Post Graduate School
Indian Agricultural Research Institute, New Delhi

Examination for Admission to Ph.D. Programme 2011-2012

Discipline : Horticulture (*Vegetable Science*)

Discipline Code : 12, *Sub code : 03* Roll No.

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. 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?
a) Reduced water application
b) Reduced plant density
c) Increased application of chemical fertilizers
d) Reduced age of seedlings

10. Which organic acid, often used as a preservative, occurs naturally in cranberries, prunes, cinnamon and cloves?
a) Citric acid
b) Benzoic acid
c) Tartaric acid
d) Lactic acid

11. Cotton belongs to the family
a) Cruciferae
b) Anacardiaceae
c) Malvaceae
d) Solanaceae

12. Photoperiodism is
a) Bending of shoot towards source of light
b) Effect of light/dark durations on physiological processes
c) Movement of chloroplast in cell in response to light
d) Effect of light on chlorophyll synthesis

13. Ergot disease is caused by which pathogen on which host?
a) *Claviceps purpurea* on rye
b) *Puccinia recondita* on wheat
c) *Drechlera sorokiniana* on wheat
d) *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
a) Igneous rock
b) Metamorphic rock
c) Sedimentary rock
d) Hybrid rock

15. Which one of the following is a *Kharif* crop?
a) Pearl millet
b) Lentil
c) Mustard
d) Wheat

16. The coefficient of variation (C.V.) is calculated by the formula
a) (Mean/S.D.) × 100
b) (S.D./Mean) × 100
c) S.D./Mean
d) Mean/S.D.

17. Which of the following is commonly referred to as muriate of potash?
a) Potassium nitrate
b) Potassium chloride
c) Potassium sulphate
d) Potassium silicate

18. Inbred lines that have same genetic constitution but differ only at one locus are called
a) Multi lines
b) Monohybrid
c) Isogenic lines
d) Pure lines

19. For applying 100 kg of nitrogen, how much urea would one use?
a) 45 kg
b) 111 kg
c) 222 kg
d) 333 kg

20. The devastating impact of plant disease on human suffering and survival was first realized by epidemic of
a) Brown spot of rice in Bengal
b) Late blight of potato in USA
c) Late blight of potato in Europe
d) Rust of wheat in India

21. The species of rice (*Oryza*) other than *O. sativa* that is cultivated is
a) *O. rufipugon*
b) *O. longisteminata*
c) *O. glaberrima*
d) *O. nivara*

22. The enzyme responsible for the fixation of CO_2 in mesophyll cells of C-4 plants is
a) Malic enzyme
b) Phosphoenol pyruvate carboxylase
c) Phosphoenol pyruvate carboxykinase
d) RuBP carboxylase

23. Which one of the following is a 'Vertisol'?
a) Black cotton soil
b) Red sandy loam soil
c) Sandy loam sodic soil
d) Submontane (Tarai) soil

24. What is the most visible physical characteristic of cells in metaphase?
a) Elongated chromosomes
b) Nucleus visible but chromosomes not
c) Fragile double stranded loose chromosomes
d) 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

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 vegetable belonging to moncotylendon is
a) Amaranthus
b) Asparagus
c) Spinach beet
d) Drumstick

32. 'Freedom' is a transgenic variety of
a) Potato
b) Squash
c) Tomato
d) Okra

33. The primary centre of origin of pea is
a) Ethiopia
b) Mexico
c) Peru
d) China

34. Commercial seed production of cabbage cannot be done at
a) Kinnaur
b) Srinagar
c) Bangalore
d) Katrain

35. The 'V' shaped lesion in the leaf is characteristics symptoms of
a) Sclerotium rot
b) Black rot
c) Downy mildew
d) *Alternaria* blight

36. Edible podded garden pea variety is
a) Pusa Pragati
b) Oragan Sugar
c) Meteor
d) Arkel

37. Which of the following is a shallow rooted crop?
a) Onion
b) Radish
c) Turnip
d) Sweet potato

38. Rat-tail or mougri radish is botanically known as
a) *Raphanus sativus* var. radicula
b) *Raphanus sativus* var. niger
c) *Raphanus sativus* var. caudatus
d) *Raphanus sativus* var. olifera

