

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF ASSISTANT SOIL CONSERVATION ENGINEER (ASCE) UNDER LAND RESOURCES, SOIL & WATER CONSERVATION DEPARTMENT GOVERNMENT OF MIZORAM. FEBRUARY, 2021

CIVIL ENGINEERING PAPER - II

Time Allowed : 2 hours

Full Marks : 200

All questions carry equal marks of 2 each.

Attempt all questions.

- The unit of dynamic viscosity of a fluid is:
(a) m^2/s (b) $\text{Pa s}/\text{m}^2$
(c) $\text{kg s}^2/\text{m}^2$ (d) Ns/m^2
- The stream function for a two-dimensional flow is given by $\psi = 2xy$, the resultant velocity at the point P (2,3) is:
(a) 4 (b) 6
(c) 7.2 (d) 10
- X component of velocity in a 2-D incompressible flow is given by $u = y^2 + 4xy$. If Y component of velocity 'v' equals zero at $y = 0$, the expression for 'v' is given by:
(a) $4y$ (b) $2y^2$
(c) $-2y^2$ (d) $2xy$
- A velocity field is given as $V = 2y\hat{i} + 3x\hat{j}$ where x and y are in metres. The acceleration of a fluid particle at $(x, y) = (1, 1)$ in the x direction is:
(a) 0 (b) 5 m/s^2
(c) 6 m/s^2 (d) 8.48 m/s^2
- A flow through a long pipe at constant rate is called:
(a) steady uniform flow (b) steady non-uniform flow
(c) unsteady uniform flow (d) unsteady non-uniform flow
- The imaginary line drawn in the fluid in such a way that the tangent to any point gives the direction of motion at that point, is known as:
(a) pathline (b) streamline
(c) streakline (d) potential line
- According to Bernoulli's equation:
(a) $Z + \frac{p}{w} + \frac{v^2}{2g} = \text{constant}$ (b) $Z + \frac{p}{w} - \frac{v^2}{2g} = \text{constant}$
(c) $Z - \frac{p}{w} + \frac{v^2}{2g} = \text{constant}$ (d) $Z - \frac{p}{w} - \frac{v^2}{2g} = \text{constant}$
- Bernoulli's equation is applied to:
(a) venturimeter (b) orifice meter
(c) pitot tube (d) all of the above

9. Coefficient of discharge is equal to:
- (a) coefficient of contraction \times coefficient of velocity
 - (b) coefficient of contraction \times coefficient of resistance
 - (c) coefficient of resistance \times coefficient of velocity
 - (d) coefficient of contraction / coefficient of resistance
10. The discharge over a rectangular notch is:
- (a) inversely proportional to $H^{3/2}$
 - (b) directly proportional to $H^{3/2}$
 - (c) inversely proportional to $H^{5/2}$
 - (d) directly proportional to $H^{5/2}$
11. A channel is said to be of most economical cross-section, if:
- (a) it gives maximum discharge for a given cross-sectional area and bed slope
 - (b) it has maximum wetted perimeter
 - (c) it involves lesser excavation for the designed amount of discharge
 - (d) all of the above
12. If pressure at a point is same in all directions for a fluid in motion, then the fluid is:
- (a) a real fluid
 - (b) a Newtonian fluid
 - (c) an ideal fluid
 - (d) a Non-Newtonian fluid
13. Critical depth at a section of a rectangular channel is 1.5 m. The specific energy at that section is:
- (a) 0.75 m
 - (b) 1.0 m
 - (c) 1.5 m
 - (d) 2.25 m
14. For subcritical flow in an open channel, the control section for gradually varied flow profile is:
- (a) at the downstream end
 - (b) at the upstream end
 - (c) at both ends
 - (d) at any intermediate section
15. A rectangular open channel of width 4.5 m is carrying a discharge of $100 \text{ m}^3/\text{sec}$. The critical depth of the channel is:
- (a) 7.09 m
 - (b) 3.69 m
 - (c) 2.16 m
 - (d) 1.31 m
16. The critical depth for a channel is given by:
- (a) $\left(\frac{q}{g}\right)^{1/2}$
 - (b) $\left(\frac{q}{g}\right)^{1/3}$
 - (c) $\left(\frac{q}{g}\right)^{1/4}$
 - (d) $\left(\frac{q}{g}\right)^{1/5}$
17. In the model of a highway bridge constructed to a scale of 1:25, the force of water on the pier was measures to be 1 kg. The force on the prototype pier will be:
- (a) 15003 kg
 - (b) 15245 kg
 - (c) 15625 kg
 - (d) 15833 kg
18. Which of the following factors are non-dimensional?
- (a) C in Chezy's equation
 - (b) $\frac{V}{\sqrt{gL}}$ used in estimating wave making drag
 - (c) $\frac{H}{N^2 D^2}$ employed in comparing performance of pumps
 - (d) $\frac{Q^2}{D^5}$ employed in computations in pipe networks

