

MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF INSPECTOR OF LEGAL METROLOGY UNDER FOOD, CIVIL SUPPLIES & CONSUMER AFFAIRS DEPARTMENT, GOVERNMENT OF MIZORAM, DECEMBER, 2018

CIVIL ENGINEERING

PAPER - II

Time Allowed : 2 hours

Full Marks : 200

*All questions carry equal marks of two (2) each.
Attempt all questions.*

- For a body completely submerged in a fluid, the centre of gravity (G) and centre of Buoyancy (O) are known. The body is considered to be in stable equilibrium if
 - O does not coincide with the centre of mass of the displaced fluid
 - G coincides with the centre of mass of the displaced fluid
 - O lies below G
 - O lies above G
- Group I contains dimensionless parameter and Group II contains ratio
 - Group I**
 - P. Mach number
 - Q. Reynold number
 - R. Weber number
 - S. Froude number
 - Group II**
 1. Ratio of inertial force and gravity force.
 2. Ratio of fluid velocity and velocity of sound.
 3. Ratio of inertial force and viscous force.
 4. Ratio of inertial force and surface tension force.

Correct match of the dimensionless parameter in Group I with Group II is

 - (a) P-3, Q-2, R-4, S-1
 - (b) P-3, Q-4, R-2, S-1
 - (c) P-2, Q-3, R-4, S-1
 - (d) P-1, Q-3, R-2, S-4
- 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
- A mild-sloped channel is followed by a steep-sloped channel. The profiles of gradually varied flow in the channel are
 - (a) M3, S2
 - (b) M3, S3
 - (c) M2, S1
 - (d) M2, S2
- In the Bernoulli's equation, used in pipe flow, each term represents
 - (a) Energy per unit flow length
 - (b) Energy per unit mass
 - (c) Energy per unit volume
 - (d) Energy per unit weight
- Water flow at a depth of 0.1m with a velocity of 6 m/s in a rectangular channel. The alternate depth is
 - (a) 0.30 m
 - (b) 0.40 m
 - (c) 0.60 m
 - (d) 0.80 m

7. Cavitations is caused by
 - (a) High pressure
 - (b) High temperature
 - (c) High velocity
 - (d) Low pressure
8. The viscosity of water as compared to that of air is about
 - (a) 50 times
 - (b) 55 times
 - (c) 60 times
 - (d) 65 times
9. Turbulent flow generally occurs
 - (a) At very low velocities
 - (b) In flows of high viscous fluids
 - (c) In flows through very narrow passages
 - (d) In flow at high velocities through large passage
10. Direct step method of computation for gradually varied flow is
 - (a) applicable to non-prismatic channels
 - (b) applicable to prismatic channels
 - (c) applicable to both prismatic and non-prismatic channels
 - (d) not applicable to both prismatic and non-prismatic channels
11. A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbance on the water surface is not travelling upstream. This is because the flow in the canal is
 - (a) sub-critical
 - (b) super-critical
 - (c) steady
 - (d) uniform
12. An inert tracer is injected continuously from a point in an unsteady flow field. The locus of locations of all tracer particles at an instance of time represents
 - (a) Streamline
 - (b) Pathline
 - (c) Streamtube
 - (d) Streakline
13. The necessary and sufficient condition for a surface to be called as a 'free surface' is
 - (a) no stress should be acting on it
 - (b) tensile stress acting on it must be zero
 - (c) shear stress acting on it must be zero
 - (d) no print on it should be under any stress
14. There is a free overfall at the end of a long open channel. For a given flow rate, the critical depth is less than the normal depth. What gradually varied flow profile will occur in the channel for this flow rate?
 - (a) M1
 - (b) M2
 - (c) M3
 - (d) S1
15. For a given discharge, the critical flow depth in an open channel depends on
 - (a) channel geometry only
 - (b) channel geometry and bed slope
 - (c) channel geometry, bed slope and roughness
 - (d) channel geometry, bed slope, roughness and Reynolds number
16. Surface tension of water
 - (a) Increases with decrease in temperature
 - (b) Decreases with decrease in temperature
 - (c) Increases with increase in temperature
 - (d) Independent of temperature
17. In steady flow of a fluid, the total acceleration of any fluid particle
 - (a) Is never zero
 - (b) Is always zero
 - (c) Can be zero
 - (d) None of these

