

MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO)(CIVIL) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, MARCH, 2017.

ENGINEERING PAPER - II

Time Allowed : 3 hours

FM : 200

SECTION - A (Multiple Choice questions)

(100 Marks)

All questions carry equal mark of 2 each. Attempt all questions.

*This Section should be answered only on the **OMR Response Sheet** provided.*

1. Practical fluid possess
 - (a) Viscosity
 - (b) Surface tension
 - (c) Compressibility
 - (d) All of these
2. Falling drops of water becomes sphere due to
 - (a) Adhesion
 - (b) Cohesion
 - (c) Surface tension
 - (d) Viscosity
3. The unit of viscosity is
 - (a) Kg sec/m²
 - (b) N sec/m²
 - (c) N sec²/m³
 - (d) Kg sec/m³
4. Piezometers are used to measure
 - (a) Pressure in water channel, pipes etc.
 - (b) Difference in pressure at two points
 - (c) Atmospheric pressure
 - (d) Very low pressure
5. The Bernoulli equation $\frac{P}{W} + \frac{V^2}{2g} + Z = constant$ is based on the following assumptions regarding the fluid flow:
 - (a) Steady, frictionless, incompressible and along a streamline
 - (b) Steady, frictionless, uniform and along a streamline
 - (c) Steady, frictionless, incompressible and uniform
 - (d) All of these
6. A fluid is a substances that:
 - (a) Is essentially in compressible
 - (b) Cannot remain at rest when subjected to shear stress
 - (c) Has viscosity that decrease with temperature
 - (d) Cannot be subjected to shear forces