39. The base temperature of peas to calculate heat unit for cultivar is
a) 4.4°C
b) 8.4°C
c) 8.8°C
d) 12.4°C

40. Yellow pigment in beet root is due to the presence of
a) β-cyanins
b) Carotene
c) Violaxanthin
d) β-xanthin

41. Wider spacing and excessive use of fertilizer in potato may cause
a) Internal brown spot
b) Black peat
c) Greening
d) Hollow heart

42. Potato leaf marker commonly associated with male sterility line of
a) Brinjal
b) Chilli
c) Tomato
d) Bell pepper

43. Gold fleck is a physiological disorder of
a) Tomato
b) Potato
c) Brinjal
d) Okra

44. Long melon can easily cross with
a) Cucumber
b) Musk melon
c) Water melon
d) Round melon

45. Which of the following cucurbits contain highest amount of iron?
a) Bitter gourd
b) Pumpkin
c) Musk melon
d) Bottle gourd

46. Which of the following palak varieties does not bolt in plain?
a) Pusa Harit
b) All Green
c) Pusa Jyoti
d) Pusa Bharathi

47. Perianth type flower is seen in
a) Bulb crop
b) Root crop
c) Okra
d) Cole crop

48. Leek is mainly propagated by
a) Clove
b) Bulb
c) Seed
d) Root cutting

49. Which of the vegetable is cross pollinated due to protandry?
a) Parsley
b) Cabbage
c) Radish
d) Turnip

50. Pinching of male bud can be commercial exploited for hybrid seed production in
a) Cucumber
b) Pumpkin
c) Water melon
d) Bitter gourd

51. Transverse cotyledon cracking is major problem in
a) Pea
b) French bean
c) Pumpkin
d) Cowpea

52. First Central Vegetable Research Station was established at Katrain in Kullu Valley of Himachal Pradesh in
a) 1942
b) 1949
c) 1952
d) 1955

53. In French bean, light or medium green round fleshy stringless pods having white seeds are suitable for
a) Freezing
b) Dehydration
c) Canning
d) Drying

54. Cytoplasmic genic male sterility in hot pepper has been first reported in an Indian introduction PI-164835 by
a) Peter
b) Peterson
c) Greenleaf
d) Veeragavthathum

55. Genic and cytoplasmic genic male sterility have been commercially exploited for development of F_1 hybrids in
a) Tomato
b) Brinjal
c) Chilli
d) Sweet pepper

56. Resistance to powdery mildew disease in garden pea is governed by
a) Single recessive gene
b) Two recessive genes
c) Single dominant gene
d) Two dominant genes

57. New Zealand spinach is a
a) Cross pollinated and cool season annual
b) Cross pollinated and warm season annual
c) Self pollinated and warm season annual
d) Self pollinated and cool season annual

58. Coriander is a member of family
a) Fabaceae
b) Rutaceae
c) Apiaceae
d) Labiatae

59. Parentage of Pusa Alankar – a summer squash F_1 hybrid is
a) Australian Green × Sel 1
b) EC 27050 × Sel 1
c) EC 27050 × Sel 2
d) EC 27050 × Sel 4

60. The Indian Society of Vegetable Science was established in
a) 1993
b) 1983
c) 1973
d) 1963

61. Male parent for development of chilli hybrid CH-3, is
a) LLS
b) S-2560
c) S-2530
d) Punjab Lal

62. Selection based on single seed descent method is quite effective in
a) Cabbage
b) Chilli
c) Brinjal
d) Tomato

63. How many lines are involved for development of synthetic variety?
a) <3
b) 4-6
c) 7-9
d) >10

64. Name the global leader in grafted vegetable production technology
a) China
b) Korea
c) Japan
d) India

65. *Solanum hirsutum* and *Solanum pennelli* are resistant to
a) Fruit borer and white fly
b) Root knot nematodes and Colorado potato beetle
c) White fly and leaf miner
d) Spider mite and Colorado potato beetle

