



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

Discipline : Plant Pathology

Discipline Code : 18

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 B<sub>12</sub>?
  - 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 F<sub>1</sub> 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  $\infty$
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. Plant parasitic bacterium was first reported by  
 a) E.F. Smith  
 b) T.J. Burril  
 c) Fischer  
 d) Woronin
32. Murein is present in the bacterium  
 a) Methanobacterium  
 b) Cyanobacteria  
 c) Halobacterium  
 d) Clavibacter
33. Total chromosome number in bacteria is  
 a) 4  
 b) 3  
 c) 2  
 d) 1
34. The red pigment producing bacteria is  
 a) Serratia  
 b) Staphylococcus  
 c) Micrococcus  
 d) Monococcus
35. The acronym of AUDPC is  
 a) Area under disease progress curve  
 b) Area under disease gradient progress curve  
 c) Area under diseased plant curve  
 d) Authority of disease protection communication
36. Important pre-disposing factor for common scab of potato is  
 a) Any types of soil  
 b) Sandy loam soil  
 c) Dry alkaline soil  
 d) Clay loam soil
37. Disease prediction simulation model 'EIPRE' is related to  
 a) Southern corn leaf blight  
 b) Cereal rust  
 c) Apple scab  
 d) Late blight of potato
38. The genus *Xanthomonas* belongs to the family  
 a) Rhizobacteriaceae  
 b) Enterobacteriaceae  
 c) Pseudomonaceae  
 d) Yet to name
39. The indicator plant used for detection of citrus tristeza virus is  
 a) Rangpur lime  
 b) Kagzi lime  
 c) Sweet orange  
 d) Trifoliate orange
40. Detection and identification of a physiological race is done by  
 a) Host range  
 b) Nested multiplex PCR  
 c) Selective culture medium  
 d) ELISA
41. Which of the following diseases is not a fungal disease?  
 a) Black rust  
 b) Brown rust  
 c) Red rust  
 d) White rust
42. Benzimidazole fungicides are categorized under  
 a) High risk  
 b) Low risk  
 c) Medium risk  
 d) Risk free
43. The most widely used biocontrol fungus *Trichoderma* releases the enzyme  
 a) Chitinases only  
 b) Glucanases only  
 c) Cellulases only  
 d) All the three enzymes
44. The wild fire toxin is secreted by  
 a) *Pseudomonas fluorescens*  
 b) *Pseudomonas solanacearum*  
 c) *Pseudomonas syringae* pv. *tabaci*  
 d) All these bacteria

45. A fully developed matured rust appressorium bears
- 2 nuclei
  - 4 nuclei
  - 8 nuclei
  - 16 nuclei
46. The 'Father of Seed Pathology' is
- Trirumalachar
  - S.B. Mathur
  - Paul Neergard
  - V.K. Aggarwal
47. Staining of Rickettsia and some protozoa is done with
- Giemsa stain
  - Acid fast stain
  - Gram stain
  - Cotton blue
48. The antibiotic produced from bacteria is
- Tetracycline
  - Polymixin
  - Erythromycine
  - Neomycin
49. Solidifying agent agar-agar is produced from
- Blue green algae
  - Green algae
  - Red algae
  - Brown algae
50. Who proved dust as a carrier of germs by conducting an experiment in a specially designed box?
- Lazaro Spallanzani
  - John Tyndall
  - Schwann
  - Antony Von Leeuwenhoek
51. Covered smut of barley is caused by the fungus
- Ustilago segetum* var. *tritici*
  - Ustilago segetum* var. *hordei*
  - Ustilago nuda*
  - Ustilago agropyri*
52. Rice tungro disease is transmitted through
- Aphid
  - Beetle
  - White fly
  - Leaf hopper
53. Downy mildew of soybean is caused by
- Sclerospora glycinae*
  - Sclerospora graminicola*
  - Peronospora mansurica*
  - Peronospora parasitica*
54. Glume blotch is very commonly found in
- Rice
  - Wheat
  - Maize
  - Barley
55. The secondary metabolite aflatoxin is released by
- Aspergillus niger*
  - Aspergillus fumigatus*
  - Aspergillus flavus*
  - All the species of *Aspergillus*
56. Black leg disease is related to a vegetable crop of
- Cruciferae
  - Solanaceae
  - Cucurbitaceae
  - Leguminosae
57. Which of the following causes poor seed germination in barley?
- Ustilago tritici*
  - Ustilago virens*
  - Ustilago nuda*
  - Ustilago scitaminae*
58. The seed borne disease Purple blotch of onion is caused by
- Alternaria solani*
  - Alternaria porri*
  - Alternaria dauca*
  - Alternaria alternata*
59. Which one can easily be transmitted by vegetatively propagating materials?
- Fungi
  - Bacteria
  - Rickettsia
  - Virus
60. Seed treatment is very effective for controlling loose smut by
- Vitavax
  - Thiram
  - Captan
  - Carbendazim
61. Expanded form of DIPA is
- Destructive immuno pattern assay
  - Destructive insect plant act
  - Destructive insect pest act
  - Direct immuno pattern assay
62. The genome of TMV codes for coat protein subunits consisting of
- 158 amino acids
  - 160 amino acids
  - 162 amino acids
  - 164 amino acids

