Post Graduate School
Indian Agricultural Research Institute, New Delhi

Examination for Admission to Ph.D. Programme 2013-2014

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

Discipline Code : 03; *Sub code-01* 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. 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_{12}?
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_1 plant?
a) Homozygous
b) Heterozygous
c) Hemizygous
d) Nullizygous

21. The highest per capita consumption of flowers in the world is in
a) The USA
b) India
c) Switzerland
d) The Netherlands

22. Which of the following is a very rich source of betalain pigment?
a) Radish
b) Beet root
c) Carrot
d) Red cabbage

23. Dog ridge is
a) Salt tolerant rootstocks of mango
b) Salt tolerant rootstocks of guava
c) Salt tolerant rootstocks of grape
d) Salt tolerant rootstocks of citrus

24. Which of the following micronutrients are most widely deficient in Indian soils?
a) Zinc and boron
b) Zinc and iron
c) Zinc and manganese
d) Zinc and copper

25. Which of the following fertilizers is not produced in India?
a) DAP
b) Urea
c) Muriate of potash
d) TSP

26. What is the estimated extent of salt affected soils in India?
a) 5.42 mha
b) 7.42 mha
c) 11.42 mha
d) 17.42 mha

27. Which of the following is not a feature of watershed?
a) Hydrological unit
b) Biophysical unit
c) Socio-economic unit
d) Production unit

28. Correlation coefficient 'r' lies between
a) 0 and 1
b) -1 and 1
c) -1 and 0
d) 0 and ∞

29. For the data 1, -2, 4, geometric mean is
a) 2
b) 4
c) $-\frac{7}{3}$
d) -2

30. The relationship between Arithmetic mean (A), Harmonic mean (H) and Geometric mean (G) is
a) $G^2=AH$
b) $G=\sqrt{A+H}$
c) $H^2=GA$
d) $A^2=GH$

PART – II (Subject Paper)

Multiple choice questions (No. 31 to 130). Choose the correct answer (*a, b, c* or *d*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

31. Notched disc blades on disc harrows are provided to
a) Enhance penetration
b) Improve balancing of gangs
c) Save on steel
d) Reduce draft

32. ULV spraying is used for
a) Minimizing drift
b) Reduce application rate
c) Aerial spraying
d) Spot application

33. A threshing cylinder of 50 cm diameter rotates at an angular velocity of 44 radians/second. The peripheral velocity (m/s) will be
a) 5.5
b) 11.0
c) 16.5
d) 22.0

34. Registration of a cutter bar means
a) Centre of knife must stop in the centre of guard on each stroke
b) Centre of knife should be ahead of guard
c) Centre of knife should be behind the guard
d) Centre of knife should be at the end of the guard

35. Duffee's formula is used to find the
a) Capacity of a blower
b) Capacity of a null
c) Ventilation rate
d) Chopping capacity of chaff cutter

36. The width of seed drill with 9 tynes, each spaced at 20 cm is
a) 160 cm
b) 180 cm
c) 200 cm
d) 220 cm

37. A flat fan nozzle is suitable for
a) Foliage spray
b) Insect control
c) Spot spray
d) Herbicide spray

38. A furrow cross-section in a country plough is commonly
a) Circular
b) Triangular
c) Rectangular
d) Trapezoidal

39. In adiabatic process
a) There is no change in volume of the medium
b) There is no change in temperature
c) There is no transfer of heat
d) The entropy is changed

40. The potential difference across the gap of a spark plug ranges between
a) 10-20 mV
b) 10-20 V
c) 10-20 kV
d) 10-20 MV

41. The electrolyte in a lead-acid battery is
a) H_2SO_4
b) HNO_3
c) HCl
d) NaCl

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

43. Calorific value of petrol is
a) 10,300 kCal/kg
b) 10,550 kCal/kg
c) 11,100 kCal/kg
d) 12,000 kCal/kg

44. The use of pressurized radiator cap is to
a) Reduce evaporation loss
b) Increase engine operating temperature
c) Increase boiling point of water
d) Reduce heat losses

45. S.I. unit of tractor power is
a) W_p
b) kW
c) kW-h
d) Newton

46. The common firing order of a 4-stroke, 6 cylinder diesel engine is
a) 2-5-3-6-1-4
b) 1-4-2-3-6-5
c) 1-5-3-6-2-4
d) 1-4-2-6-5-3

