MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, 2014

CIVIL ENGINEERING
PAPER - II

Time Allowed : 3 hours   Full Marks : 200

Attempt all questions.

Part A - Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

1. The hydraulic gradient line indicates the variation of which of the following?
   (a) Velocity head in flow direction   (b) Piezometric head in the direction of flow
   (c) Total energy of flow in the direction of flow   (d) None of these

2. Which of the following is an example of free vortex flow?
   (a) A whirlpool in a river
   (b) Flow of liquid through a hole provided at the bottom of a container
   (c) Flow of liquid around a circular bend in a pipe
   (d) All of these

3. Mach's number is defined as the square root of the ratio of
   (a) Inertia force to the pressure force   (b) Inertia force to the surface tension force
   (c) Inertia force to the elastic force   (d) None of these

4. In a pipe flow, the head loss due to friction is 6 m. If the power transmitted through the pipe has to be the maximum, then the total head at the inlet of the pipe will have to be maintained at
   (a) 36 m   (b) 30 m
   (c) 24 m   (d) 18 m

5. In open channels, gradually varied flow is caused
   (a) When the channel slope is equal to the normal slope
   (b) When the pressure forces and the change of momentum are different from each other
   (c) When the force causing the flow is not equal to the resistance force
   (d) When there is an equilibrium between the forces causing the flow and those opposing it

6. For the best rectangular open channel section, the depth Y and bed width b are related by
   (a) Y=b/3   (b) Y=b
   (c) Y=b/2   (d) Y=b/4

7. A flood is given a rank m in an observed record of n years. Then according to Weibul's formula, its return period is given by
   (a) n/m   (b) n/(m+1)
   (c) n/(m-1)   (d) (n+1)/m

8. If the duration of the unit hydrograph approaches zero, the resulting unit hydrograph is known as
   (a) The limiting unit hydrograph
   (b) The threshold unit hydrograph
   (c) The instantaneous unit hydrograph
   (d) The saturated unit hydrograph

9. The target reliability of irrigation release under normal conditions is
   (a) 100%
   (b) 90%
   (c) 75%
   (d) 50%

10. Φ index is defined as
    (a) The difference between maximum and minimum infiltration capacities
    (b) The difference between the total rainfall and the total runoff divided by the duration of the storm
    (c) The rainfall intensity above which the rainfall volume equals the observed runoff volume
    (d) The minimum infiltration rate during the storm

11. Most of the turbidity meters work on the scattering principle. The turbidity value so obtained is expressed in
    (a) CFU
    (b) FTU
    (c) JTU
    (d) NTU

12. Two primary air pollutants are
    (a) sulphur oxide and ozone
    (b) nitrogen oxide and peroxyacetylnitrate
    (c) sulphur dioxide and hydrocarbon
    (d) ozone and peroxyacetylnitrate

13. 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

14. The most common coagulant is
    (a) magnesium sulphate
    (b) alum
    (c) chlorine
    (d) bleaching powder

15. Slow sand filter is more efficient for the removal of
    (a) Bacteria
    (b) Odour
    (c) Turbidity
    (d) All of these

16. Multi-stage centrifugal pumps are used to
    (a) Give high discharge
    (b) Produce high heads
    (c) Pump viscous fluids
    (d) All of these

17. 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

18. Surge tank in a hydropower project is used to
    (a) Reduce water hammer pressure
    (b) Store water
    (c) Regulate discharge in the power house
    (d) Control sediments entering the turbine

19. The specific speed of a pump is defined as the speed of a unit
    (a) Of unit size with unit discharge at unit head
    (b) Of such a size that it requires unit power at unit head
    (c) Of such a size that it delivers unit discharge at unit head
    (d) Of such a size that it delivers unit discharge at unit power.

20. For irrigation purpose, the pH value of water should be
    (a) Between 3 and 6   (b) Between 6 and 8.5
    (c) Between 8.5 and 11   (d) More than 11

21. A canal aligned approximately parallel to the natural drainage of a country is called
    (a) Side slope canal   (b) Contour canal
    (c) Watershed canal   (d) Ridge canal

22. The co-efficient of friction for laminar flow through a circular pipe is given by
    (a) $f = \dfrac{0.079}{R_e^{1/4}}$ (b) $f = \dfrac{16}{R_e}$

    (c) $f = \dfrac{64}{R_e}$ (d) none of these

23. Total Energy Line (T.E.L.) represents the sum of
    (a) pressure head and kinetic head
    (b) datum head and kinetic head
    (c) pressure head and datum head
    (d) pressure head, kinetic head and datum head

24. The pressure rise due to water hammer, when valve is closed gradually is equal to
    (a) ρLV (b) $\dfrac{\rho LV}{t}$