19. Which one of the following can be used to check inconsistency of rainfall data?
- (a) Normal ratio method (b) Mass curve method
(c) Double mass curve method (d) Depth duration frequency curve
20. The Penmann's evapo-transpiration equation is based on:
- (a) water budget method (b) energy balance method
(c) mass transfer method (d) energy balance and mass transfer
21. An isohyet is a line joining points having:
- (a) equal evaporation value (b) equal barometric pressure
(c) equal height above MSL (d) equal rainfall depth in a given duration
22. A plot between rainfall intensity vs time is called as:
- (a) hydrograph (b) mass curve
(c) hyetograph (d) isohyet
23. The relation between duty (D) in hectares/cumec, delta (Δ) in metres and base period (B) in days is:
- (a) $\Delta = \frac{8.64B}{D}$ (b) $\Delta = \frac{86.4B}{D}$
(c) $\Delta = \frac{864B}{D}$ (d) $\Delta = \frac{8640B}{D}$
24. Annual runoff volume of 116.8 Mm³ from a catchment of area 180 km² represents an annual runoff depth of:
- (a) 649 cm (b) 6.49 cm
(c) 64.9 cm (d) 6.49 m
25. The duty of a crop is 432 hectares per cumec when the base period of the crop is 100 days. The delta of the crop will be:
- (a) 100 cm (b) 200 cm
(c) 432 mm (d) 864 cm
26. The flow-mass curve is an integral curve of:
- (a) the hydrograph (b) the hyetograph
(c) the flow duration curve (d) the S-curve
27. The shape of recession limb of a hydrograph depends upon:
- (a) basin characteristics only (b) storm characteristics only
(c) both (a) & (b) (d) none of the above
28. Infiltration capacity of soil depends upon:
- (a) number of voids present in the soil (b) shape and size of soil particles
(c) arrangement of soil particles (d) all of the above
29. The area between the two isohyets 40 cm and 50 cm is 100 km², and that between 50 cm and 60 cm is 150 km². What is the average depth of annual precipitation over the basin of 250 km²?
- (a) 50 cm (b) 51 cm
(c) 52 cm (d) 60 cm
30. The double mass curve technique is used:
- (a) to find average rainfall over a number of years
(b) to estimate the missing rainfall data
(c) to check the consistency of rain gauge records
(d) to find the minimum number of rain gauges required in a basin

31. The best estimate of runoff represented by 36 mm of runoff depth from a basin area 2400 km² is:
(a) 1000 cumec-days (b) 2400 cumec-days
(c) 3600 cumec-days (d) 2000 cumec-days
32. The probability of a 10 year flood to occur at least once in the next 4 years is:
(a) 45% (b) 35%
(c) 30% (d) 20%
33. The Muskingham method of flood routing is a:
(a) form of hydraulic routing of a flood
(b) form of reservoir routing
(c) complete numerical solution of St. Venant equations
(d) hydrological channel routing method
34. An aquifer confined at the bottom but not at the top is called:
(a) semiconfined aquifer (b) unconfined aquifer
(c) confined aquifer (d) perched aquifer
35. The surface joining the static water levels in several wells penetrating a confined aquifer represents:
(a) water table surface (b) capillary fringe
(c) piezometric surface of the (d) cone of depression aquifer
36. A geological formation which is essentially impermeable for flow of water even though it may contain water in its pores is called:
(a) aquifer (b) aquifuge
(c) aquitard (d) aquiclude
37. The volume of water that can be extracted by force of gravity from a unit volume of aquifer material is called:
(a) specific retention (b) specific yield
(c) specific storage (d) specific capacity
38. In one-dimensional flow in an unconfined aquifer between two water bodies, when there is a recharge, the water profile is:
(a) a parabola (b) part of an ellipse
(c) a straight line (d) an arc of a circle
39. The dimension of the storage coefficient S is:
(a) L³ (b) LT⁻¹
(c) L³/T (d) dimensionless
40. The dimension of transmissibility T is:
(a) L²/T (b) L³T²
(c) L/T² (d) dimensionless
41. The water obtained from the tube wells is known as:
(a) surface water (b) sub-surface water
(c) run-off (d) potable water
42. The vertical wells provided along the banks of a river to draw ground water in dry season are called:
(a) open wells (b) tube wells
(c) artesian wells (d) infiltration wells
43. For large cities, the suitable method for forecasting population is:
(a) arithmetical increase method (b) graphical method
(c) geometrical increase method (d) comparative method