18. For steady incompressible flow through a closed-conduit of uniform cross-section, the direction of flow will always be:
- (a) from higher to lower elevation
 - (b) from higher to lower pressure
 - (c) from higher to lower velocity
 - (d) from higher to lower piezometric head
19. The locus of elevations that water will rise in a series of pitot tubes is called
- (a) The energy grade line
 - (b) The hydraulic grade line
 - (c) The pressure head
 - (d) The velocity head
20. Critical depth at a section of a rectangular channel is 1.5 m. the specific energy of that section is
- (a) 0.75 m
 - (b) 1.00 m
 - (c) 1.50 m
 - (d) 2.25 m
21. Stream function $\psi = uy - vx$ represents the
- (a) Free vortex motion
 - (b) Uniform flow inclined to x-axis
 - (c) Uniform flow parallel to x-axis
 - (d) Uniform flow parallel to y-axis
22. An isohyet is a line joining points of
- (a) equal temperature
 - (b) equal humidity
 - (c) equal rainfall depth
 - (d) equal evaporation
23. In order to prepare 2 hour unit hydrograph from a six hour unit hydrograph which of the following method is suitable?
- (a) Instantaneous unit hydrograph
 - (b) S – Curve method
 - (c) Simple unit hydrograph
 - (d) Synthetic unit hydrograph
24. Which of the following is a non-recording rain gauge?
- (a) Floating type rain gauge
 - (b) Symon's rain gauge
 - (c) Steven's weighing type rain gauge
 - (d) Tipping bucket rain gauge
25. The rain fall on five successive days were measured as 100mm,80mm,60mm,40mm and 20mm respectively. If the infiltration index or the storm loss rate for the catchment area is earlier estimated as 50mm/day, the total surface run off will be
- (a) 50mm
 - (b) 70mm
 - (c) 90mm
 - (d) 120mm
26. The water bearing strata, that is, layers of sand, ground, etc., is called
- (a) an aquifer
 - (b) an aquiclude
 - (c) an aquifuge
 - (d) zone of saturation
27. Isopleths are lines on a map through points having equal depth of
- (a) Evapotranspiration
 - (b) Infiltration
 - (c) Rainfall
 - (d) Total run off
28. The ratio of actual evapo-transpiration to potential evapo-transpiration is in the rage
- (a) 0.0 to 0.4
 - (b) 0.6 to 0.9
 - (c) 0.0 to 1.0
 - (d) 100 to 2.0
29. A watershed got transformed from rural to urban over a period of time. The effect of urbanization on storm runoff hydrograph from, the watershed is to
- (a) decrease the volume of runoff
 - (b) increase the time to peak discharge
 - (c) decrease the time base
 - (d) decrease the peak discharge

30. A dam reservoir, catering to flood control, irrigation, and water supply, although basically designed for irrigation alone, is a
- (a) Distribution reservoir
 - (b) Multipurpose reservoir
 - (c) Single purpose reservoir
 - (d) None of these
31. The ordinate of the instantaneous Unit Hydrograph (UH) of a catchment at any time t is
- (a) Difference in slope of the S-curve with effective rainfall intensity of 1 cm/hr
 - (b) The slope of the direct runoff unit hydrograph at that time
 - (c) The slope of the 1-hour unit hydrograph at that time
 - (d) The slope of the S-curve with effective rainfall intensity of 1 cm/hr
32. For determining the velocity of flow of underground water, the most commonly used non empirical formula is
- (a) Darcy's formula
 - (b) Slichter's formula
 - (c) Hazen's formula
 - (d) Lacy's formula
33. Specific capacity or yield of wells, is generally expressed as
- (a) m^3/s
 - (b) m^3/hour
 - (c) $\text{m}^3/\text{hour}/\text{m}^2$
 - (d) $\text{m}^3/\text{hour}/\text{m}^2/\text{m}$
34. Ground water from artesian wells
- (a) contains no suspended materials
 - (b) contains dissolved salts
 - (c) may be saltish and hard
 - (d) all of these
35. Fluids change the volume under external pressure due to
- (a) plasticity
 - (b) viscosity
 - (c) compressibility
 - (d) none of these
36. Co-efficient of discharge can be expressed as,
- (a) $C_c \cdot C_v$
 - (b) C_v/C_c
 - (c) C_c/C_v
 - (d) $\sqrt{C_c \cdot C_v}$
37. A piezometer is not used for pressure measurement in pipe when
- (a) the pressure is very low
 - (b) velocity of fluid is high
 - (c) velocity of fluid is low
 - (d) the fluid in the pipe is high
38. Hydrostatic pressure variation is related to
- (a) pressure variation in water only
 - (b) constancy of $[(P/\gamma) + Z]$
 - (c) pressure variation in atmosphere only
 - (d) variation of $[(P/\gamma) + Z]$
39. Shear stress develops in a fluid element, if
- (a) The fluid is at rest
 - (b) The fluid container is subjected to uniform linear acceleration
 - (c) The fluid is inviscid
 - (d) The fluid is viscous and the flow is non-uniform
40. A lysimeter is used to measure
- (a) Evaporation
 - (b) Evapotranspiration
 - (c) Infiltration
 - (d) Radiation

