode is
 a) Lipids
 b) Carbohydrates
 c) Proteins
 d) Triacylglycerols
109. "Potato race, tulip race, onion race and daffodil race" refer to this nematode
 a) Rot nematode
 b) Stem and bulb nematode
 c) Foliar nematode
 d) Cyst nematode
110. The size of 325 mesh sieve is
 a) 35 μm
 b) 45 μm
 c) 55 μm
 d) 60 μm
111. Which group of nematode has the median bulb occupying the entire body width?
 a) Dorylaimida
 b) Aphelenchida
 c) Rhabditida
 d) Tylenchida

112. Which *Pasteuria* species is parasitic on lesion nematodes?
 a) *Pasteuria penetrans*
 b) *Pasteuria thornei*
 c) *Pasteuria nishizawae*
 d) *Pasteuria ramosa*
113. Tobacco ring spot virus is transmitted by
 a) *Xiphinema brevicolle*
 b) *Xiphinema index*
 c) *Xiphinema americanum*
 d) *Xiphinema diversicaudatum*
114. In USA, the following nematode has been subjected to Federal quarantine since 1954
 a) *Heterodera glycines*
 b) *Globodera pallida*
 c) *Meloidogyne incognita*
 d) *Tylenchulus semipenetrans*
115. Anchor shaped stylet knob is present in
 a) *Longidorus*
 b) *Xiphinema*
 c) *Hoplolaimus*
 d) *Criconematids*
116. All the three oesophageal glands open into median bulb in
 a) Tylenchids
 b) Aphelenchids
 c) Heteroderids
 d) Rhabditis
117. Oesophageal glands overlap the dorsal side of the intestine
 a) *Hoplolaimus* and *Radopholus*
 b) *Radopholus* and *Hirschmanniella*
 c) *Hoplolaimus* and *Pratylenchus*
 d) None of the above
118. Circum oesophageal commissure is part of
 a) Nervous system
 b) Digestive system
 c) Circulatory system
 d) None of the above
119. In Tylenchida the nerve ring encircles the middle part of
 a) Intestine
 b) Oesophagus
 c) Pharynx
 d) None of the above
120. The metabolic product of carbofuran is
 a) Carbofuran anide
 b) Carbofuran phenol
 c) Carbofuran sulfone
 d) Carbofuran phosphate
121. A nematode which is not known to be seed-borne is
 a) *Ditylenchus dipsaci* (Onion and Lucerne)
 b) *Aphelenchoides besseyi* (Rice)
 c) *Anguina tritici* (Wheat)
 d) *Aphelenchus avenae*
122. The following nematicide exhibits irreversible binding of acetyl cholinesterase
 a) Oxamyl
 b) Fenuslfothion
 c) Phorate
 d) Phenamiphos
123. Most nematicides kill nematodes by affecting respiration through
 a) Affecting enzymes
 b) Denaturing organs
 c) Blocking cytochromes
 d) Imbalancing CO₂
124. Royal 300 strain – Antipolis is commercial product of this bioagent
 a) *Arthrobotrytis superba*
 b) *Arthrobotrytis irregularis*
 c) *Arthrobotrytis robusta*
 d) *Arthrobotrytis oligospora*
125. According to de Man formula 'P' refers to
 a) Position of amphid
 b) Position of phasmid
 c) Position of cardia
 d) Position of nerve ring
126. *Pasteuria* infection in root-knot nematode occurs through
 a) Zoospores
 b) Oospores
 c) Ascospores
 d) Endospores
127. Hisar Lalit is a resistant cultivar of
 a) Brinjal
 b) Tomato
 c) Cowpea
 d) Okra
128. Which species of *Anguina* produce floral galls that are toxic to animals?
 a) *Anguina tritici*
 b) *Anguina mobilis*
 c) *Anguina agrostis*
 d) *Anguina pustulicola*
129. In 'Nematode wool', which stage of nematode undergoes anhydrobiosis?
 a) Second stage
 b) Pre-adult
 c) Adults
 d) Third-stage

130. How many life cycle does cereal cyst nematode complete on its host in a season?

- a) 1
- b) 2
- c) 3
- d) More than 3

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. Match the disease with the casual nematode

- | | |
|-------------------------|-------------------------------------|
| i) Miti miti | a) <i>M. chitwoodi</i> |
| ii) Yellow dwarf | b) <i>Hirschmanniella miticausa</i> |
| iii) Rosary root | c) <i>Criconemella ornata</i> |
| iv) Mezquino de la papa | d) <i>H. glycines</i> |
| v) Yellow disease | e) <i>Nacobbus</i> |

132.