44. Which one of the following factors has the maximum effect on figure of per capita demand of water supply of a given town?
- (a) method of charging of the consumption (b) quality of water
(c) system of supply-intermittent or continuous (d) industrial demand
45. The finely divided dispersion of solid particles which are not visible to the naked eye and cannot be removed by ordinary filters are known as:
- (a) suspended impurities (b) dissolved impurities
(c) colloidal impurities (d) none of these
46. The presence of calcium and magnesium bi-carbonates in water causes:
- (a) hardness (b) turbidity
(c) changes in colour (d) none of these
47. Suspended impurities consists of:
- (a) iron (b) chlorine
(c) bacteria (d) all of these
48. Which one of the following would contain water with the maximum amount of turbidity?
- (a) rivers (b) lakes
(c) oceans (d) wells
49. The most common cause of acidity in water is:
- (a) carbon monoxide (b) nitrogen
(c) hydrogen (d) carbon dioxide
50. The concentration of OH⁻ ion in a water sample is measured as 17 mg/L at 25°C. What is the pH of the water sample?
- (a) 10 (b) 11
(c) 12 (d) 13
51. Uniformity coefficient of filter sand is given by:
- (a) $\frac{D_{50}}{D_5}$ (b) $\frac{D_{50}}{D_{10}}$
(c) $\frac{D_{60}}{D_5}$ (d) $\frac{D_{60}}{D_{10}}$
52. In a water treatment plant, dissolved iron and manganese can be removed from the water by:
- (a) aeration (b) aeration and coagulation
(c) aeration and flocculation (d) aeration and sedimentation
53. Zero hardness of water is achieved by:
- (a) lime soda process (b) excess lime treatment
(c) ion exchange treatment (d) excess alum and lime treatment
54. The most commonly used absorbent used in water and waste water treatment is:
- (a) sand of grain size from 0.1 to 2 mm
(b) activated carbon granules of size 0.1 to 2 mm
(c) ordinary wood shavings of fine size
(d) coal tar
55. A single rapid test to determine the pollution status of river water is:
- (a) biochemical oxygen demand (b) chemical oxygen demand
(c) total organic solids (d) dissolved oxygen

