



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

Discipline : Post Harvest Technology (*Post Harvest Engineering and Technology*)

Discipline Code : 20, Sub code : 02

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. The temperature of ice after addition of salt will  
 a) Increase  
 b) Decrease  
 c) Neither increase nor decrease the temperature of mixture  
 d) Melt the ice much faster
32. In a vapour refrigeration cycle heat from the surroundings is absorbed through  
 a) Evaporator  
 b) Condenser  
 c) Compressor  
 d) Fins
33. The dimensionless number in mass transfer operations which is analogous to Nusselt number in heat transfer is known as  
 a) Lewis number  
 b) Sherwood number  
 c) Peclet number  
 d) Schmidt number
34. In a ball mill if 'R' is radius of mill, 'g' is the acceleration due to gravity and 'r' is the radius of ball, then critical speed ( $\gamma_c$ ) is given by  
 a)  $\gamma_c = (1/2\pi) \sqrt{(g/R-r)}$   
 b)  $\gamma_c = 2\pi \sqrt{(g/R-r)}$   
 c)  $\gamma_c = (1/2\pi) \sqrt{(R-r)/g}$   
 d)  $\gamma_c = 2\pi \sqrt{(R-r)/g}$
35. Which mechanism is not used for milling of pulses?  
 a) Cylinder-concave  
 b) Concentric double cylinder  
 c) Emery coated inverted cone  
 d) Breaker rolls
36. Which of the following contains gum between hull and cotyledon?  
 a) Chickpea  
 b) Lentil  
 c) Pea  
 d) Black gram
37. If two heat conducting bodies A and B having 4000 kcal and 7000 kcal of heat, respectively, at a constant temperature of 95°C are brought in contact with each other, then  
 a) Heat will flow from A to B  
 b) Heat will flow from B to A  
 c) Heat will not flow from one body to the other  
 d) Temperature of the two bodies will increase
38. Which of the following is extra long grain rice?  
 a) PB 1121  
 b) PRH 10  
 c) Pusa 44  
 d) IR 8
39. The Jansen's theory/formula is used to determine the pressure exerted by grains in a  
 a) Deep bin  
 b) Shallow bin  
 c) Trench bin  
 d) All types of bins
40. A pyranometer is used to measure  
 a) Solar radiation  
 b) Microwave intensity  
 c) Temperature of a body  
 d) Enthalpy of a body
41. 60% m.c (Wb) in the grain is equivalent to approx.  
 a) 70% m.c (db)  
 b) 81% m.c (db)  
 c) 100% m.c (db)  
 d) 150% m.c (db)

42. 'White bellies' are mostly found in  
a) Wheat  
b) Corn  
c) Polished rice  
d) Processed pulses
43. LSU dryer is most suitable for drying  
a) Wheat  
b) Corn  
c) Paddy  
d) Barley
44. The mean of first 'n' natural numbers is  
a)  $n(n+1)$   
b)  $n(n+1) / 2$   
c)  $(n+1) / 2$   
d)  $(n+1) / 4$
45. The reference electrode in pH measurements is  
a) Glass electrode  
b) Hydrogen electrode  
c) Antimony electrode  
d) Hg-calomel electrode
46. In rice milling, which of the following has commercial importance?  
a) Head rice yield  
b) Total yield  
c) Field yield  
d) All are equally important
47. The uppermost layer of brown rice is known as  
a) Endosperm  
b) Germ  
c) Bran  
d) Pericarp
48. For getting maximum flaking grits, degerming is done using  
a) Beall degermer  
b) Roller mill  
c) Rubber roller  
d) Both a) and c)
49. If  $V$  is the velocity of air entering into a cyclone separator of radius  $r$ , then separation factor of the equipment is  
a)  $V.r$   
b)  $V^2.r$   
c)  $V^2/r.g$   
d)  $V^2r/g$
50. Amount of moisture present in a unit volume of air is known as  
a) Humidity  
b) Absolute humidity  
c) Relative humidity  
d) Specific humidity
51. Calorific value of rice husk is approximately  
a) 3000 kCal/kg  
b) 5600 kCal/kg  
c) 7000 kCal/kg  
d) 11000 kCal/kg
52. COP of a refrigerator is given by  
a) Heat removed by the evaporator / heat rejected by the condenser  
b) Heat removed by the condenser / the work done by the compressor  
c) Heat rejected by the condenser / work done by the compressor  
d) None of the above
53. Which of the following is used to determine specific heat of a solid materials?  
a) Method of mixtures  
b) Probe method  
c) Guarded plate method  
d) All of the above
54. The basis for measuring temperature is given by  
a) Zeroeth law of thermodynamics  
b) First law of thermodynamics  
c) Second law of thermodynamics  
d) Newton's law of cooling
55. Heat transfer efficiency for counter current flow through a heat exchanger as compared to co-current flow would be  
a) Higher  
b) Lower  
c) Same  
d) None of the above
56. The dimensions of energy is  
a)  $ML^2T^{-2}$   
b)  $MLT^{-2}$   
c)  $ML^{-2}T^{-1}$   
d)  $ML^2T^{-1}$
57. The closeness of the instrument output to the value of the measured quantity (as per standards) is known as  
a) Accuracy  
b) Precision  
c) Deflection  
d) None of the above
58. Which of the following is an attrition type mill?  
a) Smooth roll crusher  
b) Hammer mill  
c) Ball mill  
d) Plate mill