41. For a given discharge in an open channel, there are two depths which have the same specific energy. These two depths are known as
- (a) alternate depths (b) critical depths
(c) normal depths (d) sequent depths
42. Consider the following unit processes commonly used in water treatment; rapid mixing (RM), flocculation (F), primary sedimentation (PS), secondary sedimentation (SS), chlorination (C) and rapid sand filtration (RSF). The order of these unit processes (first to last) in a conventional water treatment plant is
- (a) PS-RSF-F-RM-SS-C (b) PS-F-RM-RSF-SS-C
(c) PS-F-SS-RSF-RM-C (d) PS-RM-F-SS-RSF-C
43. Consider four common air pollutants found in urban environments, NO, SO₂, Soot and O₃. Among these which one is the secondary air pollutant ?
- (a) O₃ (b) NO
(c) SO₂ (d) Soot
44. A coastal city produces municipal solid waste (MSW) with high moisture content, high organic materials, low calorific value and low inorganic materials. The most effective and sustainable option for MSW management in that city is
- (a) Composting (b) Dumping in sea
(c) Incineration (d) Landfill
45. Particulate matter (fly ash) carried in effluent gases from the furnaces burning fossil fuels are better removed by
- (a) Cotton bag house filter (b) Electrostatic precipitator (ESP)
(c) Cyclone (d) Wet scrubber
46. Two primary air pollutants are
- (a) sulphur oxide and ozone (b) nitrogen oxide and peroxyacetyl nitrate
(c) sulphur oxide and hydrocarbon (d) ozone and peroxyacetyl nitrate
47. Two biodegradable components of municipal solid waste are
- (a) plastics and wood (b) cardboard and glass
(c) leather and tin cans (d) food wastes and garden trimmings
48. The pressure of hardness in excess of permissible limit causes
- (a) cardio-cascular problems (b) skin discolouration
(c) calcium deficiency (d) increased laundry expenses
49. The treatment that should be given to water from a deep tube well is
- (a) Coagulation and flocculation only (b) Disinfection only
(c) Filtration only (d) Pre-settling only
50. A sample of domestic sewage is digested with silver sulphate, sulphuric acid, potassium dichromate and mercuric sulphate in chemical oxygen demand (COD) test. The digested sample is then titrated with standard ferrous ammonium sulphate (FAS) to determine the un-reacted amount of
- (a) Mercuric sulphate (b) Potassium dichromate
(c) Silver sulphate (d) Sulphuric acid
51. MPN index is a measure of one of the following
- (a) BOD (b) Coliform bacteria
(c) Dissolved oxygen content (d) Hardness

52. Chlorine is sometimes used in sewage treatment to
- (a) Avoid flocculation
 - (b) Avoid bulking of activated sludge
 - (c) Helps in grease separation
 - (d) Increase biological activity of bacteria
53. Safe water is the one which does not contain
- (a) turbidity
 - (b) any colour
 - (c) any taste
 - (d) pathogenic bacteria
54. As per Noise Pollution (Regulation and Control) Rules 2000 of India, the day time noise limit for a residential zone, expressed in dB (A) L_{eq} , is
- (a) 45
 - (b) 55
 - (c) 65
 - (d) 75
55. If the total hardness of water is greater than its total alkalinity, the carbonate hardness will be equal to
- (a) Non-carbonate hardness
 - (b) Total alkalinity
 - (c) Total hardness
 - (d) Total hardness- total alkalinity
56. Dissolved oxygen in streams is
- (a) Minimum at noon
 - (b) maximum at noon
 - (c) maximum at midnight
 - (d) same throughout the day
57. Standard EDTA (Ethylene Diamine Tetra Acetic Acid) solution is used to determine the
- (a) Dissolved oxygen in water
 - (b) Hardness in water
 - (c) Residual chlorine in water
 - (d) Turbidity in water
58. Steel pipes are
- (a) Easily affected by acidic and alkaline atmospheric effects
 - (b) Enable to withstand high negative pressure
 - (c) Liable to quick rusting
 - (d) All of these
59. The specific gravity of a sewer is
- (a) Slightly lesser than 1
 - (b) Equal to 1
 - (c) Slightly greater than 1
 - (d) Much greater than 1
60. The diameter of a circular sewer laid at a slope of 1 in 400 when it is running half full and with a velocity of 1.9 m/s (n in manning's formula = 0.012) will be
- (a) 0.012 m
 - (b) 0.70 m
 - (c) 1.12 m
 - (d) 1.23 m
61. A polluted stream undergoes self purification in four district zones:
- I. Zone of clear water
 - II. Zone of active decomposition
 - III. Zone of Degradation
 - IV. Zone of recovery
- (a) II, III, IV, I
 - (b) II, IV, III, I
 - (c) III, II, IV, I
 - (d) IV, III, II, I
62. Algae dies out, though fish life may survive, in a river zone, known as
- (a) Zone of clear water
 - (b) Zone of active decomposition
 - (c) Zone of Degradation
 - (d) Zone of recovery