7. Reynolds number is:

(a) $\frac{\rho Vd}{\mu}$

(b) $\frac{Vd}{\mu}$

(c) $\frac{\mu Vd}{\rho}$

(d) $\frac{Vd}{\rho}$

8. The ratio of the pressure and inertial force acting in any flow, ignoring other forces, is called

(a) Reynolds number

(b) Froude number

(c) Euler number

(d) Weber number

9. A triangular notch is preferred to rectangular notch because

(a) Only one reading is required

(b) Its formula is simple to remember

(c) It gives more accurate results for low discharges

(d) All of these

10. The pressure at the summit of a syphon is

(a) Equal to atmospheric

(b) Less than atmospheric

(c) More than atmospheric

(d) None of the above

11. The major loss of energy in long pipes is due to

(a) Sudden enlargement

(b) Sudden contraction

(c) Gradual contraction or enlargement

(d) Friction

12. The surface runoff is the quantity of water

(a) Absorbed by soil

(b) Intercepted by buildings and vegetative cover

(c) Required to fill surface depression

(d) That reaches the stream channels

13. Hydrology is a science that deals with

(a) Rainwater

(b) River water

(c) Surface and groundwater

(d) Seawater

14. The capability of a soil mass of full width and depth to transmit water, is known

(a) Porosity

(b) Permeability

(c) Transmissibility

(d) None of these

15. 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 formula

(d) Lacy's formula

16. Water bearing soil strata is known as,

(a) Aquiclude

(b) Aquitard

(c) Aquifer

(d) None of these

17. A unit hydrograph has one unit of

(a) Rainfall duration

(b) Rainfall excess

(c) Time base of direct runoff

(d) Discharge

18. S hydrograph is used to obtain unit hydrograph of
- (a) Shorter duration from longer duration
 - (b) Longer duration from shorter duration
 - (c) Both (a) & (b)
 - (d) None of these
19. Cyclonic precipitation is caused by the lifting of air mass due to
- (a) Pressure difference
 - (b) Temperature difference
 - (c) Natural topographical barrier
 - (d) All of these
20. A raingauge should preferably fixed
- (a) Near the building
 - (b) Under a tree
 - (c) In an open space
 - (d) In a closed space
21. The surface runoff is affected by
- (a) Size of the basin
 - (b) Shape of the basin
 - (c) Elevation of the watershed
 - (d) All the above
22. Isohytes are the imaginary lines joining a point of equal
- (a) Pressure
 - (b) Elevation
 - (c) Humidity
 - (d) Rainfall
23. Hardness of water is mainly due to presence of:
- (a) Ca^{2+} and Na^+
 - (b) Na^+ and Cl^-
 - (c) Ca^{2+} and Mg^{2+}
 - (d) Ca^{2+} and K^+
24. Which of these water sources is considered to have highest turbidity:
- (a) Lake
 - (b) River
 - (c) Spring water
 - (d) Dug well
25. According to Indian Standard code:1172-1993 the domestic water consumption in liter per capita per day (lpcd) is:
- (a) 60 lpcd
 - (b) 90 lpcd
 - (c) 135 lpcd
 - (d) 250 lpcd
26. The measurement of turbidity using turbidimeter is based on:
- (a) Scattering of light
 - (b) Angle of incidence of light
 - (c) Reflection of light
 - (d) Transmission of light
27. Removal of suspended solids from water is required, because:
- (a) They cause turbidity
 - (b) Provide absorption sites for biological and chemical agents
 - (c) Aesthetically displeasing
 - (d) All of these
28. A distilled water placed in open atmospheric environment may be slightly acidic due to:
- (a) Oxygen
 - (b) Carbon-dioxide
 - (c) Hydrogen
 - (d) Nitrogen
29. The taste of hard water is better than soft water due to the presence of:
- (a) Sodium
 - (b) Calcium
 - (c) Bicarbonates
 - (d) Carbonates

30. The units of Alkalinity is express as mg/l in terms of equivalent
- (a) Calcium carbonate
 - (b) Magnesium carbonate
 - (c) Sodium carbonate
 - (d) Calcium hydroxide
31. Bacteria which causes diseases are called:
- (a) Facultative bacteria
 - (b) Pathogenic bacteria
 - (c) Anaerobic bacteria
 - (d) Aerobic bacteria
32. The self-cleansing velocity recommended for Indian conditions, in order to prevent settling down of sewage at bottom or on the sides of large sewer is:
- (a) 0.25 m/s
 - (b) 0.5 m/s
 - (c) 0.75 m/s
 - (d) 1.0 m/s
33. Removal of oil and grease from sewage, is known
- (a) Screening
 - (b) Skimming
 - (c) Filtration
 - (d) None of these
34. The consumptive use of water for a crop
- (a) Is measured as the volume of water per unit area
 - (b) Is measured as depth of water on irrigated area
 - (c) May be supplied partly by precipitation and partly by irrigation
 - (d) All of these
35. Effective precipitation for a crop may be defined as
- (a) Total precipitation minus the loss due to evaporation
 - (b) Total precipitation minus loss due to infiltration
 - (c) Total precipitation during the crop period
 - (d) Available water stored in soil within the root zone of the crop.
36. According to Kennedy, the critical velocity (V_o) in meters in a channel is the mean velocity which keeps the channel free from silting and scouring. Its value is given by
- (a) $V_o = 0.84 m D^{0.64}$
 - (b) $V_o = 0.55 m D^{0.64}$
 - (c) $V_o = 0.84 m D^{0.54}$
 - (d) $V_o = 0.55 m D^{0.54}$

Where, m is the critical velocity ratio and D is the depth of the channel.

37. Regime conditions in a channel may occur if
- (a) Discharge is constant
 - (b) Channel flows uniformly in incoherent alluvium as transported in suspension
 - (c) Silt grade and silt charge are constant
 - (d) All of these

