Sikkim Public Service Commission

Main Written Examination for the Post

Assistant Engineer (Agriculture)

Paper - II

| Time Allowed : 3 Hrs. | Maximum Marks : 300 |

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before answering the questions :-

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.

2. Please note that it is the candidate's responsibility to fill in the Roll Number and Test Booklet Serial Number carefully and without any omission or discrepancy at the appropriate places in the **OMR ANSWER SHEET.**

3. **Use only Black Ball Point Pen to fill the OMR sheet**

4. Do not write anything else on the OMR Answer Sheet except the required information.

5. *This Test Booklet contains two Sections i.e Section A and B. Section A contains 100 items of Multiple Choice Questions for 2 Marks each. Section B contains Conventional/Subjective type of questions.*

6. *Section B, Conventional/Subjective comprises of IV parts. Short answer type question and long answer type question of 100 marks.*

7. Before you proceed to mark in the Answer Sheet (OMR), you have to fill in some particulars in the Answer Sheet (OMR) as per given instructions.

8. After you have completed filling in all your responses on the Answer Sheet (OMR) and the examination has concluded, you should hand over the OMR & Conventional Answer sheet to the Invigilator only . You are permitted to take away the Test Booklet.

9. ## Marking Scheme

   There will be negative marking for wrong answers marked by a candidate in the objective type question papers.

   (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, one-third of the marks assigned to that question will be deducted as penalty.

   (ii) If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above to the question.

   (iii) If a question is left blank. i.e., no answer is given by the candidate, there will be no penalty for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Multiple Choice Questions

1. Interception loss is solely due to
   A) evaporation
   B) transpiration
   C) through fall
   D) stream flow

2. SCS method computes run-off by the formula
   A) $Q = \frac{(P-0.2S)^2}{(P+0.8S)}$
   B) $Q = \frac{P-0.2S}{P+0.8S}$
   C) $Q = \frac{(P-0.2S)}{(P+0.8S)^2}$
   D) none of above

3. Indirect runoff includes
   A) inter flow and base flow
   B) inter flow and channel flow
   C) base flow only
   D) quick return flow

4. Barlow's table is associated to the computation of
   A) evaporation
   B) hydraulic roughness
   C) runoff coefficient
   D) runoff

5. The Muskingum equation for channel storage is given by
   A) $S = K[x.T^m + (1-Q) Q^m]$
   B) $S = K [x.I + (1-x) Q]$
   C) $S = [KQ + (1-Q)x]$
   D) none of above

6. Line joining the points of equal time of concentration is called as
   A) Isochrone
   B) iso cells
   C) iso bar
   D) isohyet

7. Unit of erosion intensity of long term erosion is given by
   A) mm per annum
   B) m^3/s
   C) m^3/ha
   D) tons / ha

8. Masonary spurs are located at the point, where
    A) immediate control is needed
    B) sharp bend takes place
    C) stream current is swift
    D) none of the above

9. Based on construction of materials, the spurs are classified as
    A) vegetative, permanent and semi-permanent spurs
    B) T & L shaped spurs
    C) masonary, wooden and vegetative spurs
    D) none of the above

10. Length of deflecting type spurs varies from
    A) 2 to 3 m
    B) 6 to 10 m
    C) 15 to 20 m
    D) 1 to 2 m

11. In saltation process of soil movement, the movement takes place in the form
    of
    A) suspension in wind
    B) surface creep
    C) low bounces over the land surface
    D) none of the above

12. Shelterbelts are composed of
    A) one row of vegetative materials only
    B) more than two rows of vegetative materials only
    C) tow rows of non-vegetative materials only
    D) one row of non-vegetative materials only

13. Parabolic dunes are formed on
    A) uniform slopy ground surface
    B) undulated ground surface
    C) level ground surface
    D) slopy vegetative ground surface

14. Plastic mulching is not suitable for
    A) erosion control
    B) taller vegetation
    C) moisture conservation
    D) soil loss control