66. Anther colour is *Capsicum baccatum* is
a) Blue
b) Purple
c) Yellow
d) Bluish purple

67. The desired diameter of potato tuber for chip making
a) 2-4 cm
b) 4-6 cm
c) 6-8 cm
d) 8-10 cm

68. Estimated percentage of the total production of potato used for processing is
a) <15
b) <10
c) <5
d) <1

69. Chromosome number of trisomic tomato
a) 22
b) 23
c) 25
d) 26

70. Time of anthesis in sponge gourd
a) Morning
b) Afternoon
c) Evening
d) Night

71. Rhubarb is also known as
a) Petsai plant
b) Pie plant
c) Poi plant
d) Super plant

72. White heart is a disorder of
a) Musk melon
b) Sarda melon
c) Water melon
d) Long melon

73. Seeds requiring maximum duration for germination
a) Radish
b) Parsley
c) Muskmelon
d) Lettuce

74. For 5 gene pairs involved in the cross, number of all possible combinations in F_2 under independent assortment of genes assuming complete dominance will be
a) 64
b) 256
c) 1024
d) 1084576

75. Gamete selection was advocated by
a) Stadler
b) Davenport
c) Richey
d) Emsweller

76. The most appropriate design for testing large number of entries with limited seeds
a) RBD
b) CRD
c) LSD
d) Augmented Design

77. ICAR launched a special project for promotion of hybrid research in vegetables during the year
a) 1990
b) 1996
c) 2000
d) 2006

78. How much quantity of garden pea seed will be required for sowing 1 Ha area based on following assumptions:
Spacing: 30×10 cm, Germination percentage: 90, Purity percentage: 90, Seed required for gap filling: 5% by weight of seed required in sowing, Test weight of seed samples: 250 g
a) 98 kg
b) 108 kg
c) 118 kg
d) 128 kg

79. Main purpose of blanching is
a) Killing of microbes
b) Extending self life
c) Inactivation of enzymes
d) Softening of tissues

80. The minimum period required to harvest and sell produce from an organic farm is called
a) Waiting period
b) Fallow period
c) Conversion period
d) Rest period

81. Preharvest fruit drop in mango can be controlled by
a) 100 ppm NAA
b) 20 ppm GA_3
c) 20 ppm IBA
d) 20 ppm 2,4-D

82. In guava, fruit bearing mostly takes place on
a) Very old shoots
b) Spurs
c) Current season growth
d) One year old shoots

83. Ber plants are pruned in north India during
a) May-June
b) July-August
c) December-January
d) March-April

84. Which micronutrient is essential for synthesis of auxin?
a) Cu
b) Silicon
c) Mn
d) Zn

85. To some extent regular bearing in mango can be induced by application of
a) Auxin
b) Ethephon
c) Paclobutrazol
d) ABA

86. Cold hardy rose species is
a) *Rosa indica*
b) *Rosa foetida*
c) *Rosa multiflora*
d) *Rosa rugosa*

87. Negative geotropism is a disorder of
a) Carnation
b) Marigold
c) Tulip
d) Gladiolus

88. In recessive epistasis, the phenotypic ratio of 9:3:3:1 is modified to
a) 9:3:4
b) 9:7
c) 15:1
d) 12:3:1

89. In a diallel analysis of 6 parents and their 15 F_1's (excluding reciprocals) grown in a replicated black design with 2 replications. What will be the total degree of freedom?
a) 20
b) 21
c) 40
d) 41

90. Statistically coefficient of inbreeding in autogamons crops is
a) 1
b) >1
c) <1
d) 0

91. Eberhart and Russell (1966) model was applied for multilocation testing of the performance of 5 varieties of okra at 6 locations using RBD with 4 replications at each location. What will be the error degree of freedom?
a) 18
b) 20
c) 72
d) 119

92. Line×tester analysis was carried out of an experiment in brinjal having 6 lines and 3 tester in RBD having 3 replications. What will be the total degree of freedom including parents?
a) 17
b) 26
c) 52
d) 80

93. Selfing and massing is quite effective for improvement of a cultivar in
a) Garden pea
b) Onion
c) French bean
d) Okra

94. CH-1 and CH-3 hybrids of chilli have been developed by
a) HAU, Hisar
b) KAU, Vellanikaira
c) IIVR, Varanasi
d) PAU, Ludhiana

