MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (M.E.S.) UNDER PUBLIC WORKS DEPARTMENT, GOVERNMENT OF MIZORAM, MARCH, 2020

CIVIL ENGINEERING PAPER - II

Time Allowed : 3 hours | Full Marks : 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. Relationship between Manning's coefficient n and Chezy's coefficient c is given by

(a) $c = \frac{R^{2/3}}{n}$ (b) $c = \frac{R^{1/6}}{n}$

(c) $c = \frac{R^{1/3}}{n}$ (d) $c = \frac{R^{1/2}}{n}$

2. In the Bernoulli equation, used in pipe flow, each term represents

(a) energy per unit mass (b) energy per unit volume

(c) energy per unit weight (d) none of these

3. In a fluid flow, the line of constant piezometric head passes through two points which have the same

(a) elevation (b) pressure

(c) velocity (d) none of these

4. At a hydraulic jump, the depth at the two sides are 0.4 m and 1.4 m. The head loss in the jump is

(a) 0.45 (b) 1.0

(c) 0.35 (d) 0.9

5. To generate 10,000 HP under a head of 81 m while working at speed of 500 rpm, the turbine of choice could be

(a) Pelton (b) Kaplan

(c) Francis (d) Bulb

6. Zero hardness of water is achieved by

(a) Lime-soda process (b) Ion exchange treatment

(c) Excess lime treatment (d) Excess alum dosage

7. 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

8. The ultimate BOD value of a waste
(a) increases with temperature
(b) decreases with temperature
(c) remains same at all temperatures
(d) None of these

9. In an activated sludge process, the sludge volume index can be controlled by
(a) Aeration
(b) adding chlorine
(c) reducing recycling ratio
(d) increasing the depth of aeration tank

10. Rainfall mass curve shows the variations of
(a) rainfall intensity with time
(b) rainfall intensity with cumulative rainfall
(c) rainfall excess with time
(d) cumulative rainfall with time

11. For unconfined aquifers, storage co-efficient is same as
(a) porosity
(b) specific retention
(c) specific yield
(d) none of these

12. Discharge per unit drawdown of a well is called
(a) specific yield
(b) specific retention
(c) specific storage
(d) specific capacity

13. In gravity dam, main overturning force is
(a) self-weight of the dam
(b) wind pressure
(c) water pressure
(d) uplift pressure

14. In Ogee shaped spillway, discharge is proportional to
(a) H
(b) $H^{1/2}$
(c) $H^{3/2}$
(d) $H^{5/2}$

15. If the velocity profile in laminar flow is parabolic, then the shear stress profile must be
(a) hyperbola
(b) parabola
(c) straight line
(d) ellipse

16. The volume of water below the minimum pool level in a reservoir is known as
(a) dead storage
(b) useful storage
(c) surcharge storage
(d) bank storage

17. Standard EDTA (ethylene diamene tetra acetic acid) solution is used to determine
(a) turbidity of water
(b) residual chlorine
(c) dissolved oxygen
(d) hardness of water

18. Primary treatment of sewage consists of removal of
(a) sand and dirt
(b) oil and grease
(c) floating materials
(d) large suspended organic solids

19. How does viscosity of liquids change with increase in temperature
(a) increases
(b) decreases
(c) remains constant
(d) none of these

20. Pressure inside the casing of an impulse turbine is
(a) negative pressure
(b) positive pressure
(c) atmospheric pressure
(d) none of these

21. In centrifugal pumps, discharge is proportional
(a) linearly to speed
(b) to the square of speed
(c) to the square root of speed
(d) inversely to speed

22. Cavitation is caused by
(a) high velocity
(b) high pressure
(c) low pressure
(d) high temperature

23. Under same conditions, which of the following shapes of water surface will give the highest rate of evaporations?
(a) Flat water surface
(b) convex water surface
(c) concave water surface
(d) independent of shape of water surface

24. The most common cause of acidity in water is
(a) carbon dioxide
(b) oxygen
(c) hydrogen
(d) nitrogen

25. Chemical oxygen demand (COD) of sewage is the oxygen required to oxidise biologically
(a) active organic matter
(b) inactive organic matter
(c) both (a) & (b)
(d) none of these

26. Which of the following treatment processes are necessary for removing suspended solids from water?
(a) coagulation
(b) flocculation
(c) sedimentation
(d) all of these

27. Poise has the unit of
(a) Dyne-cm/s^2
(b) Dyne-cm/s
(c) Dyne-s/cm
(d) Dyne-s/cm^2

28. A two dimensional flow is described by velocity components $u = 2x$ and $v = -2y$. The discharge between points (1,1) and (2,2) is equal to
(a) 9 units
(b) 8 units
(c) 7 units
(d) 6 units

29. In a two-dimensional flow, with its stream function $\psi = 2xy$, the velocity at a point (3,4) is
(a) 12 units
(b) 10 units
(c) 8 units
(d) 6 units