47. Choke in a I.C. engine is used to control
a) Camshaft speed
b) Specific fuel consumption
c) Air fuel mixture
d) Crankshaft speed

48. During a field operation, the normal load below one of the rear wheels of tractor was measured as 3000 N. The draw bar pull for coefficient of traction of 0.60 will be
a) 1800 N
b) 3600 N
c) 4800 N
d) 5400 N

49. Puddling is used to
a) Reduce percolation of water
b) Pulverize soil
c) Level the field
d) Compact the soil

50. Bronze is an alloy of
a) Copper and zinc
b) Copper and tin
c) Zinc and tin
d) Aluminium and zinc

51. The dimension of surface tension is
a) [MLT]
b) $[ML^{-1}T^{-2}]$
c) $[ML^{-1}]$
d) $[MLT^{-2}]$

52. A tractor seat suspension should have its natural frequency in the range of
a) 0.5 to 2.0 Hz
b) 2.0 to 4.0 Hz
c) 4.0 to 6.0 Hz
d) 6.0 to 8.0 Hz

53. A diesel fuel has 70 parts n-cetane and 30 parts of heptamethyl nonane, its cetane number will be
a) 44.5
b) 66.5
c) 74.5
d) 90.2

54. The first derivation of e^{x^2} wrt x is
a) e^{x^2}
b) $2xe^{x^2}$
c) $x^2e^{x^2}$
d) $\frac{e^{x^2}}{x^2}$

55. Two faces of magnitude 30 N and 40 N act at right angle to each other. The resultant force is
a) 40 N
b) 50 N
c) 60 N
d) 70 N

56. A star-delta starter is used to operate
a) Diesel engine
b) Single phase electric motor
c) Three phase electric motor
d) Three wheeled tractor

57. The combustible gas in a biogas is
a) Methane
b) Hydrogen
c) Nitrogen
d) Helium

58. Anthropometry is a study of
a) Human energy consumption pattern
b) Static and dynamic human body dimensions
c) Human comfort lend
d) Human fatigue w.r.t. oxygen consumption

59. The value of slip for reporting maximum DB pull for wheeled tractor, as per BIS standards, is
a) 5%
b) 10%
c) 12%
d) 15%

60. For a tractor rubber tyre having width 'b' and length of contact as 'l', the area of contact is
a) $b \times l$
b) 0.78 bl
c) 0.5 bl
d) 0.25 bl

61. Castor angle is essentially related to
a) Drive wheels
b) Steered wheels
c) Towed wheels
d) Self-propelled wheels

62. S.I. unit of specific draft is
a) kg/cm^2
b) kg/m^2
c) N/cm^2
d) N/m^2

63. Optical pyranometer is used to measure
a) Light intensity
b) Low temperature
c) High temperature
d) None of the above

64. The ascending order of resistance to ploughing force with type of soil is
a) Clay-loam-sandy loam-sand
b) Clay-sandy loam-loam-sand
c) Sand-sandy loam-loam-clay
d) Sand-loam-sandy loam-clay

65. The speed of CPU of computer is given by
a) GB
b) GHz
c) m/s
d) GJ

66. In axial flow paddy thresher, a spike tooth cylinder is preferred over a rasp bar cylinder because
a) It has more positive feeding action
b) It requires less power
c) It does not plug easily
d) All of the above

67. Subsoiler plough is best suited for
a) Breaking hard pan
b) Deep ploughing
c) Making ditches
d) Inter cultivation

68. The value of $\lim x \to 2 \left(\frac{x^2-3x+2}{x^2+x-6} \right)$ will be
a) 0
b) 1
c) 1/5
d) 1/6

69. The value (v) of the matrix

$$\begin{pmatrix} -7 & -2 & -3 & 14 \\ -2 & -4 & 3 & 1 \\ -1 & 2 & -3 & 4 \end{pmatrix}$$

is
a) 0
b) 2
c) 3
d) 4

70. A strain gauge made of copper-nickel alloy have a gauge factor of
a) 1-2
b) 2-3
c) 3-4
d) 4-5

71. SPRERI has been working on
a) Sprayers
b) Agro-machines
c) Renewable energy
d) Irrigation pumps

72. The sum of net traction and rolling resistance of a traction device while pulling is termed as
a) Thrust
b) Tractive force
c) Power output
d) Torque output