63. The successful example of transgenic resistance against Papaya ring spot virus was obtained using gene construct of
- Movement protein
  - Replicase protein
  - Partial coat protein
  - Full coat protein
64. Mustard seed like *Sclerotia* are developed in the fungus
- Rhizoctonia solani*
  - Sclerotinia sclerotiorum*
  - Sclerotium rolfsii*
  - Sclerotium oryzae*
65. Callose, a defense governing substance is found in
- Sieve tubes
  - Vascular bundles
  - Phloem only
  - Xylem only
66. Rishitin is a
- Host specific toxin
  - Non-host specific toxin
  - Phytoalexin
  - Metabolite
67. Solar heat treatment to manage loose smut of wheat was prescribed by
- J.C. Luthra
  - V.V. Chenulu
  - E.J. Butler
  - B.B. Mundkur
68. A1 and A2 mating types are found in the fungus
- Helminthosporium maydis*
  - Phytophthora infestans*
  - Sclerotium rolfsii*
  - Fusarium oxysporum*
69. The most susceptible host of plant viruses is
- Chenopodium amaranticolor*
  - Cucumis sativus*
  - Solanum melongena*
  - Nicotiana benthamiana*
70. Tospovirus is
- Enveloped DNA virus
  - Enveloped RNA virus
  - Non-enveloped DNA virus
  - Non-enveloped RNA virus
71. Uncoating of TMV in the cells occurs after inoculation
- Within few minutes
  - After an hour
  - After 12 hours
  - After 24 hours
72. Viroids are naturally transmitted by
- Mechanical means
  - Seeds
  - Aphids
  - White flies
73. PNPP used in ELISA is
- An enzyme
  - An antibody
  - A substrate
  - An antigen
74. *Pleospora* is the teliomorph of
- Stemphylium*
  - Cercospora*
  - Septoria*
  - Paecilomyces*
75. Gram Theory was introduced by
- Louis Pasteur
  - E.F. Smith
  - Robert Koch
  - Robert Smith
76. Genome of Banana bunchy top virus consists of
- dsDNA
  - ssDNA
  - ssRNA
  - Both RNA and DNA
77. DNCP is banned due to
- Phytotoxicity
  - Environmental pollution
  - Degradation of soil
  - Pollution of ground water
78. The chemical used for the green colour preservation of the plant sample is
- Formalin
  - Glacial acetic acid
  - Cupric acetate
  - Distilled water
79. Serological methods are not used for the detection of
- Viroid
  - Virus
  - Fungi
  - Bacteria
80. The best indicator plant for potato spindle tuber viroid detection is
- Tobacco
  - Brinjal
  - Tomato
  - Chilli

