Discipline   : Agricultural Engineering *(Soil and Water Conservation Engineering)*

Discipline Code : 03; *Sub code-03*   Roll No.

Please Note:

(i) This question paper contains 12 pages. **Please check whether all the pages are printed in this set.** Report discrepancy, if any, **immediately** to the invigilator.

(ii) *There shall be NEGATIVE marking for WRONG answers in the Multiple Choice type questions (No. 1 to 130) which carry one mark each. For every wrong answer 0.25 mark will be deducted.*

PART – I (General Agriculture)

Multiple choice questions (No. 1 to 30). Choose the correct answer (a, b, c or d) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

1. Which of the following crops have been approved for commercial cultivation in India?
a) Bt cotton and Bt brinjal
b) Bt cotton and Golden Rice
c) Bt maize and Bt cotton
d) Bt cotton only

2. This year (2010-11) the expected food grain production in India is
a) 212 million tonnes
b) 220 million tonnes
c) 235 million tonnes
d) 250 million tonnes

3. The genome of which of the following crops is still not completely sequenced?
a) Rice
b) Soybean
c) Sorghum
d) Wheat

4. According to the Approach Paper to the 12th Five Year Plan, the basic objective of the 12th Plan is
a) Inclusive growth
b) Sustainable growth
c) Faster, more inclusive and sustainable growth
d) Inclusive and sustainable growth

5. To address the problems of sustainable and holistic development of rainfed areas, including appropriate farming and livelihood system approaches, the Government of India has set up the
a) National Rainfed Area Authority
b) National Watershed Development Project for Rainfed Areas
c) National Mission on Rainfed Areas
d) Command Area Development and Water Management Authority

6. Which of the following sub-schemes are not covered under the Rashtriya Krishi Vikas Yojana?
a) Extending the Green Revolution to eastern India
b) Development of 60,000 pulses and oilseeds villages in identified watersheds
c) National Mission on Saffron
d) National Mission on Bamboo

7. The minimum support price for the common variety of paddy announced by the Government of India for the year 2010-11 was
a) ₹ 1030
b) ₹ 1000
c) ₹ 980
d) ₹ 950

8. According to the Human Development Report 2010 of the United Nations, India's rank in terms of the human development index is
a) 119
b) 134
c) 169
d) 182

9. Which of the following does not apply to SRI method of paddy cultivation?
a) Reduced water application
b) Reduced plant density
c) Increased application of chemical fertilizers
d) Reduced age of seedlings

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

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

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

13. Ergot disease is caused by which pathogen on which host?
a) *Claviceps purpurea* on rye
b) *Puccinia recondita* on wheat
c) *Drechlera sorokiniana* on wheat
d) *Albugo candida* on mustard

14. Rocks are the chief sources of parent materials over which soils are developed. Granite, an important rock, is classified as
a) Igneous rock
b) Metamorphic rock
c) Sedimentary rock
d) Hybrid rock

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

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

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

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

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

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

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

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

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

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

25. All weather phenomena like rain, fog and mist occur in
a) Troposphere
b) Mesosphere
c) Ionosphere
d) Ozonosphere

26. Which of the following elements is common to all proteins and nucleic acids?
a) Sulphur
b) Magnesium
c) Nitrogen
d) Phosphorous

27. Silt has intermediate characteristics between
a) Sand and loam
b) Clay and loam
c) Loam and gravel
d) Sand and clay

28. Certified seed is produced from
a) Nucleus seed
b) Breeder seed
c) Foundation seed
d) Truthful seed

29. Seedless banana is an
a) Autotriploid
b) Autotetraploid
c) Allotriploid
d) Allotetraploid

30. Which one of the following is used to test the goodness-of-fit of a distribution?
a) Normal test
b) t-test
c) Chi-square test
d) F-test

PART – II *(Subject Paper)*

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

31. The series $a+ar+ar^2+...+ar^{n-1}$ is a
a) Geometric series
b) Harmonic series
c) Logarithmic series
d) Taylor's series