15. For the design of grassed water way, the average grade is used as
    A) 5%   C) 10%
    B) 16%   D) 1%

16. The most suitable shape of grassed way for use is
    A) triangular
    B) parabolic
    C) trapezoidal
    D) rectangular

17. In embankment of pond, the burrowing problem is more common
    A) at middle
    B) at the bottom
    C) around the spillway section
    D) throughout the length

18. A best site for pond construction is
    A) narrow valley with steep sides
    B) a clay formation
    C) a depressed part with pervious layer below
    D) all above

19. Laplace equation used for seepage analysis is valid for
    A) isotropic soil
    B) anisotropic soil
    C) sandy soil
    D) clay soil

20. A rectangular channel would be hydraulically most efficient, if the flow depth
    is equal to
    A) bottom width
    B) half of bottom width
    C) half of top width
    D) none of the above

21. Manning's n for a straight concrete channel is equal to
    A) 0.015
    B) 0.018
    C) 0.014
    D) 0.019

22. In rivers and canals the average flow velocity occurs at the depth of
    A) 0.4 d from the free surface
    B) 0.6 d from the free surface
    C) 0.4 d to 0.8 d from the free surface
    D) none of the above

23. Froude Number for a flow is defined as
    A) $F = \dfrac{V}{\sqrt{gA/T}}$
    B) $F = \dfrac{V}{\sqrt{gD}}$
    C) $F = \sqrt{v/gD}$
    D) none of the above

24. A channel with constant cross-sectional shape, size and bottom slope is called
    as
    A) natural channel
    B) prismatic channel
    C) ideal channel
    D) all above

25. Hydraulic jump below a spillway or a sluice gate is an example of
    A) steady rapidly-varied flow
    B) unsteady-rapidly varied flow
    C) steady gradually-varied flow
    D) none of the above

26. Froude number for a triangular channel is defined as
    A) $F = \dfrac{V\sqrt{2}}{\sqrt{gy}}$
    B) $F = \dfrac{V}{\sqrt{gy}}$
    C) $F = \dfrac{V}{\sqrt{gA/y}}$
    D) none of the above

27. In laminar flow, the
    A) viscous forces are strong
    B) inertia forces are strong
    C) viscous forces are week
    D) none of the above

28. Time of concentration is the function of
    A) channel length and its slope
    B) channel length and watershed slope
    C) channel slope and elongated length of watershed
    D) none of the above

29. For a given cross-sectional area of channel, the hydraulic radius decreases with
    A) decrease in wetted perimeter
    B) increase in wetted perimeter
    C) decrease in flow depth
    D) none of the above

30. Spiles are used for the purpose of
    A) conveyance of water in a channel
    B) erosion control at outlet
    C) diversion of water
    D) none of the above

31. The depth of water flowing over the weir is called as
    A) weir crest
    B) water depth
    C) flow head
    D) none of the above

32. The flow velocity in the channel is directly proportional to the square
    A) of the wetted perimeter
    B) root of the hydraulic radius
    C) root of the hydraulic depth
    D) none of the above

33. Parshal flumes allow reasonably accurate measurement of flow, even when
    A) partially submerged
    B) fully submerged
    C) not smoothly installed
    D) none of the above

34. Irrigation frequency is the functions of
    A) crop and soil
    B) soil and climate
    C) crop, soil and climate
    D) all above

35. Line of equal wind speed is called as
    A) iso bath
    B) isotach
    C) iso bar
    D) isochrone

36. Consumptive use will be less in
    A) poorly planted crop but water is efficiently applied as per requirement
    B) poorly planted crop with inefficient water application
    C) density planted crops
    D) none of the above

37. The value of crop coefficient (K_c) during maximum canopy coverage and root system, is usually
    A) 0.5
    B) 1.5
    C) 1.0
    D) 0.2

38. Availability of water is higher in
    A) clay and clay loam soils
    B) sandy and sandy loam soils
    C) silty soils
    D) silty loam soil

39. Sorption refers to
    A) rising of water content in the soil
    B) reduction of water content in the soil
    C) decrease in infiltration
    D) all above