81. The most sensitive technique for the plant virus diagnostic is
- ELISA
  - Western blotting
  - Immunodiffusion
  - Real time PCR
82. Pisatin, Rishitin & Phaseollin are
- Phytoanticipins
  - Phytoalexins
  - Phytotoxins
  - Patholoxins
83. Rust which is caused by Pseudofungi is
- White rust of crucifers
  - Bean rust
  - Wheat rust
  - Gram rust
84. The fungi which does not cause powdery mildew is
- Erysiphe*
  - Phyllactinia*
  - Leveillula*
  - Bremia*
85. Physiological specialization in stem rust of wheat was demonstrated by
- Anton de Bary
  - Stalkman
  - Erickson
  - Craigie
86. A group of fungi not producing spores is
- Hyphomycetes
  - Asomycetes
  - Mycelia sterilia
  - Coelomycetes
87. Coconut root wilt is associated with
- Viroid
  - Pseudomonas solanacearum*
  - Phytoplasma
  - Fusarium oxysporum*
88. The cell wall of oomycetes contain
- Chitin
  - Chitosan
  - Cellulose
  - Pectin
89. The fungus showing highest host range is
- Puccinia graminis*
  - Sclerotium rolfsii*
  - Phytophthora infestans*
  - Rhizoctonia solani*
90. The nematode genus which do not act as vector of virus transmission is
- Xiphinema*
  - Trichodorus*
  - Meloidogyne*
  - Polymyxa*
91. The fungus which is used for trapping the nematode is
- Prichoderma viride*
  - Arthobotrys superba*
  - Paecilomyces liliacinus*
  - Pasteuria penetrans*
92. Pre-formed antimicrobial compounds often present in healthy plants is
- Phytoalexin
  - Reactive oxygen species
  - Phytoanticipins
  - Pathogenesis related proteins
93. Lignin and silicilic acid of the epidermal cell of rice leaves provide protection against
- Brown spot of rice
  - Bacterial blight of rice
  - Leaf streak of rice
  - Rice blast
94. The opening and closing of stomata in wheat varieties serve as an example of functional resistance to
- Rust
  - Powdery mildew
  - Smut
  - Leaf blight
95. Major gene, race-specific, seedling, monogenic, differential and pathotype specific resistance are example of
- Vertical resistance
  - Horizontal resistance
  - Apparent resistance
  - Both b) and c)
96. 'QTL' stands for
- Qualitative trait loci
  - Quantitative trait loci
  - Quantitative trait like
  - Qualitative trait like
97. Population of a host in which all individuals have a particular character of resistance in common is known as
- General resistance
  - Immunity
  - Pathodeme
  - Durable resistance

98. "The *R* protein being guarded by another protein that detects degradation by an *avr* gene" is
- Ion channel
  - Guard hypothesis
  - Gene for gene hypothesis
  - Receptor legand hypothesis
99. Candidates liberibacter asiaticus is a
- Phloem limited bacterium
  - Phloem limited phytoplasma
  - Xylem limited bacteria
  - Xylem limited mycoplasma
100. Double stranded DNA is found in
- Mycovirus
  - Luteovirus
  - Caulimovirus
  - Tospovirus
101. The virus causing sunflower necrosis disease is a
- Tospovirus
  - Tobamovirus
  - Ilarvirus
  - Potyvirus
102. Who demonstrated first that the pathogen associated with mosaic disease of tobacco was filterable?
- Beijerinck
  - Stanley
  - Ivonavsky
  - Paul Frosch
103. Which of the following is a cup-shaped structure?
- Apothecium
  - Cleistothecium
  - Zoosporangium
  - Sporangium
104. Clark and Adams are known for development of
- PCR
  - ELISA
  - Real time PCR
  - Nucleic acid hybridization
105. Which of the following viruses are bacilliform in shape?
- Banana streak Mysore virus
  - Cucumber mosaic virus
  - Tobacco streak virus
  - Potato virus X
106. Which of the following viruses is seed borne?
- Banana bract mosaic
  - Lettuce mosaic
  - Cassava mosaic
  - Potato virus X
107. The fourth rule of Koch's postulates was prescribed by
- Robert Koch himself
  - E.F. Smith
  - Brefeld
  - Leeuwenhoek
108. Resolving power of transmission electron microscope is
- 1 mm
  - 1  $\mu$ m
  - 1 nm
  - 1 fm
109. Southern blotting is
- Transfer of protein from gel to nitrocellulose membrane
  - Transfer of RNA from gel to nitrocellulose membrane
  - Transfer of DNA from gel to nitrocellulose membrane
  - Transfer of dyes from gel to nitrocellulose membrane
110. The first systemic account on Indian fungi was published by
- Mundukar
  - Butler and Bisby
  - Vasudeva
  - Ramkrishnan & Subramanian
111. The person(s) who demonstrated the phenomenon of variability among fungi is
- Stakman
  - William *et al.*
  - Anton de Bary
  - Erickson
112. The "Herbarium Cryptogamiae Indian Orientalis" was first created by
- E.F. Smith
  - J.G. Kuhn
  - E.J. Butler
  - K.C. Mehta
113. A chemical compound that prevents multiplication without killing the fungus is
- Mycocidal
  - Antibiotic
  - Fungicide
  - Fungistatic
114. Who advanced the gene for gene concept of disease resistance and susceptibility?
- Van der Plank
  - Flor
  - Ganmann
  - Muller