95. Bud, blossom and fruit drop in chilli is attributed to
a) Deficiency of nitrogen and other micronutrients
b) Humid and cloudy weather
c) Unfavourable temperature and water supply
d) Poor fertility and shady location

96. Flower colour of Kasuri Methi
a) White
b) Red
c) Orange yellow
d) Purple

97. Hakuran is a
a) Root vegetable
b) Stem vegetable
c) Leafy vegetable
d) Fruit vegetable

98. Okra variety 'Arka Abhay' is developed through crossing between *Abelmoschus esculantus* and
a) *Abelmoschus manihot*
b) *Abelmoschus moschatus*
c) *Abelmoschus ficulneus*
d) *Abelmoschus tetaraphyllus*

99. The temperature requires for maximum lycopene content in tomato is
a) 13-15°C
b) 15-20°C
c) 20-25°C
d) 25-30°C

100. Which of the following species is the wild progenitor of French bean?
a) *Phaseolus coccineus*
b) *Phaseolus aborigineus*
c) *Phaseolus vulgaris*
d) *Phaseolus aconitifolius*

101. 'Horticultural Reviews' is published by
a) Wiley-Blackwell
b) Springer
c) The Haworth Press
d) Narosa Publishing House

102. Butternut squash belongs to
a) *Cucurbita pepo*
b) *Cucurbita moschata*
c) *Cucurbita maxima*
d) *Cucurbita mixta*

103. The variety of carrot having roots cylindrical with straight or sloppy shoulder is
a) Chantenay
b) Imperator
c) Nantes
d) Danvers

104. Club root resistant turnip cv. Manga has been reported from
a) Australia
b) USA
c) New Zealand
d) France

105. Which of the following nutrients is essential for nodulation of leguminous vegetables?
a) Copper
b) Molybdenum
c) Zinc
d) Iron

106. 'Deepaliwal' is a variety of
a) Lablab bean
b) French bean
c) Jack bean
d) Pea

107. Under seed plot technique, planting of potato tubers should be done
a) 25th August to 15th September
b) 25th September to 15th October
c) 25th October to 15th November
d) 25th November to 15th December

108. The chromosome number (2n) of *Amaranthus dubius* is
a) 32
b) 34
c) 62
d) 64

109. The genomic constitution of *Brassica carinata* is
a) AABBCC
b) AACC
c) BBCC
d) AABB

110. Downy mildew resistance in onion reported in
a) *Allium cepa*
b) *Allium roylei*
c) *Allium fistulosum*
d) *Allium sativum*

111. 'Pusa Rudhira' is a variety of
a) Radish
b) Carrot
c) Cauliflower
d) Red cabbage

112. Which of the following is used as rootstock for flowering induction in sweet potato?
a) *Ipomoea carnea*
b) *Ipomoea trifida*
c) *Ipomoea triloba*
d) *Ipomoea fistulosa*

113. The andromonoecious sex form in melon is denoted as
a) A-G-
b) A-gg
c) aaG-
d) aagg

114. Vegetable soybean cultivation has been promoted by AVRDC in
a) Maharashtra
b) Uttaranchal
c) Jharkhand
d) Orissa

115. Most pungent part of chilli is
a) Placenta
b) Seeds
c) Pericarp
d) Peduncle

116. The research on triploid watermelon has been revived at
a) IARI, New Delhi
b) IIVR, Varanasi
c) PAU, Ludhina
d) IIHR, Bangaluru

117. The gene exploited for carotene rich in cauliflower is designated as
a) 'Cr' gene
b) 'Or' gene
c) 'Mi' gene
d) 'fp' gene

118. Cavity spot in carrot is due to deficiency of
a) Ca
b) B
c) Mg
d) Fe

119. The shortest duration variety of radish is
a) Pusa Chetki
b) Pusa Reshmi
c) Pusa Desi
d) Pusa Mridula

120. 'Fufu' is prepared from
a) Yam
b) Bottle gourd
c) Pumpkin
d) Ash gourd

121. Brown seed marker is associated with male sterile line of
a) Water melon
b) Carrot
c) Musk melon
d) Onion

122. Mutant of pea in which all the leaves are converted into tendril like
a) Afila
b) Acacia
c) Papila
d) Adnate

123. Flowering in potato generally takes place in
a) Long day and high temperature
b) Long day and low temperature
c) Short day and high temperature
d) Short day and low temperature