38. V and R are the regime mean velocity and hydraulic mean depth respectively in meters. Lacey's silt factor is
- (a) $\frac{2V^2}{\sqrt{3}R}$ (b) $\frac{3V^2}{4R}$
- (c) $\frac{5V^2}{2R}$ (d) $\frac{2V^2}{5R}$
39. The structure constructed to allow drainage water flow under pressure through an inverted syphon below a canal, is called
- (a) Syphon (b) Super passage
- (c) Super aqueduct (d) Syphon aqueduct
40. Process of meandering is due to
- (a) Sediment load of streams
- (b) Discharge and hydraulic properties of streams
- (c) Relative erodibility of the bed and banks
- (d) All of these
41. Which of the following methods of applying water may be used on rolling land
- (a) Border flooding (b) Check flooding
- (c) Furrow flooding (d) Free flooding
42. The ratio of quantity of water stored in the root zone of the crops to the quantity of water actually delivered in the field is known as
- (a) Water conveyance efficiency (b) Water application efficiency
- (c) Water use efficiency (d) None of these
43. The amount of irrigation water required to meet the evapotranspiration needs of the crop during its full growth is called
- (a) Effective rainfall (b) Consumptive use
- (c) Consumptive irrigation requirement (d) Net irrigation requirement
44. The major resisting force in the gravity dam is
- (a) Water pressure (b) Wave pressure
- (c) Uplift pressure (d) Self weight
45. Horizontal acceleration due to earthquake results in
- (a) Hydrodynamic pressure
- (b) Inertial force into the body of the dam
- (c) Both (a) & (b)
- (d) None of these
46. 1. The minimum dissolved oxygen which should always be present in water in order to save the aquatic life is
- (a) 1 ppm (b) 4 ppm
- (c) 10 ppm (d) 40 ppm
47. Muskingum method of flood routing is
- (a) Reservoir routing method (b) Channel routing method
- (c) Hydraulic method of flood routing (d) None of these

48. An impulse turbine
- (a) Always operates submerged
 - (b) Makes use of draft tube
 - (c) Operate by initial complete conversion to kinetic energy
 - (d) Converts pressure head into velocity head throughout the vanes
49. The specific speed of a turbine is defined as the speed of a unit of such a size that it
- (a) Delivers unit discharge at unit head
 - (b) Delivers unit discharge at unit power
 - (c) Produces unit power for unit head
 - (d) None of the se
50. Two geometrically similar units are homogenous if they have
- (a) Same Reynold number
 - (b) Same Froude number
 - (c) Same efficiency
 - (d) Similar streamlines.

SECTION - B (Short answer type question)
(100 Marks)

All questions carry equal marks of 5 each.

*This Section should be answered only on the **Answer Sheet** provided.*

51. There is sudden enlargement of water pipeline from 200 mm to 400 mm. The hydraulic gradient rises by 10 mm. Estimate the discharge in the pipe.
52. Define specific energy and critical depth in open channel flow.
53. What is the difference between economical section and hydraulically efficient channel section?
54. Differentiate between pumps and turbine.
55. Define specific speed of a pump. Where it is useful.
56. Explain Theissen polygon method.
57. A hydraulic structure is sized for a 50 year recurrence interval design discharge. What is the risk that the flow capacity will be exceeded during any future 20 year period? What is the probability that the 50 year recurrence interval peak flow rate will be exceeded in the next 50 years?
58. Explain the assumptions in unit hydrograph theory.
59. Define the following term with reference to groundwater:
- (a) Storage coefficient
 - (b) Specific yield
60. An aquifer of 25 m average thickness is overlain by an impervious layer of 30 m thickness. A test well 0.4 m diameter and two observation wells at a distance of 12 m and 48 m are located in the aquifer. After a pumping rate of $0.2 \text{ m}^3/\text{s}$ for a long time, the drawdowns in the wells were observed to be 3.5 m and 1.5 m respectively. Determine the coefficient of permeability.
61. Differentiate slow sand filter and rapid sand filter.
62. Draw a flowchart of various treatment units of municipal wastewater using activated sludge processes.
63. What are the sources and impact of hardness in water supplies?
64. Schematically draw the various treatment units of typical drinking water treatment plant.

65. Explain suspended growth and attached growth systems in wastewater treatment systems with examples.
66. What are greenhouse gases? To combat the alarming global warming lists 3 major steps you suggest.
67. Briefly explain the working principle of septic tank.
68. Define duty, delta and base period of a crop and express the relationship connecting them.
69. Draw a sketch of typical layout of diversion headwork. Indicate the various components.
70. Explain the steps in the design of irrigation channel using Lacey's theory.

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