56. A wastewater sample has an initial BOD of 200 mg/L. The first order BOD decay coefficient is 0.5/day. The BOD consumed (in mg/L) in 5 days is:
- (a) 150 (b) 184
(c) 30 (d) 50
57. Total Kjeldahl nitrogen is a measure of:
- (a) total organic nitrogen (b) total organic and ammonia nitrogen
(c) total ammonia nitrogen (d) total inorganic and ammonia nitrogen
58. The ultimate BOD value of a waste:
- (a) increases with temperature (b) decreases with temperature
(c) remains the same at all temperatures (d) doubles with every 10°C rise in temperature
59. From ecological considerations, the minimum level of Dissolved Oxygen (DO) necessary in the rivers and streams is:
- (a) 1 mg/L (b) 2 mg/L
(c) 4 mg/L (d) 8 mg/L
60. The best method suitable for disposal of plastic and rubber waste is:
- (a) composting (b) incineration
(c) pyrolysis (d) sanitary landfill
61. A Pelton wheel is:
- (a) tangential flow impulse turbine (b) inward flow impulse turbine
(c) outward flow impulse turbine (d) inward flow reaction turbine
62. The hydraulic efficiency of an impulse turbine is:
- (a) ratio of actual power produced by the turbine to the energy supplied by the turbine
(b) ratio of actual work available at the turbine to the energy imparted to the wheel
(c) ratio of work done on the wheel to the energy of the jet
(d) none of the above
63. The maximum hydraulic efficiency of an impulse turbine is (where ϕ is angle of blade tip at outlet):
- (a) $\frac{1 + \cos \phi}{2}$ (b) $\frac{1 - \cos \phi}{2}$
(c) $\frac{1 + \sin \phi}{2}$ (d) $\frac{1 - \sin \phi}{2}$
64. The jet ratio is defined as the ratio of:
- (a) diameter of jet to the diameter of Pelton wheel
(b) velocity of jet to the velocity of Pelton wheel
(c) diameter of Pelton wheel to the diameter of jet
(d) velocity of Pelton wheel to the velocity of jet
65. In a reciprocating pump, air vessels are used to:
- (a) smoothen the flow (b) reduce suction head
(c) increase delivery head (d) reduce acceleration head
66. Discharge of a centrifugal pump is:
- (a) directly proportional to diameter of impeller
(b) inversely proportional to diameter of impeller
(c) directly proportional to square of diameter of impeller
(d) inversely proportional to square of diameter of impeller

67. Which of the following pump is successfully used for lifting water from deep wells?
- (a) centrifugal pump (b) reciprocating pump
(c) jet pump (d) air lift pump
68. The specific speed of a centrifugal pump is given by:
- (a) $\frac{N\sqrt{Q}}{H^{2/3}}$ (b) $\frac{N\sqrt{Q}}{H^{3/4}}$
(c) $\frac{N\sqrt{Q}}{H}$ (d) $\frac{N\sqrt{Q}}{H^{5/4}}$
69. The specific speed of a turbine under a head of 150 m to develop 2000 HP while running at 300 rpm is:
- (a) 10-35 (b) 35-60
(c) 60-300 (d) 300-1000
70. What type of turbine is suitable to generate 8100 kW under a head of 81 m while working at a speed of 540 rpm?
- (a) Pelton (b) Kaplan
(c) Bulb (d) Francis
71. In all reaction turbines, maximum efficiency is obtained if the:
- (a) guide vane angle is 90°
(b) blade angle is 90° at the inlet
(c) blade angle is 90° at the outlet
(d) angle of the absolute velocity vector at the outlet is 90°
72. A centrifugal pump discharges 260 litres of water per second when running at 600 rpm. The impeller diameter at the outlet is 80 cm. It develops a head of 15.3 m. What is the approximate minimum starting speed?
- (a) 425 rpm (b) 450 rpm
(c) 475 rpm (d) 500 rpm
73. A centrifugal pump gives maximum efficiency when its impeller blades are:
- (a) bent forward (b) bent backward
(c) straight (d) wave shaped
74. By which one of the following, a small quantity of water may be lifted to a great height?
- (a) hydraulic ram (b) hydraulic crane
(c) hydraulic lift (d) hydraulic coupling
75. The flow ratio of a Francis turbine is defined as the ratio of the:
- (a) velocity of flow at inlet to the theoretical jet velocity
(b) theoretical velocity of jet to the velocity of flow at inlet
(c) velocity of runner at inlet to the velocity of flow at inlet
(d) none of the above
76. Multi stage centrifugal pumps are used to:
- (a) give high discharge (b) produce high heads
(c) pump viscous fluids (d) all of these
77. A pump running at 1414 rpm delivers 256 lps of water against a head of 16 m. The pump is of the:
- (a) normal speed radial type (b) double section type
(c) mixed flow type (d) axial flow type