32. The instrument used to measure the area of a map is known as
a) Dumpy level
b) Theodolite
c) Plannimeter
d) Current meter

33. Initial velocity of an object is 2 m/s. How much will it travel in 10 seconds if acceleration is 4 m/sec/sec?
a) 20 m
b) 80 m
c) 180 m
d) 220 m

34. Bourdon gauge is a device to measure
a) Torque
b) Force
c) Acceleration
d) Pressure

35. A thermostat is used for
a) Temperature control
b) Temperature measurement
c) Lowering the temperature
d) Increasing the temperature

36. Solar cells are made of
a) Aluminium
b) Silicon
c) Radium
d) Platinum

37. The equation $x^2+ix+1=0$, where $i=\sqrt{-1}$ has
a) Two real roots
b) Two imaginary roots
c) One real and one imaginary root
d) Infinite number of roots

38. The slope of curve $Y=(5/3)x^2$ at $x=2$ is given by
a) 5/3
b) 10/3
c) 20/3
d) 10

39. The sum of a complex number (a+ib) and that of its conjugate complex number is equal to
a) a
b) 2a
c) 2a+2b
d) 2a-2b

40. For the condition when θ tends to zero, the value of Sin θ tends to
a) Cos θ
b) Tan θ
c) Cot θ
d) Sec θ

41. The system of linear equation
    x+3y=4
    2x+6=7
    has
a) Unique solution
b) Many solutions
c) No solution
d) Imaginary solution

42. The objective function $z = x^2 + 2/x^2$ with unconstrained x
a) has a minimum finite value only
b) has a maximum finite value only
c) has both a minimum and a maximum value
d) cannot be optimized

43. Light year is the unit of
a) Time
b) Distance
c) Light intensity
d) Speed of rotation

44. If $\sin \lambda = 1/2$, the value of $\cot \lambda$ will be
a) $\sqrt{3}$
b) $1/\sqrt{3}$
c) $\sqrt{3}/2$
d) $1/\sqrt{2}$

45. Photosynthesis in plants takes place in the radiation wavelength of
a) 200-500 nm
b) 300-600 nm
c) 400-700 nm
d) 500-800 nm

46. $Y^2 = 4ax$ is the form of equation of a
a) Straight line
b) Circle
c) Parabola
d) Ellipse

47. Consider two vectors $\vec{F_1} = 2\hat{i} + 5\hat{k}$ and $\vec{F_2} = 3\hat{j} + 4\hat{k}$. The magnitude of the scalar product of these vectors is
a) 20
b) 23
c) $(33)^{1/2}$
d) 26

48. $(d/dx) \tan^{-1} x^2$ is
a) $2x/(1+x^2)$
b) $2x/(1+x^4)$
c) $2x \sec^2 x$
d) $2x/(\sec x^2)$

49. An iron ball and a wooden ball of the same radius are released from a height 'h' in vacuum. The time taken by both of them to reach ground are
a) Unequal
b) Exactly equal
c) Roughly equal
d) Zero

50. LVDT is
a) Linear variable differential transducer
b) Least variable dual transformer
c) Least variable differential transducer
d) Linear variable differential transformer

51. The first derivative of e^{x^2} w.r.t. x is
a) e^{x^2}
b) $2x\, e^{x^2}$
c) $x^2 e^{x^2}$
d) e^{x^2}/x^2

52. Bernoulli's equation relates
a) Total energies at two points
b) Kinetic energies at two points
c) Potential energies at two points
d) Discharges at two points

53. A catchment area produces runoff as 40% of the rainfall. If the rainfall is 5 cm and the catchment area is 100 ha, the capacity of the pond to store the entire runoff is
a) 200 m^3
b) 500 m^3
c) 2,000 m^3
d) 20,000 m^3