40. A well designed irrigation system should satisfy the condition that
    A) irrigation period is not greater than the irrigation frequency
    B) irrigation frequency is not greater than the irrigation period
    C) irrigation period is equal to irrigation frequency
    D) none of the above

41. Dimension of USWB class-A pan is
    A) 120 cm diameter and 50 cm depth
    B) 120 cm diameter and 25 cm depth
    C) 100 cm diameter and 50 cm depth
    D) none of the above

42. Quantity of water, exclusive of precipitation, required for crop production is called as
    A) irritation requirement
    B) net irrigation requirement
    C) gross water requirement
    D) none of the above

43. In furrow irrigation method, the furrows are constructed
    A) along the field boundary
    B) across the land slope
    C) along the general land slope
    D) none of the above

44. Formation that contains water but transmits water at slow rate, is called as
    A) aquiclude
    B) aquifer
    C) Aqifuge
    D) hard pan

45. The drip system was firstly used in
    A) America
    B) Israel
    C) USSR
    D) India

46. In border irrigation, the cut off ratio generally lies between
    A) 65 to 80%
    B) 60 to 70%
    C) 50 to 60%
    D) 30 to 60%

47. Operating pressure of sprinkler system is
    A) 1 to 4 kg/cm^2
    B) 10 to 15 kg/cm^2
    C) 0.15 to 0.5 kg/cm^2
    D) none of the above

48. The coefficient of discharge (Cd) of a good nozzle for sprinkler system should be
    A) 0.95 to 0.96
    B) 0.96 to 0.97
    C) 0.85 to 0.90
    D) 0.70 to 0.75

49. The degree of variation of emitter flow, can be evaluated by
    A) uniformity coefficient
    B) discharge measurement
    C) pressure measurement
    D) all above

50. For operation of sprinkler system, the suitable pump is
    A) propeller pump
    B) turbine pump
    C) volute centrifugal pump
    D) reciprocating pump

51. Check basin method of irrigation is most suitable in
    A) heavy soils
    B) coarse soils
    C) loamy soils
    D) sandy soils

52. Sichardt equation is associated to compute
    A) radius of influence in ground water flow
    B) friction factor
    C) grain size
    D) none of above

53. The furrow length which can be efficiently irrigated may be
    A) as long as 205 m
    B) as short as 45 m
    C) up to 30 m
    D) less than 120 m

54. Border irrigation is most commonly used in
    A) row crops oftenly
    B) all close growing grain crops
    C) horticultural crops
    D) vegetable crops

55. Tensiometer measures the moisture content indirectly, by measuring
    A) matrix potential
    B) hydrostatic potential
    C) osmotic potential
    D) none of the above

56. Water held in interstices or small pores of soil is called as
    A) structural water
    B) capillary water
    C) adsorbed water
    D) none of the above

57. Infiltration capacity of soil is a
    A) dynamic property
    B) static property
    C) random component
    D) all above

58. Soil water that is not available for plant growth is the
    A) capillary water
    B) gravitational water
    C) hygroscopic water
    D) vadose water

59. To retain 90% of gravel pack material, the slot size of screen should be equal to
    A) d_{10} of pack material
    B) d_{50} of pack material
    C) d_{60} of pack material
    D) none of the above

60. Darcy's law is applicable to the
    A) viscous flow of water in the soil
    B) viscous flow of water in the conduit
    C) ideal flow in the pipe
    D) all above

61. At saturation stage, the hydraulic conductivity of soil approaches
    A) percolation rate
    B) infiltration rate
    C) basic intake rate
    D) leaching capacity

62. The force, to keep the soil and water together during wet condition is the
    A) adhesion force
    B) suction
    C) soil water potential
    D) surface tension

63. Crop coefficient is the ratio of
    A) ET_{crop} and reference crop ET
    B) reference crop ET and ET_{crop}
    C) actual ET and pan evaporation
    D) none of the above

64. Jacob method for evaluation of aquifer parameters, is valid for the value of u
    A) less than 0.01
    B) as 1
    C) more than 0.01
    D) none of the above

