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

Discipline : Agricultural Engineering (*Farm Power and Equipment*)

Discipline Code : 03; *Sub code-02*   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. $\int \sec x \, dx$ equals
a) $\sec x + \tan x + c$
b) $\sec x. \tan x + c$
c) $\dfrac{\sec^2 x}{2} + c$
d) $\log |\sec x + \tan x| + c$

32. $\int_0^{2/3} \dfrac{dx}{4 + 9x^2}$ equals
a) $\pi/4$
b) $\pi/6$
c) $\pi/12$
d) $\pi/24$

33. If the coefficients of x^7 and x^8 in $\left(2 + \dfrac{x}{3}\right)^n$ are equal then n equals
a) 27
b) 35
c) 45
d) 55

34. Which of the following is not a temperature measuring device?
a) Thermistor
b) Thermostat
c) PRT
d) Thermopiles

35. $x^{1/x}$ is a decreasing function of
a) x<e
b) X>e
c) X=e
d) X>$\frac{1}{e}$

36. The number of cycles completed in a unit of time is called
a) Acceleration
b) Momentum
c) Frequency
d) Period

37. A hydraulic motor is a device which converts
a) Mechanical energy into hydraulic energy
b) Hydraulic energy into potential energy
c) Hydraulic energy into mechanical energy
d) Hydraulic energy into electrical energy

38. A heel clearance is provided in a tractor drawn mould board plough to
a) Reduce wear of landside
b) Carry plough weight by furrow wheel
c) Reduce side draft on the plough bottom
d) Increase penetration of plough

39. Hydraulic pump converts
a) Hydraulic energy into electrical energy
b) Mechanical energy into hydraulic energy
c) Hydraulic energy into mechanical energy
d) Mechanical energy into electrical energy

40. Rocking vibration in an in-line I.C. engine in the plane of the cylinders exists in engine with
a) 1 cylinder
b) 2 cylinders
c) 4 cylinders
d) 6 cylinders

41. The pressure occurring in combustion chambers of a diesel engine after ignition is highest in
a) Open chamber
b) Swirl chamber
c) Precombustion chamber
d) Auxillary chamber

42. Implement used for breaking the hard pan is
a) Subsoiler
b) Rotavator
c) Ridger
d) Mole plough

43. The exhaust heat loss as percentage of fuel energy of an I.C. engine is maximum when the engine runs at
a) No load
b) 25% of full load
c) 75% of full load
d) 100% load

44. The combustion of gasoline is expressed as : $C_8H_{18} + 12.5\ O_2 = 8\ CO_2 + 9\ H_2O$. If air contains 23.1% oxygen by weight, the number of units of air required to meet 100% oxygen requirement for the combustion is
a) 14.2
b) 15.1
c) 16.8
d) 17.2

45. When the temperature of a bi-metallic strip is increased, the strip bends due to
a) Differences in elastic property
b) Differences in thermal conductivity
c) Differences in coefficient of linear expansion
d) Differences in coefficient of friction

46. The electric resistance of a thermistor
a) Increases as temperature increases
b) Increases at low temperature and decreases at high temperature
c) Decreases as temperature increases
d) Increases at high temperature and decreases at low temperature

47. A wheatstone bridge has 3 resistances taken in one direction as 120.3 Ω, 119.2 Ω and 119.2 Ω. The value of the fourth resistance for null balance is
a) 118.9 Ω
b) 119.2 Ω
c) 120.0 Ω
d) 120.3 Ω

48. Audio-frequency range lies between
a) 20,000 to 30,000 Hz
b) 16 to 20,000 Hz
c) About 1,000 Hz
d) >40,000 Hz

49. Thermostatic cut-out works on the principle of
a) Thermal expansion of fluid
b) Thermal expansion of metals
c) Expansion due to air pressure
d) Variation of resistance with temperature

50. For measurement of temperature of a source without direct contact, the correct instrument to be chosen is
a) Pyrometer
b) Bi-metallic cut-out
c) Vapour pressure thermometer
d) Thin-film thermometer

51. The smallest change in the value of input variable being measured that will cause a change in the output signal of an instrument is termed as
a) Drift
b) Resolution
c) Hysteresis
d) Threshold