54. Seepage loss in irrigation network is
a) Desirable as it contributes to ground water recharge
b) Desirable as it protects the overtopping of canal bank
c) Contributes to the irrigation by subsurface flow
d) Undesirable as it causes water table rise and salinity problem

55. Super critical flow in a flume is one for which the value of F is
a) Less than 1
b) 1
c) Greater than 1
d) No relation

56. For open channel flow measurement under partially submerged flow condition, the best device is
a) V-notch
b) Parshall flume
c) Weir
d) Orifice meter

57. Irrigation channels are usually designed for
a) Steady and uniform flow
b) Unsteady and uniform flow
c) Unsteady and non-uniform flow
d) Steady and non-uniform flow

58. Irrigation efficiencies in the command area is approximately
a) 20%
b) 30%
c) 40%
d) 60%

59. The catchment area of a reservoir lies in its
a) Upstream
b) Downstream
c) No relation
d) None of the above

60. The equation: $\delta^2\phi/\delta x^2 + \delta^2\phi/\delta y^2 =0$, when ϕ is the velocity potential and x and y are mutually perpendicular space coordinates, is known as
a) Boussinesque equation
b) Navier-Stokes' equation
c) Laplace equation
d) Darcy's equation

61. A rainfall simulator is useful in studying
a) Wind effect on rainfall
b) Space distribution of rainfall
c) Drop size distribution of rainfall
d) Soil erosion

62. The H-Q curve of a centrifugal pump is
a) Horizontal
b) Vertical
c) Rising
d) Falling

63. The area under a hydrograph represents the
a) Watershed area
b) Peak runoff rate
c) Average runoff rate
d) Volume of runoff

64. Coshocton wheel is used for
a) Sediment sampling
b) Flow measurement
c) Water lifting
d) Hydel power generation

65. The curve number for watershed runoff estimation varies between
a) -100 to 100
b) 0 to 100
c) 10 to 100
d) 100 to 200

66. Drainage density of a watershed is the ratio of
a) Total number of streams to watershed area
b) Total length of streams to watershed area
c) Total number of streams to total length of streams
d) Total length of streams to total number of streams

67. The term CAD stands for
a) Computerized Access of Data
b) Canal Approaching Drop
c) Canal Alignment Domain
d) Command Area Development

68. Occurrence of ground water can be detected by
a) Water meter
b) Current meter
c) Neutron meter
d) Resistivity meter

69. A drop spillway is used for
a) Erosion control
b) Flow measurement
c) Flow regulation
d) Flow diversion

70. A plot between rainfall intensity versus time is called as
a) Hydrograph
b) Mass curve
c) Hyetograph
d) Isohyet

71. Mathematical equation used to describe saturated-unsaturated flow of water in drip irrigation
a) Richard equation
b) Continuity equation
c) Bernoulli's theorem
d) Laplace equation

72. Irrigation frequency is a function of
a) Crop only
b) Soil only
c) Crop and soil only
d) Crop, soil and climate

73. A soil sample has porosity of 40 percent, its void ratio is
a) 0.06
b) 0.28
c) 0.40
d) 0.66

74. Salinity of irrigation water is measured by
a) SAR value
b) Electrical conductivity value
c) pH value
d) ESP value

75. Open channel flow is said to be uniform when
a) dy/dx=0
b) dy/dt=0
c) dv/dt=constant
d) dv/dx=constant

76. A cipolletti weir is a trapezoidal weir having side slope of
a) 1:2
b) 1:3
c) 1:4
d) 1:1

77. An automatic stream flow recorder chart gives the record of
a) Discharge vs. Time
b) Velocity vs. Time
c) Stage vs. Time
d) Discharge vs. Stage

78. Practically which of the following type of flow cannot occur
a) Steady and uniform
b) Steady and non-uniform
c) Unsteady and uniform
d) Unsteady and non-uniform

79. PF is defined as
a) The logarithm of negative pressure head in cm of water
b) Logarithm of pressure head in cm of water
c) Pressure head in cm of water
d) None of the above