59. In milling of pulses, the whole dehusked grain is called
- Gota
  - Bhushi
  - Chuni
  - Grade-I dal
60. The amount of husk in pulses varies from
- 5 to 10%
  - 10 to 15%
  - 20 to 30%
  - 30 to 35%
61. A liquid mixture is separated into individual compounds or in some cases groups of components by vapourization is called
- Distillation
  - Coagulation
  - Granulation
  - Evaporation
62. The unit of measurement of electrical conductance is
- Coulomb
  - Farad
  - Henry
  - Siemens
63. Most of the storage fungi do not develop below
- 0°C
  - 5°C
  - 10°C
  - 15°C
64. Which of the following insect species is a secondary pest?
- Khapra beetle
  - Grain weevil
  - Flat grain beetle
  - All of the above
65. Morai, a traditional storage structure of rural areas for storing grain has the shape of
- Cylindrical
  - Rectangular
  - Inverted truncated cone
  - None of the above
66. During winter season, moisture accumulation and spoilage of grain take place at the
- Top of the bin
  - Center of the bin
  - Bottom of the bin
  - None of the above
67. The gelatinization temperature of different varieties of paddy are normally within
- 10-20°C
  - 20-30°C
  - 65-75°C
  - 90-100°C
68. The boiling point of a solution at different pressures can be found using
- Hysteresis curve
  - Psychrometric chart
  - Duhurring plot
  - All of the above
69. The shear rate in an extruder is influenced by
- The internal design of the barrel
  - Speed and geometry of the screws
  - Type of extruded product
  - Both a) & b)
70. The most essential constituent required for making fruit jelly is
- Acid
  - Pectin
  - Sugar
  - Sucrose
71. Vegetable seeds having high initial moisture content and lighter in weight are efficiently dried in a
- Solar dryer
  - Flat bed dryer
  - Fluidized bed dryer
  - Deep bed dryer
72. Which of the following grain dryers is not a continuous flow mixing type?
- L.S.U. dryer
  - Baffle dryer
  - Recirculating batch dryer
  - Columnar dryer
73. The roller diameter of a processing machine is 700 mm and its peripheral speed is 11 m/s. The machine rpm is then
- 150
  - 210
  - 275
  - 300
74. True density of an agricultural produce is 1000 kg/m<sup>3</sup> and bulk density is 40 kg/m<sup>3</sup>. The porosity of the product is
- 0.40
  - 0.80
  - 0.86
  - 0.96
75. Homogenized milk must have 90% fat globules of diameter smaller than
- 2 µm
  - 4 µm
  - 6 µm
  - 8 µm