63. Zone of aeration in a ground profile does not include
- (a) Capillary zone
 - (b) Intermediate zone
 - (c) Saturation zone
 - (d) Soil water zone
64. The organism, which exhibits very nearly the characteristics of an ideal pathogenic indicator is
- (a) *Entamoeba histolytica*
 - (b) *Escherichia coli*
 - (c) *Salmonella typhi*
 - (d) *Vibrio comma*

23. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I		List-II		
A. Release valve		1. Reduce high inlet pressure to lower outlet pressure		
B. Check valve		2. Limit the flow of water to single direction		
C. Gate valve		3. Remove air from the pipeline		
D. Pilot valve		4. Stopping the flow of water in the pipeline		
Codes :	A	B	C	D
(a)	3	2	4	1
(b)	4	2	1	3
(c)	3	4	2	1
(d)	1	2	4	3

66. 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
67. Which of the following sewage treatment methods has inherent problems of odour, ponding and fly nuisance ?
- (a) UASM system
 - (b) Activated sludge process
 - (c) Trickling filters
 - (d) Stabilization ponds
68. From amongst the following sewage treatment options, largest land requirements for a given discharge will be needed for
- (a) trickling filter
 - (b) anaerobic pond
 - (c) oxidation ditch
 - (d) oxidation pond
69. In disinfection, which of the following forms of chlorine is most effective in killing the pathogenic bacteria?
- (a) Cl
 - (b) OCl
 - (c) NH₂Cl
 - (d) HOCl
70. In a domestic wastewater sample, COD and BOD were measured. Generally which of the following statement is true for their relative magnitude?
- (a) COD = BOD
 - (b) COD > BOD
 - (c) COD < BOD
 - (d) Nothing can be said
71. Use of coagulants such as alum
- (a) results in reduction of pH of the treated water
 - (b) results in increase in pH of the treated water
 - (c) results in no change in pH of the treated water
 - (d) may cause an increase or decrease of pH of the treated water

72. Aeration of water is done to remove
- (a) Suspended impurities
 - (b) Colour
 - (c) Dissolved Salts
 - (d) Dissolved gases
73. The following chemical is used for coagulation
- (a) Ammonium Chloride
 - (b) Aluminium Chloride
 - (c) Aluminium Sulphate
 - (d) Copper Sulphate
74. The grit chambers of a sewage treatment plant, normally need cleaning
- (a) Every day
 - (b) Every fortnight
 - (c) Every month
 - (d) Every year
75. Composting and Lagooning are the methods of
- (a) Filtration
 - (b) Sedimentation
 - (c) Sludge digestion
 - (d) Sludge disposal
76. A flood wave with a known inflow hydrograph is routed through a large reservoir. The outflow hydrograph will have
- (a) attenuated peak with reduced time-base
 - (b) attenuated peak with increased time-base
 - (c) increased peak with increased time-base
 - (d) increased peak with reduced time-base
77. On which of the canal systems, R.G. Kennedy, executive engineer in the the Punjab Irrigation Department made his observations for proposing his theory on stable channels?
- (a) Krishna Western Delta canals
 - (b) Lower Bari Docab canals
 - (c) Lower Chenab canals
 - (d) Upper Bari Doab canals
78. When the outflow from a storage reservoir is controlled as in a freely operating spillway, the peak of outflow hydrograph occurs at
- (a) the point of intersection of the inflow and outflow hydrographs
 - (b) a point, after the intersection of the inflow and outflow hydrographs
 - (c) the tail of inflow hydrographs
 - (d) a point, before the intersection of the inflow and outflow hydrographs
78. A minor irrigation scheme involves command area, equal to or less than
- (a) 100 hectares
 - (b) 500 hectares
 - (c) 1000 hectares
 - (d) 2000 hectares
79. Wheat crop requires 55 cm of water during 120 days of base period. The total rainfall during this period is 100 mm. Assume the irrigation efficiency to be 60%. The area (in ha) of the land which can be irrigated with a canal flow of $0.01 \text{ m}^3/\text{s}$ is
- (a) 13.82
 - (b) 18.65
 - (c) 23.42
 - (d) 234.20
80. A rectangular open channel of width 5.0 m is carrying a discharge of $100 \text{ m}^3/\text{s}$. The Froude number of the flow is 0.8. The depth of flow (in m) in the channel is
- (a) 4
 - (b) 5
 - (c) 16
 - (d) 25
81. If root zone depth is 2m, existing water content is 5%, the dry density of soil is $1.5 \text{ g}/\text{cm}^3$, water applied to the soil is 500 m^3 , water loss due to evaporation etc is 10% and the area of the plot is 100 m^2 . What will be the field capacity of the soil
- (a) 5%
 - (b) 10%
 - (c) 20%
 - (d) 50%