73. The lowest temperature at which a fuel ceases to flow is known as
a) Cloud point
b) Flash point
c) Pour point
d) Chilled point

74. For a wheeled tractor with mass M and velocity V, the kinetic energy may be better approximated by
a) $\frac{1}{2} MV^2$
b) $\frac{1.1}{2} MV^2$
c) $\frac{1}{2.1} MV^2$
d) MV^2

75. OECD deals in
a) Tractor manufacturing
b) Tractor performance test standards
c) Tractor trading in Europe
d) Export of tractors

76. Which of the following is not included in flexible manufacturing system (FMS)?
a) Automation
b) CNC
c) DNC
d) Jig fixture

77. Which of the following is not a reliability engineering tool?
a) Weibull analysis
b) Accelerated testing
c) Uniform testing
d) Bayes method

78. The Headquarters of BIS is located in
a) Kolkata
b) Delhi
c) Chennai
d) Bangalore

79. If P is a square matrix, then the matrix P+P is
a) Symmetric
b) Skew symmetric
c) Diagonal
d) Involutory

80. The property of a material which allows it to be drawn into a smaller section is called
a) Plasticity
b) Ductility
c) Drawability
d) Elasticity

81. The octane rating of methane gas is
a) 130
b) 80
c) 50
d) 35

82. Shortening of top link of tractor three-point hitch system
a) Increases weight transfer on rear wheels
b) Decreases weight transfer on rear wheels
c) Increases penetration of implement
d) Decreases penetration of implement

83. In a hydrostatic drive, the speed is governed by
a) Rate of oil flow
b) Direction of oil flow
c) Pressure of oil flow
d) Viscosity of oil flow

84. A piston type accumulator is filled with
a) Oxygen
b) Hydrogen
c) Nitrogen
d) Argon

85. In a single action disc harrow for balanced draft, the right and left gangs are angled
a) Exactly the same
b) Right gang has 2-4^o more angle
c) Left gang has 2-4^o more angle
d) Both gangs are right angled to the line of motion

86. The centre of resistance is the point
a) Through which c.g. of a tractor passes
b) Through which centre line of a tractor passes
c) At which centre line of implement and line of draft intersect
d) At which line of draft and centre line of tractor intersect

87. The penetration of a tandem disc harrow can be increased by
a) Increasing tilt angle
b) Increasing disc angle
c) Increasing disc diameter
d) All of the above

88. A cam and follower mechanism is used in
a) Cultivator
b) Disc harrow
c) Transplanters
d) Wheel hoe

89. The instrument used to measure area of map is
a) Dumpy level
b) Theodolite
c) Planimeter
d) Dynamometer

90. Ozone layer in atmosphere is contained in
a) Troposphere
b) Stratosphere
c) Ionosphere
d) Mesosphere

91. The tractor testing facility of Government of India is located at
a) New Delhi
b) Bundi (Madhya Pradesh)
c) Allahabad (Uttar Pradesh)
d) Kharagpur (West Bengal)

92. Penetration of a trailed type disc harrow is not affected by
a) Size of disc
b) Angle of disc
c) Weight of disc
d) Tractor hydraulic system

93. Two nozzles in a spray boom are 40 cm apart and 50 cm high from the ground. If the core angle of nozzle is 60^o, the overlap will be approximately
a) 20%
b) 30%
c) 45%
d) 80%

94. The product of two orthogonal matrices is
a) Unitary matrix
b) Orthogonal matrix
c) Unit matrix
d) Null matrix

95. The bending moment on a section is maximum where shearing force is
a) Maximum
b) Minimum
c) Equal
d) Zero

96. The draft of a trailed type implement can be measured using
a) Brake dynamometer
b) Torque meter
c) Tension dynamometer
d) Dial gauge

97. In a flail harvester, the cutting operation is performed by
a) Horizontally rotating circular blades
b) Vertically rotating circular blades
c) Knives mounted on a horizontal shaft
d) Knives mounted on a vertical shaft

98. The relationship between soil thrust (F), load on wheel (W), ground contact area (A), cohesion of soil (c) and internal frictional angle (φ) is be expressed as
a) $F = Wc + A \tan \varphi$
b) $F = AC \tan \varphi + W$
c) $F = W/A + c \tan \varphi$
d) $F = Ac + W \tan \varphi$