115. The first plant virus whose genome was completely sequenced
- CMV
  - CaMV
  - TMV
  - PVX
116. Which of the following is an anti-oomycetes fungicide?
- Carbendazim
  - Benomyl
  - Thiophenate methyl
  - Metalaxyl
117. Which of the following chemical fungicides acts by interfering with nuclear division?
- Benzimidazoles
  - Oxathiins
  - Strobilurins
  - Triadimefon
118. Mycoparasitism is associated with
- Trichoderma*
  - Cercospora*
  - Septoria*
  - Alternaria*
119. Phytoplasma are mainly transmitted by
- Aphids
  - Mites
  - Leaf hoppers
  - Thrips
120. Which one of the followings methods give accurate estimate of the radius of the virus?
- Electron microscopy
  - X-ray crystallography
  - Mass spectrometry
  - Serology
121. Which of the following is an internally borne pathogen?
- Synchytrium endobioticum*
  - Ustilago nuda*
  - Ustilago hordei*
  - Ustilago avenae*
122. *Ustilago nuda* causes
- Smut of oats
  - Loose smut of wheat
  - Loose smut of barley
  - Bunt of wheat
123. Cotton leaf curl virus and Groundnut bud necrosis virus is transmitted by which vectors?
- Thrips and thrips
  - Thrips and whitefly
  - Whitefly and thrips
  - Thrips and aphids
124. "Murein B" contains what type of cross-linkage between the peptide side chains?
- 1,3 linkage
  - 1,4 linkage
  - 2,4 linkage
  - 3,4 linkage
125. Dipicolinic acid is an important constituent of
- Bacterial cell wall
  - Bacterial protoplasm
  - Endospore
  - Ascospore
126. F-factor remains as integrated within bacterial chromosomes of which type of bacterial cell?
- F<sup>+</sup>
  - F'
  - Hfr
  - Pfr
127. Which one of the following bacterium contains peritrichous flagella?
- Erwinia*
  - Xanthomonas*
  - Agrobacterium*
  - Bacillus*
128. Serologically which class of immunoglobulins is important?
- IgA
  - IgD
  - IgG
  - IgM
129. The antibodies have a length of approximately
- 100 nm
  - 50 nm
  - 10 nm
  - 1 nm
130. Cucumber mosaic virus is transmitted
- Only by mechanical means
  - Only by aphids
  - By both aphids and mechanical means
  - By seeds, aphids and mechanical means



**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) <i>Fluorescent pseudomonas</i> | a) 1940              |
| ii) Bunchy top of banana          | b) Muller and Berger |
| iii) Kitazin                      | c) King's B medium   |
| iv) Phytoalexin                   | d) Ilarvirus         |
| v) Sunflower necrosis             | e) Blast of rice     |

132.