80. Drip irrigation is recommended when the water is saline because
a) Total water used in drip system is very small
b) Atleast area between plants will be saved from becoming saline
c) Due to continuous but low discharge, high salt concentration cannot build up near the root
d) As and when need, fresh water can be pumped through the system to flush out the salts

81. Warabandi refers to
a) Giving irrigation by turns
b) Rectangulation of fields
c) Land consolidation
d) A water law evicted by Warren Hastings

82. Combined use of surface and groundwater for crop production is called
a) Consumptive use
b) Conjunctive use
c) Joint use
d) Optimal use

83. In surge irrigation, water is released to the field
a) Under pressure
b) Continuously
c) Intermittently
d) Below the surface

84. Gabions are used for
a) Flood control
b) Flow measurement
c) Storage of runoff
d) Gully stabilization

85. Drip irrigation is most suitable for irrigating
a) Paddy
b) Wheat
c) Cotton
d) Orchard

86. A tile-drainage network is effective in
a) Controlling water table
b) Controlling weed growth
c) Controlling evapotranspiration losses
d) Removing the profile water

87. The Hooghoudt's equation for spacing of drains is applicable to
a) Any type of soil
b) Only for sandy soil
c) Non-homogeneous soil
d) A homogeneous soil with an impermeable layer below it

88. A Persian wheel is a
a) Water lifting device
b) Device to generate electricity from water power
c) Wind mill wheel
d) Water distribution device

89. Establishment of shelterbelt reduces
a) Flood
b) Drought
c) Incoming radiation
d) Wind erosion

90. Total energy line (TEL) represents the sum of
a) Pressure head and kinetic head
b) Kinetic head and datum head
c) Pressure head and datum head
d) Pressure head, kinetic head and datum head

91. The head loss due to friction when water flows through a pipe is proportional to
a) Velocity
b) Square of velocity
c) Square root of velocity
d) Reciprocal of velocity

92. A rice field is irrigated by
a) Border method
b) Basin method
c) Furrow method
d) Corrugation

93. Strip cropping consists of
a) Growing crops along the slope
b) Growing crops across the slope
c) Alternate strips of row and close growing crops
d) None of the above

94. For soil conservation purpose, the land is usually classified in
a) 4 classes
b) 6 classes
c) 8 classes
d) 10 classes

95. At saturation a clay soil will hold more water than a sandy soil due to
a) Ink bottle effect
b) Clay particles are charged
c) Clay has high porosity
d) Clay has large pores

96. Which technology is used in locating a point on the earth surface?
a) GIS
b) GPS
c) RBD
d) Split Plot Design

97. Ground water recharge by surface flooding of water is governed primarily by
a) Infiltration rate
b) Transmissivity
c) Hydraulic conductivity
d) Storage coefficient

98. The most wind erosion prone state in the country is
a) Gujarat
b) Rajasthan
c) Punjab
d) Karnataka

99. Soil erosion, if detected in the toe region of an earth dam, can be checked by
a) Compaction
b) Grass lining
c) Flattening the downstream slope
d) Stone pitching

100. The term PRA stands for
a) Planned Resource Allocation
b) Probable Resource Allocation
c) People's Response Analysis
d) Participatory Rural Appraisal

101. If V is velocity and I is hydraulic gradient, then in the relation V=KI, K has the dimension of
a) LT^{-1}
b) Dimensionless
c) T^{-1}
d) LT^{-2}

102. An axial flow pump is ideal for
a) Low discharge
b) High discharge
c) Pumping from tubewell
d) Pumping from dug well

103. The concept of equivalent depth in subsurface tile drainage was given by
a) Hooghoudt
b) Kirkham
c) Glover
d) Ernst

104. The runoff from a watershed of 18 ha area having rainfall intensity of 10 cm/h and runoff coefficient 0.3 is
a) $0.5 \ m^3/s$
b) $1.0 \ m^3/s$
c) $1.5 \ m^3/s$
d) $3.0 \ m^3/s$