78. A commonly used handpump is:
- (a) centrifugal pump
 - (b) reciprocating pump
 - (c) rotary pump
 - (d) axial flow pump
79. The narrow strip of land left at the ground level between the inner toe of the bank and top edge of the cutting, is known as:
- (a) free board
 - (b) dowel
 - (c) inspection roadway
 - (d) berm
80. Lining of a canal is necessary:
- (a) to minimise the seepage loss in canal
 - (b) to prevent erosion of bed and sides due to high velocities
 - (c) to increase the discharge in canal section by increasing the velocity
 - (d) all of the above
81. Sandy soils with good drainage become impermeable after prolonged use, if it is irrigated with a water containing _____ sodium.
- (a) 25%
 - (b) 50%
 - (c) 75%
 - (d) 85%
82. The pH of water suitable for irrigation purpose is:
- (a) between 3 and 6
 - (b) between 6 and 8.5
 - (c) between 8.5 and 11
 - (d) more than 11
83. Which of the salt present in water is harmful for cultivation purposes?
- (a) sodium carbonate
 - (b) potassium sulphate
 - (c) calcium sulphate
 - (d) none of these
84. A useful soil moisture for plant growth is:
- (a) capillary water
 - (b) gravitational water
 - (c) hygroscopic water
 - (d) all of these
85. The amount of water required to fill up the pore spaces in soil particles by replacing all air held in pore spaces, is known as:
- (a) field capacity
 - (b) saturation capacity
 - (c) available moisture
 - (d) all of these
86. Consumptive use of water by a crop is equal to:
- (a) the depth of water consumed by evaporation
 - (b) the depth of water consumed by transpiration
 - (c) the depth of water consumed by evaporation and transpiration during crop growth, including water consumed by accompanying weed growth
 - (d) none of the above
87. Crop ratio is the ratio of area irrigated:
- (a) in Rabi season to Kharif season
 - (b) in Kharif season to Rabi season
 - (c) under perennial crop to total crop
 - (d) under perennial crop to non-perennial crop
88. For closed growing crops (such as wheat), the method of irrigation used is:
- (a) free flooding
 - (b) border flooding
 - (c) check flooding
 - (d) basin flooding
89. The amount of precipitation is measured by:
- (a) rain gauge
 - (b) osmoscope
 - (c) turbidimeter
 - (d) all of these

90. Which of the following method is useful for obtaining values of flood discharges for a high recurrence interval?
- (a) California method (b) Hazen's method
(c) Gumbel's method (d) all of these
91. The total number of independent equations that form the Lacey's regime theory is:
- (a) 2 (b) 3
(c) 4 (d) 6
92. In a Lacey regime channel:
1. The bed load is zero.
 2. The suspended load is zero.
 3. The bed slope is a function of the full supply discharge and the silt size.
- Which of the above statements is/are correct?
- (a) 1 and 2 (b) 3 only
(c) 2 and 3 (d) 2 only
93. What is the height of wave which is likely to be generated by a wind of 80 km/hr in a reservoir having a fetch of 50 km?
- (a) 0.5 m (b) 1.0 m
(c) 2.0 m (d) 3.0 m
94. For moderate discharge of 40-60 cumecs used and low fall heights of 1 to 1.5 m, which type of fall can be generally used?
- (a) Vertical drop fall (b) Ogee fall
(c) Glacis fall (d) Baffle fall
95. A submerged pipe outlet is an example of:
- (a) semi-modular outlet (b) non-modular outlet
(c) rigid module (d) adjustable proportional module
96. In a siphon aqueduct, the worst condition of uplift on the floor occurs when:
- (a) the canal is full and the drainage is empty, with water table at drainage bed level
(b) the canal is empty and the drainage is full, with water table at drainage bed level
(c) both the canal and the drainage are full
(d) the canal is empty and the drainage is full, with water table below the floor
97. What is the regime scour depth for a channel in soil with silt factor of unity and carrying $8 \text{ m}^3/\text{s}$ of discharge intensity in accordance with Lacey's regime theory?
- (a) 3.6 m (b) 4 m
(c) 5.4 m (d) 25.6 m
98. Objective for river training are:
1. high flood discharge may pass safely through the reach
 2. sediment load (including bed and suspended load) may be transported efficiently
 3. by making the river course unstable whereby to increase bank erosion
- Select the correct answer using the codes given below:
- (a) 1, 2 and 3 (b) 1 and 2
(c) 2 and 3 (d) 1 and 3
99. The volume of water below the minimum pool level in a reservoir is known as:
- (a) useful storage (b) surcharge storage
(c) dead storage (d) bank storage

100. The water shed canal is also called:

- (a) side slope canal
- (b) contour canal
- (c) ridge canal
- (d) all of these

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