65. A soil with high organic matter and fine texture contains
    A) lower field capacity
    B) higher field capacity
    C) lower saturation capacity
    D) higher infiltration rate

66. For a well construction in a aquifer with coefficient of permeability less than 20 m/day, the optimum value of screen entrance velocity for screen design should be
    A) cm/s
    B) 10.0 cm/s
    C) 11.5 cm/s
    D) 5.0 cm/s

67. Specific capacity of well denotes
    A) discharge per unit time
    B) discharge per unit draw down
    C) draw down per unit time
    D) none of the above

68. In an aquifer containing corrosive water, the slot size should initially be
    A) reduced
    B) enlarged
    C) kept 0.3 mm
    D) none of the above

69. Slope of water table or piezometric surface, represents the
    A) slope of energy gradient
    B) ground water flow direction
    C) hydraulic gradient
    D) none of the above

70. Jocob's method gives a fair prediction only, when
    A) steady state condition is developed
    B) unsteady state condition is developed
    C) well discharge rate is uniform
    D) none of the above

71. Uniformity coefficient (Cu) of any material is defined as
    A) $Cu = \frac{D_{60}}{D_{10}}$
    B) $Cu = \frac{D_{10}}{D_{60}}$
    C) $Cu = \frac{D_{50}}{D_{10}}$
    D) none of the above

72. Most commonly used threshing mechanism on the grain combines is
    A) peg tooth cylinder
    B) spring tooth cylinder
    C) spike tooth cylinder
    D) rasp bar cylinder

73. Stroke bore ratio for tractor engine is
    A) 1.25
    B) 1.45
    C) 1.75
    D) 2.00

74. Foam spraying requires special type of nozzle
    A) flat fan nozzle
    B) flooding nozzle
    C) hollow cone nozzle
    D) air aspiring nozzle

75. When stroke : bore ratio is increased, volumetric efficiency of high speed engine is
    A) increased
    B) decreased
    C) unaltered
    D) none of the above

76. A manually operated knapsack sprayer works on the principle of
    A) hydraulic energy
    B) centrifugal energy
    C) gaseous energy
    D) kinetic energy

77. When the speed of a tractor drawn seed drill is doubled, the seed rate (kg/ha) is
    A) doubled
    B) remains the same
    C) halved
    D) none of the above

78. Planters differ from a seed drill in respect of:
    A) kind of power transmission system
    B) kind of metering mechanism
    C) kind of furrow opener used
    D) all the above

79. Vertical suction of a plough influences :
    A) depth of cut
    B) pulverization
    C) width of cut
    D) direction of pull

80. Disc angle adjustment influences :
    A) soil break up
    B) depth of cut
    C) width of cut
    D) direction of travel

81. Per hectare application rate of a ULV sprayer is :
    A) upto 5 liters
    B) 5-100 liters
    C) 400 liters
    D) none of these

82. A thresher causes more seed damage if :
    A) speed is increased
    B) clearance is increased
    C) feed rate is reduced
    D) seed is reduced

83. The depth of penetration of a disc harrow is increased by :
    A) tilt angle
    B) gang angle
    C) disc angle
    D) all of above

84. Subsoiler plough is best suited for :
    A) breaking hard pan
    B) Deep ploughing
    C) making ditches
    D) inter cultivation

85. Bevel gear is used for transmitting power between two shafts:
    A) at right angle to each other and can not intersect
    B) at right angle to each other and can intersect
    C) parallel to each other
    D) at an angle to each other

86. Subsoilers are operated at the maximum depth of
    A) 30 - 40 cm
    B) 45-75 cm
    C) 75 - 90 cm
    D) 10 - 20 cm

87. The amount of liquid required for ground spraying of agricultural crops is:
    A) 400-600 l/ha
    B) 200 – 400l/ha
    C) 1000-2000 l/ha
    D) 600-800 l/ha