52. In an adiabatic process, the system
a) Temperature is constant
b) Heat is constant
c) Temperature increases
d) Heat increases

53. Human tolerance to vertical vibration is minimum in the range of
a) 0-4 Hz
b) 4-8 Hz
c) 8-12 Hz
d) 12-16 Hz

54. The drawbar force of a tractor can be increased by changing the location of centre of gravity of the tractor
a) Forward
b) Backward
c) Upward
d) Downward

55. The most useful criteria for assessing tractor performance is
a) Engine brake power
b) PTO power
c) Drawbar pull
d) Drawbar power

56. One of the dynamic properties of soil is
a) Soil texture
b) Soil angle of internal friction
c) Soil structure
d) Soil abrasion

57. Soil adhesion is not influenced by
a) Salts in soil
b) Surface roughness
c) Viscosity of liquid
d) Natural heating of soil

58. Abrasion of metal tillage tool by soil is caused by
a) Soil in plastic state
b) Soil as rigid body
c) Low soil-metal friction
d) Rolling of soil

59. Of the total energy generated in India, the share of renewable energy is
a) Less than 10%
b) Between 10% to 15%
c) Between 15% to 20%
d) Between 20% to 25%

60. The average range of power of total tractors sold in India is
a) 20-25 HP
b) 30-36 HP
c) 40-47 HP
d) 55-65 HP

61. The highest percentage of irrigated area covered by a irrigation source in India is by
a) Canal
b) Well
c) Tubewell
d) Tank

62. The rotating shaft of a machine rotates at 100 rpm, experiences a large radial load and is required to rotate with low friction. The appropriate type of bearing to be used is
a) Ball bearing
b) Roller bearing
c) Tapered roller bearing
d) Bush bearing

63. The exhaust valve of a 4-stroke engine opens 23° before BDC and closes at TDC. The valve thus remains open for
a) 23°
b) 113°
c) 203°
d) 563°

64. The brake horsepower of an engine represents the power developed at
a) Flywheel
b) Drawbar
c) PTO
d) Driving wheel

65. The average force a bullock can exert is
a) 1/10 of its body weight
b) 1/5 of its body weight
c) 1/3 of its body weight
d) 1/2 of its body weight

66. The percent of methane gas in biogas is about
a) 10%
b) 50%
c) 65%
d) 90%

67. For achieving high temperature, the type of solar reflector to be used is
a) Plane reflector
b) Double mirror reflector
c) Spherical reflector
d) Irregular reflector

68. A single selenium solar cell of 4 cm^2 produces potential difference of
a) 0.1 to 0.2 v
b) 0.2 to 0.3 v
c) 0.3 to 0.4 v
d) 0.4 to 0.5 v

69. A 2-bottom M.B. plough pulled by a tractor cuts rectangular furrow each of 25 cm width at operating speed of 4 km/h. The depth of cut is 15 cm. The average soil resistance is 0.75 kg/cm^2. If drawbar efficiency of the tractor is 52%, the required horsepower of the tractor is
a) 28.34 HP
b) 33.34 HP
c) 38.34 HP
d) 42.34 HP

70. When tillage tools operate in isolated bands of soil, it is called
a) Zero tillage
b) Strip tillage
c) Minimum tillage
d) Conservation tillage

71. In tractor drawn plough, the center of pull is the
a) Center of resistance
b) True point of hitch
c) Line of pull
d) Vertical suction

72. The power requirement of a blower varies with
a) Speed of rotation
b) Square of speed
c) Cube of speed
d) Fourth power of speed

73. Traction coefficient is the ratio of
a) Pull developed and normal load
b) Drawbar power and BHP
c) Drawbar power and PTO hp
d) Pull developed and BHP

74. I.C. engine thermal efficiency is correlated to its specific fuel consumption as
a) Inversely proportional
b) Directly proportional
c) Equal to
d) Not related/unaffected

75. Weight transfer to front wheels of a tractor is caused by
a) Traction force
b) Tractor weight
c) Tractor slip
d) Application of pull

76. Utility index is a measure of
a) Lugging ability of a tractor
b) Traction ability of a tractor
c) Percent assurance of proper working of a tractor
d) Number of working hours per year of a tractor