30. In a laminar flow through a circular pipe of diameter 200 mm, the maximum velocity is found to be 1 m/s. The velocity at a radial distance of 50 mm from the axis of the pipe will be
(a) 0.5 m/s
(b) 0.25 m/s
(c) 0.75 m/s
(d) 1.25 m/s

31. On an immersed body in a flowing fluid, the lift force is
(a) due to buoyant force
(b) always in the opposite direction due to gravity
(c) due to wake phenomenon
(d) the dynamic fluid force component normal to approach velocity

32. An isohyet is a line joining points of
(a) equal temperature
(b) equal humidity
(c) equal rainfall depth
(d) equal evaporation

33. The shape of the recession limb of a hydrograph depends on

(a) basin as well as storm characteristics
(b) storm characteristics only
(c) basin characteristics only
(d) base flow only

34. 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

35. A river training work is generally required when the river is

(a) aggrading type
(b) degrading type
(c) meandering type
(d) stable type

36. The total depth of water required by a crop during the entire period the crop is in the field, is known as

(a) delta
(b) duty
(c) base period
(d) crop period

37. Irrigation canals are generally aligned along

(a) contour line
(b) water shed
(c) straight line
(d) valley line

38. As per the Lacey's method for design of alluvial channels, identify the TRUE statement from the following:

(a) wetted perimeter increases with an increase in design discharge
(b) hydraulic radius increases with an increase in silt factor
(c) wetted perimeter decreases with an increase in design discharge
(d) wetted perimeter increases with an increase in silt factor

39. The purpose of constructing a 'Groyne' is to

(a) expand a river channel to improve its depth
(b) encourage meandering
(c) train the flow along a certain course
(d) reduce the silting in the river bed

40. The water obtained from the tube wells is known as

(a) surface water
(b) sub-surface water
(c) run-off
(d) potable water

41. The correct sequence of processes in a water treatment plant for rural water supply is

(a) chlorination, aeration, sedimentation, rapid sand filter
(b) coagulation, sedimentation, slow sand filter, chlorination
(c) coagulation, flocculation, clarification, pressure filter
(d) aeration, plain sedimentation, slow sand filter, chlorination

42. A trickling filter is designed to remove

(a) settleable solids
(b) dissolved organic matter
(c) colloidal solids
(d) none of these

43. Two primary air pollutants are

(a) sulphur oxide and ozone
(b) nitrogen oxide and peroxyacetylnitrate
(c) sulphur oxide and hydrocarbon
(d) ozone and peroxyacetylnitrate

44. When wastewater is disposed of into a running stream, four zones are formed. In which one of the following zones will the minimum level of dissolved oxygen be found?

(a) Zone of degradation
(b) Zone of active composition
(c) Zone of recovery
(d) Zone of clear water

45. 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

46. Which one of the following is not present in acid rain?

(a) HNO_3
(b) H_2SO_4
(c) H_2CO_3
(d) CH_3COOH

47. Reciprocating pumps are suitable for

(a) low discharge and high head
(b) high discharge and low head
(c) low discharge and low head
(d) high discharge and high head

48. The unit discharge through the turbine is

(a) $Q/\sqrt{H}$
(b) Q/H
(c) $Q/H^{3/2}$
(d) Q/H^2

49. The overall efficiency of a reaction turbine is the ratio of

(a) power produced by the turbine to the energy actually supplied to the turbine
(b) actual work available at the turbine to the energy imparted to the wheel
(c) work done on the wheel to the energy actually supplied to the turbine
(d) none of these

50. The Froude number of flow in a rectangular channel is 0.8. If the depth of flow is 1.5 m, the critical depth is

(a) 1.8 m
(b) 1.56 m
(c) 1.36 m
(d) 1.29 m

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.*

1. Discuss two applications of Bernoulli's equation.

2. Define five different types of flow in a pipe.

3. Differentiate between suspended and colloidal impurities.

4. Describe the process of disinfection in water treatment.

5. What are the different types of plumbing systems for building drainage?

6. Define activated sludge process.

7. Enlist the various methods of distribution of irrigation water.

8. How are irrigation canals classified?

9. What are the different types of cross-drainage works? Differentiate between them.

10. Define: coefficient of contraction, coefficient of velocity, coefficient of discharge, coefficient of resistance.

11. Explain the different types of water treatment processes.

12. A pelton wheel turbine operates at 630 rpm taking 3 m^3/s of water under a head of 256 m with a speed of 0.48. Calculate the diameter of the impeller.

13. Explain the physical characteristics of sewage.

14. Explain the concept of design for best hydraulic system for open trapezoidal channel section.

15. Explain the working operations of centrifugal pumps.

16. Explain the conditions for critical flow in an open channel.

17. Explain break-point chlorination with a suitable graph.

18. Explain piping and direct uplift failure of hydraulic structures founded on pervious foundations.

19. Define water-logging. What are the problems caused by water-logging?

20. Explain the essential characteristics for True Regime of a channel according to Lacey's theory.

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