- | | |
|--------------------------|---------------------------|
| i) Bloat | a) <i>Heterorhabditis</i> |
| ii) Weevil | b) Tundu |
| iii) <i>Photorhabdus</i> | c) <i>Ditylenchus</i> |
| iv) <i>Xenorhabdus</i> | d) <i>Steinernema</i> |
| v) Yellow slime rot | e) Redring disease |

133.

- | | |
|---------------------|-------------|
| i) Aldicarb | a) Nema-cur |
| ii) Phenamiphos | b) Dowfume |
| iii) Methyl bromide | c) Temik |
| iv) Metham sodium | d) Vapam |
| v) DBCP | e) Nemagon |

134.

- | | |
|-------------------|---|
| i) Platymerian | a) Having more than 5 muscle cells in each inter chordal zone |
| ii) Coelomyarian | b) It has a wide flat base with contractile element limited only to the base lying closest to the epidermis |
| iii) Circomyarian | c) Having 2 to 5 muscle cells in each inter chordal zone |
| iv) Meromyarian | d) It has a narrow base, the contractile elements extend to the sides of the cell towards pseudocoelom |
| v) Polymyarian | e) It is rounded and has contractile fibers all along its circumference |

135.

- | | |
|----------------|---|
| i) Axenic | a) Culturing of a nematode in the presence of one known biological entity |
| ii) Xenic | b) Culturing of a nematode in the presence of unknown species |
| iii) Monoxenic | c) Pertains to a medium in which chemicals used are of unknown composition |
| iv) Oligidic | d) Culturing of a nematode in the absence of any other biological entity |
| v) Meridic | e) Pertains to a medium in which chemicals used are of partly known composition |

136.

- | | |
|-----------|--------------------------|
| i) Cortex | a) <i>Anguina</i> |
| ii) Seed | b) <i>Hexameris</i> |
| iii) Leaf | c) <i>Cephalobus</i> |
| iv) Soil | d) <i>Radopholus</i> |
| v) Insect | e) <i>Aphelenchoides</i> |

137.

- | | |
|----------------------------------|-------------------------------|
| i) <i>Radopholus citrophilus</i> | a) Florida |
| ii) Rostock | b) Golden nematode |
| iii) Glasshouse cucumbers | c) Nematologia Mediterranea |
| iv) Highest number of host races | d) <i>Ditylenchus dipsaci</i> |
| v) Lamberti | e) Berkeley |

138.

- | | |
|------------------------------------|--|
| i) <i>Anguina tritici</i> | a) Hypertrophy and hyperplasia of host roots |
| ii) <i>Ditylenchus dipsaci</i> | b) Hypertrophy and hyperplasia forming a syncytial mass of multinucleate cells |
| iii) <i>Xiphinema index</i> | c) Hypertrophy and multinucleate cells |
| iv) <i>Nacobbus aberrans</i> | d) Hypertrophy and hyperplasia of cells adjacent to central cavity where larvae accumulate |
| v) <i>Hemicycliophora arenaria</i> | e) Necrosis, plasmolysis, nuclear distortion, cell multiplication, hypertrophy |

139. Match the number of races/biotypes reported in nematodes

- | | |
|-------------------------------------|--------|
| i) <i>Heterodera rostochiensis</i> | a) >20 |
| ii) <i>Rotylenchulus reniformis</i> | b) 4 |
| iii) <i>Meloidogyne incognita</i> | c) 2 |
| iv) <i>Heterodera zaeae</i> | d) 5 |
| v) <i>Ditylenchus dipsaci</i> | e) 3 |

140.

- | | |
|-------------------------------------|----------------------------|
| i) <i>Xiphinema index</i> | a) Amphimixis |
| ii) <i>Caenorhabditis elegans</i> | b) Pseudogamy |
| iii) <i>Rhabditis aberrans</i> | c) Mitotic parthenogenesis |
| iv) <i>Pratylenchus brachyurous</i> | d) Meiotic parthenogenesis |
| v) <i>Anguina tritici</i> | e) Hermaphroditism |

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. Nematode community is more diverse and stable in a forest bed compared to an agricultural field. Why?

142. What are North Carolina host differentials and list out host differentials for *Meloidogyne* species and races?

143. List enzymes secreted by plant parasitic nematodes during penetration and formation of feeding sites.

144. Why are systemic nematicides preferred for nematode control?

145. How do organic amendments suppress nematodes in soil?

146. What factors influence virus retention, specificity and dissociation in nematode vectors of viruses?