99. In a tractor, if the crankshaft is perpendicular to rear axle and flywheel rotation is clockwise when viewed from front then in making right turn, tractor shall have tendency to tip
a) Forward
b) Backward
c) Left
d) Right

100. In which flow meter, the pressure drop remains nearly constant but the area changes?
a) Pitot tube
b) Venturimeter
c) Rotameter
d) Orifice meter

101. If f(x) is a perfect normal distribution with mean and standard deviation of 5 and 1, respectively, then the value of f(x) for x=6 is
a) 0.124
b) 0.242
c) 0.482
d) 0.524

102. As per the nature of relative motion belt and pulley drive is categorized as
a) Sliding pair
b) Turning pair
c) Cylindrical pair
d) Rolling pair

103. The four bar mechanism is usually rejected, if the transmission angle is
a) Less than 30^o
b) Between 30^o to 40^o
c) Between 45^o to 60^o
d) More than 60^o

104. In proper seat suspension design, the transmissibility should be
a) Less than unity
b) More than unity
c) Less than 2
d) More than 2

105. Which of the following is an inversion of a double slider crank mechanism?
a) Oldham's coupling
b) Double sliding mechanism
c) Quick return motion mechanism
d) Witworth mechanism

106. In a force-feed lubrication system, the type of pump generally used in tractor engines, is
a) Centrifugal pump
b) Gear pump
c) Rotary vane pump
d) Plunger pump

107. Hot magma is a source of
a) Wind energy
b) Solar energy
c) Tidal energy
d) Geothermal energy

108. The ratio of the volume of the voids to the total soil volume is called
a) Void ratio
b) Porosity
c) Dry bulk density
d) Wet bulk density

109. Ballasts are sometimes used on front tyres of a 4-wheel tractor to
a) Increase traction
b) Increase stability
c) Decrease front wheel slippage
d) Decrease tractor vibration

110. For a given spray sample
a) VMD is equal to NMD
b) VMD is less than NMD
c) VMD is more than NMD
d) None of the above

111. The bearing material that is most susceptible to corrosion is
a) Babbit
b) Copper-lead
c) Aluminium
d) Aluminium-babbit

112. The high speed plow is
a) Sod or breaker bottom
b) Stubble bottom
c) General purpose bottom
d) None of the above

113. For puddling operation, the tynes used in power tiller are
a) C-type
b) Curved type
c) L-type
d) Combination of C and L type

114. Recommended peripheral velocity of spike tooth threshing cylinder for wheat crop is
a) Less than 20 m/s
b) 20 to 25 m/s
c) 25 to 30 m/s
d) 30 to 35 m/s

115. The speed regulation (S_R) of a governer is related to the average speed ($\bar{N}$) and the change in speed at load (ΔN) by

a) $S_R = \frac{\Delta N}{\bar{N}}$

b) $S_R = \frac{\bar{N}}{\Delta N}$

c) $S_R = \frac{100\bar{N}}{\Delta N}$

d) $S_R = \frac{\Delta N}{100\,\bar{N}}$

116. The toe-in provided in a tractor is approximately
a) 18 to 28 mm
b) 14 to 15 mm
c) 7 to 10 mm
d) 2/3 mm

117. The type of starting aid generally used in a diesel power tiller is
a) Glow plug
b) Thermostat
c) Decompression lever
d) Intake manifold surrounded by exhaust manifold

118. A 8-row automatic transplanter operates at a forward speed of 0.25 m/sec. If seedling spacing along the row is 0.25 m and row to row spacing is 0.75 m, the required feed rate of the seedlings into the transplanter is
a) 100 seedlings per minute
b) 130 seedlings per minute
c) 240 seedlings per minute
d) 480 seedlings per minute

119. In case of semiconductors, the resistance decreases with increase in temperature due to
a) Velocity of electron increases
b) Number of free electrons decreases
c) Number of free electrons increases
d) All of the above

120. The traction theory, $\frac{CIbd}{W}$ is expression for
a) Motion resistance ratio
b) Wheel numeric
c) Traction coefficient
d) Weight transfer