76. Ground brick dust, commonly used as a substitute for sand in places where sand is scarce, is better known as
- Kankar
  - Moorum
  - Surkhi
  - Shingles
77. The freezing point of a solution is affected by the concentration level of
- Salts
  - Sugars
  - Salts and sugars
  - None of the above
78. Rate of leaching
- Increase with size reduction of particles
  - Increase in temperature of solvent
  - Both a) and b)
  - is higher in cocurrent process than counter current process
79. The dimensionless number relating buoyant and viscous forces in natural convection is
- Nusselt number
  - Reynold number
  - Grashoff number
  - Prandtl number
80. Fruits bars are
- Dried product
  - Intermediate product
  - High moisture product
  - None of the above
81. The point of intersection of total revenue and total cost is known as
- Critical point
  - Yield point
  - Elastic point
  - Break even point
82. The working principle of a mortar and pestle is analogous to that of
- Ball mill
  - Roll mill
  - Gyratory crusher
  - Hammer mill
83. Steam economy of a single effect evaporator is
- <1
  - Equal to 1
  - >1
  - $\geq 1$
84. Which C:N ratio of animal dung is considered to be suitable for biogas production?
- 10:1
  - 20:1
  - 30:1
  - 45:1
85. Velvet roll separator separates grains on the basis of
- Shape and surface texture
  - Roundness
  - Specific gravity
  - Relative length
86. Log mean temperature difference (LMTD) in case of a parallel flow compared to that of counter flow would be
- More
  - Less
  - Same
  - None of the above
87. A standard screw has the following parameters
- Pitch > diameter of screw
  - Pitch = diameter of screw
  - Pitch < diameter of screw
  - Pitch = shaft diameter of screw
88. Mechanical damage of seeds can be determined by
- Mercury test
  - Water displacement method
  - Ferric chloride test
  - None of the above
89. A mixture of air and water vapour is adiabatically cooled. The lowest temperature of the mixture thus achieved is equal to
- Dry bulb temperature
  - Wet bulb temperature
  - Dew point temperature
  - Saturation temperature
90. 100 units of sensible heat were given to a unit mass of water and a unit mass of mercury each. The rise in temperature of
- water will be more than that of mercury
  - mercury will be more than that of water
  - will be same for both mercury and water
  - None of the above
91. The analogy between heat, mass and momentum transfer is given by
- Chilton-Colburn
  - Fick's
  - Newton
  - None of the above
92. Critical moisture content in soaking of paddy during parboiling process is
- 20-25%
  - 30-35%
  - 40-45%
  - 50-55%

93. For clarification of fruit based beverage, the suitable enzyme is
- Papain
  - Rennin
  - Amylase
  - Pectinase
94. Which of the following fruit has maximum shelf-life?
- Apple
  - Papaya
  - Banana
  - Mango
95. Asepsis refers to prevention from
- Air
  - Light
  - Microorganism
  - Moisture
96. Stokes' law is used to find out
- Terminal velocity
  - Drag coefficient
  - Surface tension
  - Specific gravity
97. If electrical current is flowing in a circuit of two dissimilar metals then heat is absorbed at one junction and liberated at the other junction. This phenomenon is known as
- Seeback effect
  - Thompson effect
  - Peltier effect
  - Refrigeration effect
98. *Escherichia coli* enters in food chain mainly through
- Air
  - Water
  - Dust particle
  - Field contamination
99. Identify the most suitable pre-cooling method employed for grapes.
- Vacuum cooling
  - Hydro-cooling
  - Forced air cooling
  - Ice-cooling
100. Vapour heat treatment is common post harvest treatment employed for
- Killing bacteria
  - Killing insects
  - Killing pests
  - Killing yeasts
101. A fruit powder is classified as 'instant', if it has the following set of properties
- Wettability, sinkability and solubility
  - Wettability, sinkability, dispersibility and solubility
  - Dispersibility and solubility
  - Wettability and dispersibility
102. The slope of the TDT (Thermal Death Time) curve, defined as the number of degree Celsius required to bring about a ten fold change in decimal reduction time is called
- D-value
  - t-value
  - Z-value
  - None of the above
103. Gauge factor of a strain gauge refers to
- Resistance change per unit strain
  - Change in diameter of wire or thickness of foil unit strain
  - Resistance change per degree change in temperature
  - Elasticity of the material of strain gauge
104. Mixing of two solid constituents could be considered as complete when standard deviation of relevant property is
- Maximum
  - Moderate
  - Minimum
  - None of the above
105. Food safety refers to
- That it does not cause harm when consumed any way
  - That it does not cause harm when consumed as per intended use
  - That it causes harm when consumed
  - All of the above
106. Diode in an electronic device allows the current to flow in
- Single direction
  - Two directions
  - Three directions
  - Multiple directions
107. An isochoric process occurs at
- Constant pressure
  - Constant volume
  - Constant temperature
  - Constant entropy
108. The process of production of tar, gas and coke from biomass is known as
- Hydrolysis
  - Pyrolysis
  - Esterification
  - Photosynthesis