105. Which of the following is a dimensionless number?
a) Manning's coefficient, 'n'
b) Pipe friction factor, 'f'
c) Chezy's coefficient, 'c'
d) Hazen-William coefficient, 'Cn'

106. The specific yield for an unconfined aquifer is
a) Greater than porosity
b) Less than porosity
c) Equal to porosity
d) Unrelated to porosity

107. A lysimeter is used to measure
a) Evaporation
b) Evapotranspiration
c) Infiltration
d) Seepage

108. Wells that are used for obtaining only fresh water from fresh water aquifer under lain with deep brackish water aquifer, are called
a) Cavity wells
b) Bore wells
c) Skimming wells
d) Semi artesian wells

109. Sprinkler irrigation is ideally suited when
a) Wind velocity is high
b) Water is abundant
c) Land is flat
d) Soil is light

110. A centrifugal pump delivers 10 L/sec against a total head of 7.5 m. The water power is
a) 1 kw
b) 0.746 kw
c) 10 kw
d) 7.5 kw

111. The ratio of inertia forces to gravitational forces is called
a) Reynold's number
b) Froude number
c) Euler number
d) Weber number

112. A tensiometer is used to measure
a) Tensile strength of a wire
b) Moisture content of soil
c) Moisture content of leaves
d) Tensile strength of concrete

113. The term saltation refers to
a) Salt movement
b) Salinization of soil
c) Soil particle movement
d) Reclamation of saline soil by growing salt resistant plants

114. The water table is measured using a device
a) Pitot tube
b) Piezometer
c) Anemometer
d) Manometer

115. The instrument TDR is used to determine
a) Radiation
b) Wind velocity
c) Soil moisture
d) Transverse Diffusion Rate

116. In runoff estimation by Curve Number method, the abbreviation AMC stands for
a) Actual Moisture Content
b) Available Moisture Content
c) Average Moisture Content
d) Antecedent Moisture Condition

117. An unconfined aquifer is also known as
a) Artesian aquifer
b) Water table aquifer
c) Leaky aquifer
d) Perched aquifer

118. Curve number represents
a) Rainfall property
b) Watershed feature
c) Runoff trend
d) Stream flow feature

119. The relationship between particle density (ρ_s), bulk density (ρ_b) and porosity (n) can be expressed by the following relationship

a) $n = 1 + \dfrac{\rho_b}{\rho_s}$

b) $n = 1 - \dfrac{\rho_b}{\rho_s}$

c) $n = \dfrac{\rho_b}{\rho_s}$

d) $n = 2 - \dfrac{\rho_b}{\rho_s}$

120. At critical condition of flow
a) Specific energy is minimum
b) Specific force is maximum
c) Viscous force is minimum
d) Total force is maximum

121. Common method of estimating soil erosion by water is
a) Water measurement
b) Runoff sampling
c) Soil sampling
d) Visual observation

122. The cumulative infiltration equation is
$I = 2t^{0.5}$ (I in cm, t in minutes).
The instantaneous infiltration rate at 4 minutes from start will be
a) 0.1 cm/min
b) 0.5 cm/min
c) 1.0 cm/min
d) 1.5 cm/min

123. Mulching is used for
a) Conserving soil moisture
b) Ensuring good germination
c) Preventing soil compaction
d) Increasing irrigation application efficiency

124. The line joining the static water levels in several wells, excavated through a confined aquifer, is know as the
a) Cone of depression
b) Piezometric surface
c) Perched water table
d) Hypsometric curve

125. Removal of a thin and fairly uniform layer of the soil from the land surface by runoff water is called
a) Water erosion
b) Sheet erosion
c) Glacial erosion
d) Geologic erosion

126. An average value of sustainable discharge from an open well is
a) Less than 5 l/s
b) 5-10 l/s
c) 10-15 l/s
d) More than 15 l/s