- |                  |                                   |
|------------------|-----------------------------------|
| i) Grey mold     | a) <i>Peronospora humuli</i>      |
| ii) Downy mildew | b) <i>Colletotrichum coccodes</i> |
| iii) White rust  | c) <i>Botrytis cinerea</i>        |
| iv) Charcoal rot | d) <i>Albugo candida</i>          |
| v) Anthracnose   | e) <i>Macrophomina phaseolina</i> |

133.

- |                      |                              |
|----------------------|------------------------------|
| i) Lycomarasin       | a) Phytoalexin of pea        |
| ii) Pisatin          | b) Anthracnose of chilli     |
| iii) Alternaric acid | c) <i>Magnaporthe grisea</i> |
| iv) Pyricularin      | d) Wilt of tomato            |
| v) Colletin          | e) Potato early blight       |

134.

- |                                |                              |
|--------------------------------|------------------------------|
| i) Teliospore morphogenesis    | a) Type-III secretion system |
| ii) Expert system CLIMEX       | b) Phylogenetic relationship |
| iii) Plant pathogenic bacteria | c) Pectinases                |
| iv) Phytoanticipins            | d) Rice blast forecasting    |
| v) Bacterial pathogenesis      | e) Saponins                  |

135.

- |                          |                                   |
|--------------------------|-----------------------------------|
| i) Horizontal resistance | a) fig 22                         |
| ii) Vertical resistance  | b) <i>Agrobacterium rhiogenes</i> |
| iii) PAMPS               | c) PAMP triggered immunity        |
| iv) T3 SS                | d) Effector triggered immunity    |
| v) Ri plasmid            | e) Bacterial pathogens            |

136.

- |                                 |                  |
|---------------------------------|------------------|
| i) Cotton leaf curl virus       | a) Flexuous rod  |
| ii) Papaya ring spot virus      | b) Bacilliform   |
| iii) Cacao swollen shoot virus  | c) Dumble shaped |
| iv) Cucumber mosaic virus       | d) Enveloped     |
| v) Groundnut bud necrosis virus | e) Spherical     |

137.

- |                             |         |
|-----------------------------|---------|
| i) Wheat leaf rust          | a) Pi-b |
| ii) Rice blast              | b) prf  |
| iii) Tomato bacterial speck | c) Lr21 |
| iv) Tobacco mosaic virus    | d) Xal  |
| v) Rice bacterial blight    | e) N    |

138.

- |                     |              |
|---------------------|--------------|
| i) Dithiocarbamates | a) Benomyl   |
| ii) Benzimidazole   | b) Carboxin  |
| iii) Oxathiins      | c) Zineb     |
| iv) Phthalimides    | d) Metalaxyl |
| v) Acylalanine      | e) Captan    |

139.

- |                         |                                |
|-------------------------|--------------------------------|
| i) Free cell formation  | a) Apothecia                   |
| ii) Ascocarp            | b) Ascospores                  |
| iii) Hymenia            | c) <i>Lentinus edodes</i>      |
| iv) Shiitake            | d) <i>Volvariella volvacea</i> |
| v) Paddy straw mushroom | e) Basidia                     |

140.

- |   |                                |
|---|--------------------------------|
| i) <i>Uromyces appendiculatus</i>                       | a) Bacterial wilt of cucurbits |
| ii) <i>Erwinia amylovora</i>                            | b) Bean rust                   |
| iii) <i>Ralstonia solanacearum</i>                      | c) Black rot of crucifers      |
| iv) <i>Xanthomonas campestris</i> pv. <i>campestris</i> | d) Moko disease of banana      |
| v) <i>Erwinia tracheiphila</i>                          | e) Fire blight of apple        |

**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. Sulphur fungicides are highly effective against powdery mildew than other fungi. Why?

142. DAS ELISA is more sensitive, specific and reliable than DAC ELISA, why?

143. Resistance breeding is successful against biotrophic fungal pathogen. Why?

144. Who coined the word 'vertical and horizontal resistance'? What are the differences between vertical and horizontal resistance?

145. What are the main groups of substances secreted by the pathogen during disease development?  
Does virus and viroids also produce these chemicals?

146. Explain briefly the principles of getting virus free planting material in vegetatively propagated plants.