109. In an aspirator, the fan is placed at the air discharge point to create
- Atmospheric pressure
  - A positive high pressure
  - A negative pressure (vacuum)
  - None of the above
110. Plank's law can be used for estimation of
- Time of freezing
  - Time of drying
  - Time of boiling
  - Time of germination
111. Diverging belts are used to grade fruits on the basis of
- Shape
  - Size
  - Weight
  - Density
112. If plane of rupture passes through opposite side of the wall without touching grain surface, then the bin is categorized as
- Deep bin
  - Shallow bin
  - Metal bin
  - None of the above
113. An evaporator has a rated evaporation capacity of 300 kg/h of water. Calculate the rate of production of juice concentrate containing 40% total solids from raw juice containing 10% solids.
- 100 kg/h
  - 150 kg/h
  - 181.8 kg/h
  - 200 kg/h
114. Corrugation of a break roll in roller mill is specified by
- Spiral of corrugation
  - Disposition of corrugation
  - Corrugation profile
  - All of the above
115. Which of the following represent commercial importance of rice milling?
- Field yield
  - Total yield
  - Head yield
  - Both field and total yield
116. Active packaging refers to
- Rapid changes of gaseous composition inside package
  - Maintaining gaseous composition inside package
  - Incorporation of additives into packaging film
  - Activity of packaging material leading to contamination of food
117. Which of the following is ethylene scavenger?
- Calcium oxide
  - Potassium permanganate
  - Sodium bicarbonate
  - Citric acid
118. The overall dimensions of a godown for 2 stacks, each stack of length 10 m and width 6 m should be
- 16 × 8 m
  - 16 × 12 m
  - 20 × 10 m
  - 24 × 6 m
119. In purification of crude oil to edible oil, removal of free fatty acid is referred as
- Degumming
  - Bleaching
  - Refining
  - Deodorization
120. Which of the following is continuous type mill?
- Hydraulic press
  - Ram press
  - Ghani
  - Screw press
121. Which of the following law can be used to calculate mass flux?
- Newton's law
  - Fourier's law
  - Fick's law
  - Both b) and c)
122. Irradiation of food is
- Thermal process
  - Non-thermal process
  - High pressure process
  - Impregnation process
123. A package is considered to provide protection to the food from
- Light
  - Oxygen
  - Contamination
  - All of the above
124. Which of the following properties is used to separate material in a winnower?
- Size
  - Terminal velocity
  - Shape
  - Density
125. Purification in wheat milling refers to
- Separation of pure endosperm
  - Breaking of grain
  - Tempering of grain
  - Degerming of grain



126. Stability of an emulsion depends upon
- Size of dispersed phase
  - Viscosity of continuous phase
  - Density of dispersed phase
  - All of the above

127. The standard test sieves contain
- Circular holes
  - Rectangular holes
  - Square holes
  - Triangular holes

128. If  $\theta$  is the angle of internal friction, pressure ratio in a bin can be defined by
- $(1+\tan\theta) / (1-\tan\theta)$
  - $(1+\cos\theta) / (1-\sin\theta)$
  - $(1-\sin\theta) / (1+\sin\theta)$
  - $(1+\sin\theta) / (1-\sin\theta)$

129. Hydraulic press for oil milling consists of
- Vertical plates
  - Horizontal plates
  - Inclined plates
  - None of the above

130. Which of the following has largest size?
- Corn meal
  - Brewery grit
  - Flaking grit
  - Corn flour

**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) Newtonian fluid       | a) Quick sand        |
| ii) Bingham plastics     | b) Rubber latex      |
| iii) Pseudoplastic fluid | c) Real biomaterials |
| iv) Dilatant fluid       | d) Sewage sludge     |
| v) Visco-elastic         | e) Gas               |

- 132.
- |                          |                           |
|--------------------------|---------------------------|
| i) Cabinet dryer         | a) Milk powder            |
| ii) Spray dryer          | b) Meat and meat products |
| iii) Fluidized bed dryer | c) Rice                   |
| iv) Freeze dryer         | d) Fine granular product  |
| v) LSU dryer             | e) Fruits and vegetables  |