127. The intensity of rainfall varies
a) Directly with duration of rainfall
b) Inversely with duration of rainfall
c) Exponentially with duration of rainfall
d) No relation is established

128. Stream gauging can generate
a) Hygrograph
b) Hydrograph
c) Hyetograph
d) Hype-O-graph

129. Terracing is done mainly to
a) Make the hill top accessible
b) Reduce earthwork
c) Increase the beauty of hills
d) Conserve soil and water

130. *In situ* hydraulic conductivity is determined by
a) Pumping test
b) Permeameter
c) Double ring infiltrometer
d) Auger hole method

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) Filtration unit
ii) LT^{-1}
iii) Mulching

iv) Reynold's number
v) Hydraulic gradient

a) Laminar flow
b) Arid & semi-arid regions
c) Ground water recharge shaft
d) Darcy's law
e) Hydraulic conductivity

132.
i) Force
ii) Acceleration
iii) Power
iv) Viscosity
v) Stress

a) $[ML^{-1}T^{-1}]$
b) $[ML^2T^{-3}]$
c) $[ML^{-1}T^{-2}]$
d) $[LT^{-2}]$
e) $[MLT^{-2}]$

133.
i) Ring infiltrometer
ii) Flow control
iii) Tensiometer
iv) Curve number
v) Current meter

a) Regulator
b) Infiltration rate
c) Soil moisture
d) Surface runoff
e) Velocity of flow

134.
i) Central Arid Zone Research Institute
ii) Indian Grassland & Fodder Research Institute
iii) Central Research Institute for Dryland Agriculture
iv) Directorate of Water Management Research
v) Central Soil Salinity Research Institute

a) Karnal
b) Bhubaneshwar
c) Jhansi
d) Hyderabad
e) Jodhpur

135.
i) Kirpich formula
ii) Kostiakov formula
iii) Jacob-Hantush method
iv) Sherman
v) Kennedy theory

a) Canal design
b) Aquifer parameters
c) Unit hydrograph theory
d) Time of concentration
e) Infiltration depth

136.
i) Irrigation
ii) Drainage
iii) Water pumping
iv) Soil conservation
v) Water resources

a) Terrace
b) Surge
c) Foot valve
d) Land reclamation
e) Dam

137.
i) Infiltration
ii) Sunshine
iii) Rainfall

iv) Parshall flume
v) Pressure compensating device

a) Discharge measurement
b) Raingauge
c) Campbell-stroke's recorder
d) Drip irrigation
e) Phillips

138.
i) IUH
ii) Manning's equation
iii) Work
iv) Force
v) Power

a) Watts
b) Newtons
c) Hydrograph
d) Erg
e) Velocity

139.
i) Computer
ii) Latitude
iii) Simulation
iv) Water balance
v) Hydraulic jump

a) Stilling basin
b) Model
c) Day length
d) Logic
e) Rainfall

140.
i) Return period
ii) Weathering
iii) Tile drain
iv) Vertical drain
v) Mohr circle

a) Filter
b) Tubewell
c) Design rainfall
d) Stress analysis
e) Rock

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 canal is carrying 1 m³/sec flow and the electrical conductivity of the water is 0.2 dS/m. It is proposed to supplement the canal flow by pumping ground water which has a salinity of 3 dS/m. If the maximum permissible salinity of the mixed water is 0.5 dS/m, find the number of the tubewells that may be commissioned, each with a capacity to discharge 20 L/sec.

142. Why and how is a tubewell developed?

143. Draw and explain typical characteristics curve of a centrifugal pump.

144. Name the different components of a total hydrograph and explain with the help of neat sketches how are these components found?

145. What is a critical flow? Why the criticality of flow is essential in developing head discharge relationship of flow in an open channel?
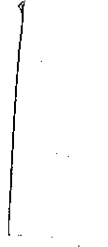
146. Estimate the specific surface area of a soil particle resembling the shape of a sphere with radius 0.03 mm contained in a cubical packing.