77. Double disc type furrow opener in seed drill is used for
a) Shallow depth of sowing
b) Medium depth of sowing
c) Deep depth of sowing
d) Narrow slit with minimum soil disturbance

78. For proper spraying, the overlap of sprays on target surface should be
a) 5%
b) 15%
c) 25%
d) 35%

79. For proper cutting of crop, the speed of finger type cutter bar ranges between
a) 0.5 to 2.0 m/s
b) 1.5 to 3.0 m/s
c) 4.0 to 5.5 m/s
d) 6.0 to 7.5 m/s

80. The ratio of peripheral speed of the reel and forward speed of a combine should range between
a) -0.20 to -0.30
b) 1.25 to 1.50
c) 2.0 to 2.25
d) 3.0 to 3.25

81. With lower grain/non-grain ratio, the shoe loss in a combine harvester would
a) Increase
b) Decrease
c) Not be affected
d) Unaltered

82. Bronze (gun metal) has composition of copper, zinc and tin in the ratio of
a) 58:12:30
b) 68:22:10
c) 78:2:20
d) 88:2:10

83. Plough share for use in sandy soil should be made of
a) Mild steel
b) Soft centre steel
c) High carbon steel
d) Chilled cast iron

84. For mechanical threshing of wheat, the type of threshing cylinder should be
a) Spike tooth or wire loop
b) Hammer mill or flails
c) Serrated disc or rasp bar
d) Spike tooth or hammer mill

85. The angle of repose of dry wheat and paddy seeds while filling in hopper is
a) Greater while emptying
b) Lower while emptying
c) Same when emptying
d) No relation while emptying

86. Soil failure in compression is associated with
a) Volume change
b) No clearly developed failure surface
c) Cohesion strength
d) Uniaxial tensile stress

87. The soil-on-soil coefficient of friction is dependent on
a) Normal load
b) Surface area of contact
c) Speed of slipping
d) Frictional force tangent to the surface

88. Mechanical vibrations in tractors normally lie in the range of
a) 1 to 100 Hz
b) 50 to 150 Hz
c) 100 to 200 Hz
d) 200 to 300 Hz

89. R-type thermocouples of platinum-rhodium can be used to measure temperature in the range of
a) $540^\circ C – 1480^\circ C$
b) $540^\circ C – 1700^\circ C$
c) $0^\circ C – 540^\circ C$
d) $-200^\circ C – 0^\circ C$

90. For measurement of power by absorption type dynamometer, one should use
a) Driving type dynamometer
b) Eddy current dynamometer
c) Belt dynamometer
d) Gear dynamometer

91. Automatic draft control system controls
a) Depth
b) Draft
c) Depth and draft
d) Torque

92. The effective field capacity of a 1.6 m cutter bar reaper working at 2.5 km/h with field efficiency of 80% is
a) 0.20 ha/h
b) 0.32 ha/h
c) 0.40 ha/h
d) 0.128 ha/h

93. Seed rate of a seed drill is altered by changing the
a) Speed of the feed shaft
b) Row spacing
c) Speed of the grand wheel
d) Length of the fluted roller

94. Droplet size of pesticide spray for effective use should be in the range of
a) 1-10 micron
b) 10-40 micron
c) 30-50 micron
d) 50-100 micron

95. Clutch is used for
a) Disconnecting engine from transmission assembly
b) Change of transmission gear
c) Apply brakes
d) To take turn

96. The material for construction of seed box of seed cum ferti drill should be
a) Stainless steel
b) Mild steel
c) Corrosion resistance steel
d) Hot rolled buck sheet

97. Biodiesel is manufactured from vegetable oil by the process called as
a) Mixing alcohol to vegetable oil
b) Trans esterification
c) Separating wax form vegetable oil
d) None of the above

98. Rated horsepower of tractor correspond to
a) Power at highest torque
b) Power at highest speed
c) Power at rated speed
d) Maximum power

99. Calorific value of biodiesel is lower than conventional diesel due to
a) Presence of oxygen in fuel
b) Change in specific gravity
c) Difficulties in combustion
d) None of the above

100. The percent of oil in crushed seed is highest in
a) Cotton seed
b) Niger seed
c) Soybean seed
d) Castor seed

101. In an I.C. engine a drop in jacket temperature will little effect the specific fuel combustion when the engine operates at
a) No load
b) Light load
c) Medium load
d) Maximum load