- 133.
- |                            |                                  |
|----------------------------|----------------------------------|
| i) Impact type mill        | a) Fine product                  |
| ii) Attrition mill         | b) Coarse product                |
| iii) Compression type mill | c) Fine, medium, coarse products |
| iv) Cutting                | d) Sphericity                    |
| v) Shape                   | e) Sized products                |

- 134.
- |                             |                           |
|-----------------------------|---------------------------|
| i) Transport process        | a) Concentration gradient |
| ii) Pneumatic conveyor      | b) Augur flight           |
| iii) Diffusion of molecules | c) Momentum transfer      |
| iv) Screw conveyor          | d) Air blowing or suction |
| v) Food freezing            | e) Eutectic temperature   |

- 135.
- |                                      |                      |
|--------------------------------------|----------------------|
| i) Destruction of all microorganisms | a) Twin fluid nozzle |
| ii) Spray drying                     | b) Water activity    |
| iii) Food spoilage                   | c) Sterilization     |
| iv) Hammer mill                      | d) Impact            |
| v) Cyclone separator                 | e) Centrifugal force |

- 136.
- |                        |                     |
|------------------------|---------------------|
| i) Chelating agent     | a) BHT              |
| ii) Emulsifier         | b) EDTA             |
| iii) Anti-caking agent | c) Lecithin         |
| iv) Curing agent       | d) Calcium silicate |
| v) Antioxidant         | e) Polyphosphates   |

- 137.
- |                            |                             |
|----------------------------|-----------------------------|
| i) Byproduct of mango peel | a) Pectin                   |
| ii) Vitamin B <sub>1</sub> | b) Chitin                   |
| iii) Fungal cell wall      | c) Cell wall of plant cells |
| iv) Cellulose              | d) Goiter                   |
| v) Iodine                  | e) Thiamin                  |

- 138.
- |                      |  |
|----------------------|--|
| i) Jansen's theory   | a) Lateral strain/linear strain                    |
| ii) Bond's law       | b) Current = voltage / resistance                  |
| iii) Poisson's ratio | c) Grain pressure                                  |
| iv) Ohm's law        | d) Relationship between wavelength and temperature |
| v) Wein's law        | e) Size reduction                                  |

- 139.
- |                        |                |
|------------------------|----------------|
| i) Sprouting           | a) Mango       |
| ii) Bitter pit         | b) Shallow bin |
| iii) Jansen's equation | c) Apple       |
| iv) Rankine's equation | d) Potato      |
| v) Spongy tissue       | e) Deep bin    |

- 140.
- |                      |                             |
|----------------------|-----------------------------|
| i) Filtration        | a) Size difference          |
| ii) Heat flux        | b) Pressure difference      |
| iii) Mass transfer   | c) Shape difference         |
| iv) Spiral separator | d) Concentration difference |
| v) Screening         | e) Temperature difference   |

**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. Briefly discuss the changes occurring in food grains with reference to germination and moisture migration during storage.

142. Assuming necessary data, show the mass balance in a rice mill for milling five tonnes of paddy.

143. Differentiate between the following:

- (a) Dry cleaning and wet cleaning in agricultural processing.
- (b) Screening and filtration in mechanical separation.
- (c) Head yield and total yield in rice milling.
- (d) Deep bin and shallow bin for grain storage.

144. Enlist the components of a bucket elevator. Briefly discuss the different methods of bucket loading and unloading.

145. Write short notes on intelligent and aseptic packaging.

146. Fruit juice containing 9% W/w solids is pre-concentrated at 35°C by reverse osmosis, prior to concentration in an evaporator. If the operating pressure is 4000 kPa and the mass transfer coefficient is  $6.3 \times 10^{-3} \text{ kg m}^{-2} \text{ h}^{-1} \text{ kPa}^{-1}$ , calculate the area of membrane required to remove 5 tonnes of permeate in 8 h shift. (Assume that sucrose forms the majority of the solids in the juice and the universal gas constant is  $8.314 \text{ kPa m}^{-3} \cdot \text{mol}^{-1} \text{ K}^{-1}$ ).