124. Palak variety developed by hybridization of sugarbeet and local palak
a) Pusa Harit
b) All Green
c) Pusa Bharti
d) Jobner Green

125. Isogenic lines are derived through
a) Mass selection
b) Mutation
c) Pure line selection
d) Back crossing

126. *Cucurbita moschata* is cross fertile with
a) *Cucurbita pepo*
b) *Cucurbita mixta*
c) *Cucurbita ficifolia*
d) *Cucurbita maxima*

127. Which of the following is a long day plant?
a) Radish
b) Potato
c) Chilli
d) Sweet potato

128. Which irrigation system can control weed most effectively?
a) Sprinkler
b) Furrow
c) Basin
d) Drip

129. Which of the vegetable has highest inbreeding depression?
a) Cabbage
b) Carrot
c) Leek
d) Radish

130. One of the major problem in hydroponics is
a) High oxygen supply to the root
b) Root die back caused by inadequate oxygen
c) Difficulty in preparation of growing media
d) Difficulty in supporing plants

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) Central and South America	a) Carrot
ii) Ethiopia	b) Mutation breeding
iii) Cytoplasmic genic male sterility	c) Spodoptera leaf eating caterpillar
iv) Punjab Lal	d) French bean
v) Pusa Parvati	e) Garden pea

132.

i) Indigenous F_1 hybrids	a) Muskmelon
ii) Rabies Glycoprotein gene	b) Sprouting broccoli
iii) Dioecious	c) Watermelon
iv) Pusa Bedana	d) Brinjal
v) Palam Samridhi	e) Ivy gourd

133.

i) Potato	a) Greening
ii) Light exposure	b) Greenhouse
iii) Very high respiratory activity	c) Tomato
iv) Parthenocarpic cucumber	d) Low respiratory activity
v) White fly	e) Sprouting broccoli

134.

i) CIPHET	a) China
ii) ISHS	b) Srinagar
iii) AVRDC	c) Ludhiana
iv) IVF	d) Belgium
v) CITH	e) Taiwan

135.

i) *Bt* brinjal	a) IARI
ii) Karnataka	b) Nunhems
iii) Indra	c) IAHS
iv) Pusa Sanyog	d) Syngenta
v) Natasha	e) Mahyco

136.

i) Dioecious	a) Onion
ii) Tip burn of lettuce	b) Pea
iii) Marsh spot	c) Kakrol
iv) Quercetin	d) Calcium and boron deficiency
v) Black heart	e) Celery

137.

i) Cleistogamy	a) Fenugreek
ii) Self-incompatibility	b) Bitter gourd
iii) Functional male sterility	c) Pea
iv) Momordicin	d) Cabbage
v) Methyl-amine	e) Brinjal

138.

i) Malvidin-S-Glucoside	a) Cauliflower
ii) Browning	b) Carrot (Black)
iii) Puffiness	c) Sweet corn
iv) Monoecy	d) Tomato
v) Calcium oxalate	e) Colocasia

139.

i) Fruit cracking	a) Boron deficiency
ii) Hollow tem of cauliflower	b) Cabbage
iii) Protogyny	c) Temperature and moisture fluctuation
iv) Powdery mildew	d) Peas
v) Roma	e) Tomato

140.

i) Knol-khol	a) Tomato
ii) Early blight	b) Onion
iii) Arka Nishant	c) 2n=18
iv) Sylvia	d) Brinjal
v) Manjari Gota	e) Peas

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. Hybrids are popular in solanaceous and cucurbitaceous vegetables. Justify.

142. Enlist the barriers in crossability in distantly related vegetable crops and the methods to overcome these barriers.

143. Describe the role of PPV & FRA in vegetable breeding.

144. Hybrid production in tomato is not remunerative in north India plains. Justify.

145. What will be the major challenges on vegetable crops due to climate changes? What will be the major breeding strategies to mitigate these challenges?

146. Vegetable plays a significance role in nutritional and health security. Justify.