102. Disc angle of a disc plough should range between
a) 15° to 17°
b) 23° to 25°
c) 43° to 45°
d) 53° to 55°

103. Multiple universal joint gives better performance than single joint due to
a) Lighter in weight
b) Higher strength
c) Higher flexibility
d) Lower speed fluctuation

104. Two systems are said to be dynamically similar, if homologous parts of the systems experience
a) Same force
b) Same net force
c) Similar force
d) Similar net force

105. The difference in the measured value due to change in direction of measurement is termed as
a) Noise
b) Blacklash
c) Resolution
d) Drift

106. The efficiency of a diesel engine varies between
a) 30-36%
b) 30-38%
c) 32-38%
d) 32-36%

107. Which one of the following may be the cheapest source of power for pumping water in Indian scenario?
a) Manpower
b) Bullock power
c) Wind power
d) Electrical power

108. The ratio of output vibration intensity to input vibration intensity with reference to a tractor operator, is termed as
a) Vibration ratio
b) Vibration sensitivity
c) Transmissibility
d) Damping ratio

109. When traction conditions are good, the largest improvement in traction can be made by
a) Adding more weight
b) Suing chains
c) Using strakes
d) Using half tracks

110. Which of the following is not a description for commonly used transmission type on a tractor?
a) Power shift
b) Constant gear ratio
c) CVT
d) Hydromechanical

111. Management of farm machines does not include
a) Cost determination
b) Selection of best size
c) Establishing an effective maintenance programme
d) Selection of crop rotation

112. The specific gravity of electrolyte solution in a changed battery should be
a) 1.01
b) 1.19
c) 1.27
d) 1.37

113. Most commonly used method to change the depth of cut by trailed disk harrow is by
a) Changing the gang angle
b) Changing disk concavity
c) Varying the operating speed
d) Sharpening the disk edge

114. Tillage is done to improve
a) Soil organic matter content
b) Soil cohesion
c) Soil structure
d) Soil texture

115. Seed rate of a seed drill is governed by
a) Width of seed drill
b) Capacity of seed box
c) Diameter of ground wheel
d) Length of fluted roller exposed to seeds

116. The tractor gives optimum tractive performance at wheel slip of
a) 0-5%
b) 10-15%
c) 30-35%
d) >40%

117. Rotor speed of rotavator is in the range of
a) 100-150 rpm
b) 150-250 rpm
c) 250-350 rpm
d) 500-700 rpm

118. Rocking sprayers work on the basis of
a) Electrostatic
b) Centrifugal energy
c) Hydraulic energy
d) Gaseous energy

119. The entropy of a reversible process
a) Decrease
b) Exponentially increase
c) Linearly increases
d) Remains constant

120. Bulk density and porosity of a material are 1.25 gm/cc and 36%. The particle density will be
a) 1.85 gm/cc
b) 1.95 gm/cc
c) 2.05 gm/cc
d) 2.25 gm/cc

121. The force that holds two particles of the same kind together is called as
a) Shear force
b) Adhesion
c) Cohesion
d) Compressive

122. Penetrometer is used to determine
a) Equilibrium moisture content
b) Porosity of soil
c) Texture of soil
d) Soil strength

123. Horizontal suction in a m.b. plough is provided to
a) Make the plough work at proper depth
b) Have better pulverization
c) Counteract the side thrust
d) Make the plough take proper width

124. Threshing effectiveness is not related to
a) Moisture content of crop
b) Peripheral speed of the cylinder
c) Cylinder-concave clearance
d) Peripheral speed of fan

125. Due to weight transfer in a tractor-implement system
a) PTO speed increases
b) The soil reaction at the front wheels decreases
c) Gyroscopic effects become more pronounced
d) The soil reaction at the front wheel increases

126. Form the standpoint of longitudinal stability of a tractor, the line of action of drawbar pull should be
    a) Left of centerline of the tractor
    b) Right of centerline of the tractor
    c) As low as possible
    d) As high as possible

127. The antiknock quality of diesel fuel is measured by
    a) Octane number
    b) Cetane number
    c) Pour point
    d) Flash point