88. Power sprayers are operated at a pressure
    A) 5-10 kg/m^2
    B) 10-20kg/m^2
    C) 20-55kg/m^2
    D) >55 kg/m^2

89. Application rates for dusters are
    A) <10 kg/ha
    B) 10-20 kg/ha
    C) 20-40 kg/ha
    D) >40 kg/ha

90. Lewis formula is used in the design of
    A) gears
    B) clutch
    C) chain drive
    D) belt drives

91. Optimum operating cylinder speed for wheat threshing using power operated thresher is
    A) 300-400 rpm
    B) 400-600 rpm
    C) 600-800 rpm
    D) 1100-1200 rpm

92. Coupling used when two shafts are appreciably out of line
    A) Universal coupling
    B) Oldham coupling
    C) Flanged coupling
    D) Flexible coupling

93. Inflation pressure in rear wheel to tractor (2 wheel drive)
    A) 0.8-1.2 kg/cm^2
    B) 1.2-2.0 kg/cm^2
    C) 2.0-2.5 kg/cm^2
    D) 2.5 kg/cm^2

94. Improving power factor
    A) reduces current for a given output
    B) increases losses in line
    C) increases the cost of station equipment
    D) none of the above

95. For the same voltage drop, increasing the voltage of a distributor n time –
    A) reduces the x section of the conductor by n times
    B) increases the x section of the conductor by n times
    C) reduces the x section of the conductor by n^2 times
    D) increases the x section of the conductor by n^2 times

96. The generating voltage and frequency in India is about?
    A) 11 kV and 60 Hz
    B) 11 kV and 50 Hz
    C) 220 kV and 60 Hz
    D) 220 kV and 50 Hz

97. What is the highest possible transmission voltage in India?
    A) 675 kV
    B) 765 kV
    C) 132 kV
    D) 440 kV

98. The speed of an induction motor
    A) Decreases too much with the increase of load
    B) Increase with the increase of load
    C) Decreases slightly with the increase of load
    D) Remains constant with the increase of load

99. The most economical area of conductor is that for which the total annual cost of transmission line is minimum. Which law states this?
    A) Lenz's law
    B) Kelvin's law
    C) Faraday's law
    D) Ohm's law

100. Ratio of maximum demand to connected load is termed as :
    A) Load factor
    B) Power factor
    C) Demand factor
    D) Form factor

Section – B

Subjective mode

1. **Define any five of the following:**   (5x5=25)
   a) Duty of water
   b) Water application efficiency
   c) Storage coefficient
   d) Mole drainage system
   e) Well development
   f) Conjunctive use of surface water and groundwater
   g) Torrents
   h) Compression ignition

2. **Differentiate between *any five* of the following**   (5x5=25)
   a) Disk angle and tilt angle
   b) Chisel Plough and Duck Foot cultivator
   c) 'Reaper', 'Mower' and 'Reaper Binder'
   d) Notches and weirs
   e) Bench terracing and broad base terracing
   f) Consumptive use and conjunctive use
   g) Interceptor drainage and relief drainage
   h) Stanchion and loose housing barns

3. **Answer *any two* questions out of the following:**   (2x10=20)
   a) What are different methods of controlling detonation (knocking) in an I.C. engine? Describe them in brief.

   b) Discuss the unit operations performed in paddy production system in Sikkim along with different equipment's used. What other equipment's can be used in paddy production system.

   c) What are the main constraints for selection, installation and maintenance of electric motors?

4. **Answer any two questions out of the following:**   (2x15=30)

   a) How will you prepare a "ground water basin management and conjunctive use plan" for the optimum development of water resources of any basin and their management? Describe it step by step.

   b) A diesel fuel contains 85% Carbon, 15% Hydrogen an API gravity as 40. If it is consumed at the rate of 6.5L per 85 mins, calculate
      i)   Air-fuel ratio
      ii) air admitted into cylinder per minute
      iii) fuel water ratio by weight

      assume that the complete combustion takes place at 15.5 degree celcius and 1.02 kg/cm2 pressure of mixture.

   c) Enumerate the conditions under which permanent gully control structures are recommended. Illustrate your answer with suitable examples and proper diagrams