121. Which one is not a traction aid?
a) Tyre chain and girdles
b) Dual tyre
c) Wheel strokes
d) Cage wheel extension

122. At what fraction of maximum drawbar load, tractive efficiency reaches maximum?
a) 95%
b) 90%
c) 66%
d) 33%

123. CVT is a type of
a) Transmission
b) Valve
c) Voltage regulator
d) UPS

124. The slope of calibration curve of dynamometer gives
a) Threshold value
b) Least count
c) Range
d) Sensitivity

125. Vibration is usually measured with
a) Vibration meter
b) Oscillograph
c) Rotameter
d) Accelerometer

126. Which of the following codes is not followed while testing agricultural machinery?
a) RNAM
b) BIS
c) ISO
d) RCC

127. Which one is not a conservation tillage machine?
a) Zero till drill
b) Raised bed planter
c) MB plough
d) Laser leveller

128. Straw combine is machine for
a) Harvesting
b) Reaping
c) Harvesting and threshing of straw and left over grain
d) An attachment to combine

129. If a machine has a 1000-h success reliability of 90%, this means
a) An average of 10% will fail in 1000 hours
b) An average of 90% will have life exceeding 1000 hours
c) On an average of 90% machines will work
d) Both a) and b)

130. Draft of an implement mounted on 3-point hitch of a tractor is sensed by
a) Top link
b) Lower link
c) Draft control lever
d) Position control lever

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) Steering geometry	a) Jointer
ii) Tractive effort	b) Camber angle
iii) Mould board plough	c) Angle of internal friction
iv) Wheatstone Bridge	d) Hydraulic system
v) Gear pump	e) Strain measurement

132.

i) Harmonic motion	a) Size of droplets
ii) Four-bar linkage	b) 3-dimensional motion
iii) Gyroscopic action	c) Venturi effect
iv) Drift control	d) Mechanism
v) Carburetion	e) Damping

133.

i) Cereal crop harvester	a) Caster
ii) Implement for shallow ploughing	b) Spool
iii) Inclination of king pin	c) Blade harrow
iv) Outward inclination of tractor front wheel	d) Camber
v) Flanged tube in a harrow	e) Reaper

134.

i) Temperature at which fuel catches fire	a) Cetane number
ii) Specific gravity of fuel	b) A.P.I.
iii) Percentage of iso-octane	c) Octane number
iv) Ignition quality of gasoline	d) Diesel knock
v) Abnormal sound in an engine	e) Flash point

135. Match the most appropriate source of power with the task

i) Lifting water	a) Tractor
ii) 3-bottom M.B. plough	b) Pair of bullocks
iii) Harvesting	c) Manual
iv) Interculture operation	d) Electric motor
v) 3×20 seed drill	e) Self-propelled combine

136. Match the material used for manufacturing components

i) The blade of a hand chaff cutter	a) Plastic
ii) Flywheel of a thresher	b) Aluminium
iii) Nozzle of a sprayer	c) High-carbon steel
iv) Flutted roller of a seed drill	d) Cast iron
v) Seed tube of a seed drill	e) Brass or gun metal

137. Match the product with process

i) Biogas	a) SPV system
ii) Char	b) Anaerobic digestion
iii) CO	c) Trans esterification
iv) Electric current	d) Direct gasification
v) Bio-diesel	e) Pyrolysis

138.

i) Friction plate	a) Oscillating sieves
ii) Dynamometer	b) Puddling
iii) Star wheel	c) Clutch
iv) Crank and connecting rod	d) Force
v) Cage wheel	e) Reaper

139.

i) Standard	a) Selective sowing
ii) Bite length	b) Mower
iii) Dibbling	c) Plough
iv) Registration	d) Disc harrow
v) Gang angle	e) Rotary tiller

140.

i) Disc angle	a) Body measurement
ii) Centre of load	b) Soil tilling
iii) Rotary cultivator	c) Implement
iv) Anthropometry	d) Sticky soil
v) Disc type	e) Width of cut

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. Explain analytically how various forces acting on a disc harrow gang can be balanced to obtain even penetration of discs?

142. Give a graphical representation of effect of concave length, cylinder-concave clearance and crop moisture content on cylinder loss and grain damage.

143. Compare coefficient of traction and tractive efficiency of a tractor-implement system with respect to their comprehensiveness.

144. With the help of an example, briefly describe various stages of design of agricultural machine

145. (i) What are the main adjustment of a mower having a pitman drive? Explain briefly.
(ii) Calculate power that a tractor is producing if a P.T.O. dynamometer test shows a scale reading of 30 kgf at 1000 rpm. The scale arm is 1 m long.

146. With the help of free-body diagrams, explain the difference between a towed and a traction wheel.