82. For standing crops in undulating sandy fields the best method of irrigation is
(a) Basin irrigation (b) Free flooding
(c) Natural irrigation (d) None of these
83. A crop that takes more than 4 months to mature is called
(a) Cash crop (b) Hard crop
(c) Long crop (d) Solid crop
84. A canal which is aligned at right angles to the contour is called
(a) Branch canal (b) Contour canal
(c) Side slope canal (d) None of these
85. If duty (D) is 1428 hectares/m³ and base period (B) is 120 days for an irrigated crop then Delta (D) in meters is given by
(a) 0.01 (b) 0.27
(c) 0.52 (d) 0.73
86. Garrets diagrams are based on
(a) Bligh's theory (b) Kennedy's theory
(c) Khosla's theory (d) Lacey's theory
87. In Ogee shaped spillway the discharge is proportional to
(a) H (b) H^{1/2}
(c) H^{3/2} (d) H^{5/2}
88. The amount of irrigation water required to meet the evapotranspiration needs of the crop during its full growth is called
(a) Consumptive irrigation requirement (b) Effective rainfall
(c) Net irrigation requirement (d) None of these
89. In gravity dam, tail water causes
(a) Decreases in principal stress (b) Decrease in shear stress
(c) Increase in both principal and shear stress (d) Both (a) & (b) are true
90. When the reservoir is full, the maximum compressive force in a gravity dam is produced
(a) At the centre of base (b) At the level
(c) At the toe (d) Within the middle third of base
91. A sprinkler irrigation system is suitable when
(a) The crops to be grown have deep roots
(b) The land gradient is steep and soil is easily erodible
(c) The soil is having low permeability
(d) The water table is low
92. Discharge per unit of drawdown of a well is known as
(a) yield (b) specific yield
(c) well losses (d) transmissivity
93. Aquiclude can be described as a formation which
(a) not only stores water but also yields it in sufficient quantity
(b) allows only seepage and insignificant yield
(c) is impermeable to flow of water but may be porous
(d) is neither porous nor permeable like unfractured rock

94. Rainfall mass curve shows the variation of
- (a) rainfall excess with time
 - (b) accumulated penetration against time
 - (c) rainfall intensity against time
 - (d) none of these
95. The Muskingum equation is $S =$
- (a) $k[xI + (1-x)Q]$
 - (b) $k[xI + (1-x)I]$
 - (c) $k[xI + (1+x)Q]$
 - (d) $k[xI - (1-x)Q]$
96. The efficiency of sedimentation tank does not depend upon
- (a) depth of tank
 - (b) length of tank
 - (c) detention period
 - (d) velocity of water
97. The detention period for plain sedimentation water tanks, is usually
- (a) 4 to 8 hours
 - (b) 8 to 16 hours
 - (c) 16 to 24 hours
 - (d) 24 to 36 hours
98. Guide banks are provided to
- (a) Confine the width of river
 - (b) Increase the water way
 - (c) Reduce the peak flood discharge
 - (d) Train the flow of a river along a specified course
99. The rate of silting in a reservoir
- (a) is less in the beginning
 - (b) remains constant throughout
 - (c) is more in the beginning
 - (d) is more in the beginning and reduces in the end
100. The expression for the specific speed of a pump
- (a) Does not include the diameter of the impeller
 - (b) Includes power as one of the variables
 - (c) Is necessarily non dimensional
 - (d) Yields larger values for radial pumps than for axial flow pump

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