128. Differential lock in a tractor is used to improve
    a) Lateral stability
    b) Braking performance
    c) Hydraulic lift
    d) Traction of a wheel

129. The standard rotational speed (rpm) of tractor PTO is
    a) 520±10
    b) 540±10
    c) 560±10
    d) 780±20

130. The compression ratio of diesel engine is in the range of
    a) 7:1 to 9:1
    b) 11:1 to 13:1
    c) 16:1 to 20:1
    d) 30:1 to 35:1

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) Angular speed   a) ML^2
ii) Specific heat   b) J/L
iii) Entropy   c) KJ/kg.k
iv) Moment of inertia   d) s^{-1}
v) Angular momentum   e) ML^2T^{-1}

132.
i) Pyranometer   a) Velocity
ii) Pitot tube   b) Force
iii) Tachometer   c) Pressure
iv) Bourdon gauge   d) Solar radiation intensity
v) Dynamometer   e) RPM

133.
i) Cone index   a) Water flow measurement
ii) Mohr's circle diagram b) Measure of specific gravity of fuel
iii) Weir   c) Soil strength
iv) Octane number   d) Percentage of iso-octane in a mixture of normal heptane and iso-octane
v) API   e) Soil shearing resistance

134.
i) $\cos 2\theta$ a) $2[\sin(x+y)/2] [\cos(x-y)/2]$
ii) Sin x. Sin y   b) $1/X$
iii) Sin x + Sin y   c) $\cos^2\theta - \sin^2\theta$
iv) [d/dx (log e^x)]   d) $\dfrac{a^x}{\log a} + c$
v) $\int a^x.dx$ e) ½ $[\cos(x-y) - \cos(x+y)]$

135.
i) Spool valve   a) Steering system
ii) Three point hitch   b) Hydraulic circuit
iii) Centre of pull   c) Tractor
iv) Splines   d) Double axis
v) Drop arm   e) Shaft

136.
i) Tillage   a) Fixed cost
ii) Cutter bar loss   b) Variable cost
iii) Depreciation   c) Mould board plough
iv) Labour wages   d) Combine
v) Farm machinery management e) Cost of operation

137.
i) Work   a) Mould board plough
ii) Power   b) Disc plough
iii) Primary tillage   c) Rate of doing work
iv) Tilt angle   d) Fluted roller
v) Seed drill   e) Force × distance

138.
i) Tyne   a) Seed drill
ii) Furrow opener   b) Radiator
iii) Pressure relief valve c) I.C. engine
iv) Spark plug   d) Tyres
v) Ply rating   e) Cultivator

139.
i) Air dust   a) Fuel
ii) Respirable dust   b) Sound
iii) Calorific value   c) <100 μm
iv) Decibel   d) <2.5 μm
v) Lux   e) Light

140.
i) Viscosity   a) Energy
ii) Erg   b) Dust
iii) Horsepower   c) Fluid
iv) Vibration   d) Frequency
v) Particulate matter   e) Engine

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. A pair of bullock exerts 90 kg pull at 30° to the horizontal while pulling an indigenous plough at a speed of 2.5 km/h. The plough cuts continuous v-shaped furrow 15 cm wide and 5 cm deep. Calculate the (a) unit draft of the implement, and (b) horsepower developed by the bullocks.

142. Calculate the diameter and peripheral distance between two consecutive cells to get 20 cm seed spacing by a seed drill having a speed ratio of 4:3. The diameter of the ground wheel is 70 cm. The rotor speed for 93% fill is 27 m/min. The forward speed of the machine is 3.2 km/h.

143. A farmer purchased a tractor in the current year at a cost of ₹ 3,00,000/-. The useful life of the tractor is 10 years. If the salvage value of the tractor is 10% of the initial cost, calculate the depreciated value after 5 years by (a) Straight line method, (b) Decline method, (c) Sum of year digit method.

144. A four wheel tractor has tread width of 1.42 m and its center of gravity located at a height of 1.06 m from the ground. The tractor on forward movement on the road has to take a turn with a radius of 4.6 m. Find the maximum speed (m/s) at which the tractor can take the turn. Assume no other lateral forces acting on the tractor.

145. Explain the role of international standard as facilitator of international trade.

146. What is basal metabolism rate and how it is measured?