    (c) $\dfrac{\rho t}{VL}$ (d) $\dfrac{\rho}{LVt}$

25. The flow in open channel is laminar if the Reynold number is
    (a) 2000   (b) less than 2000
    (c) less than 5000   (d) none of these

26. The discharge through a trapezoidal channel is maximum when
    (a) half of top width = sloping side   (b) top width = sloping side
    (c) top width = 1.5 x sloping side   (d) none of these

27. Draft tube is used for discharging water from the exit of
    (a) an impulse turbine   (b) a Francis turbine
    (c) a Pelton wheel   (d) all of these

28. In selecting site for a rain gauge the nearest object should be at a minimum distance of
    (a) twice its height   (b) three times its height
    (c) equal to its height   (d) anywhere

29. Double mass curve technique is used
    (a) to prepare rainfall hyetograph   (b) to derive the hydrograph
    (c) to derive the S-curve hydrograph   (d) to check the consistency of rainfall records

30. A hydrograph is the graph drawn between
    (a) discharge in the river and stage in the river   (b) discharge and time
    (c) stage and time   (d) none of these

31. The S-curve hydrograph is
    (a) the summation of the unit hydrograph
    (b) the summation of the total runoff hydrograph
    (c) the summation of the rainfall hyetograph
    (d) all of these

32. In the case of water table well, the piezometric surface
    (a) is above the ground level
    (b) is below the water level in the well
    (c) coincides with water level in the well
    (d) is between the water level in the well and ground level

33. A flood with a return period of 100 years is the flood which occurs
    (a) every 100th year
    (b) the maximum observed flood in the last 100 years
    (c) once in every 100 years on the average
    (d) only after 100 years in the immediate future

34. A water borne virus infection is
    (a) cholera
    (b) swimmer's itch
    (c) jaundice
    (d) cancer

35. The average domestic demand of water for an Indian city is
    (a) 135 lpcd
    (b) 270 lpcd
    (c) 500 lpcd
    (d) 750 lpcd

36. Detention time in a "flocculator" is
    (a) 10 sec to 20 sec
    (b) 20 min to 30 min
    (c) 1 hour to 8 hour
    (d) 2 hour to 3 hour

37. Ultra violet rays are highly effective for disinfection for
    (a) hard water
    (b) highly turbid water
    (c) water rich in suspended solids
    (d) clear water

38. A sanitary sewer is expected to run
    (a) full
    (b) half full
    (c) $\frac{2}{3}$ full
    (d) 90% full

39. The velocity of flow in a sewer should be between
    (a) 0.6 m/sec and 3 m/sec
    (b) 2 m/sec and 10 m/sec
    (c) 30 cm/sec and 90 cm/sec
    (d) 30 m/sec and 90 m/sec

40. Water present in the soil which cannot be removed except by heating is called
    (a) gravity water
    (b) capillary water
    (c) hygroscopic water
    (d) free water

41. Net irrigation requirement of a crop is given by
    (a) Consumptive use + field losses
    (b) Consumptive use + conveyance losses
    (c) Consumptive use + field losses + conveyance losses
    (d) Consumptive use – effective rainfall

42. Water logging is the state of soil where

    (a) the water table is brought very nearer to the ground surface

    (b) the water table is at deeper depth

    (c) the moisture in the soil is beyond the reach of plant roots

    (d) none of these

43. The difference in elevations of top of bank and full supply level of a canal is called

    (a) berm   (b) critical depth

    (c) free board   (d) surcharge depth

44. A pumped storage plant is a

    (a) High head plant   (b) Peak load point

    (c) Runoff river plant   (d) Base Load plant

45. In linear reservoir, storage varies linearly with

    (a) Time   (b) Outflow rate

    (c) Inflow rate   (d) None of these

46. 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

47. Unit of runoff in M.K.S. system is

    (a) Cubic meter / Sec   (b) Meter / Sec

    (c) Cubic meter   (d) Square meter

48. A current meter is used to measure the

    (a) Velocity of flow of water   (b) Depth of flow of water

    (c) Discharge   (d) None of these

49. Probability of a 10 year flood to occur at least once in the next 4 year is

    (a) 25 %   (b) 35 %

    (c) 50 %   (d) 65 %

50 An ideal fluid is

    (a) One which obeys Newton's law of Viscosity (b) Frictionless and Incompressible

    (c) Very Viscous   (d) Frictionless and Compressible

Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

51. State and prove the Pascal's law.

52. The barometric pressure at sea level is 760 mm of mercury while that on a mountain top is 735 mm, if the density of air is assumed constant at 1.2 kg/m^3, what is the elevation of the mountain top?

53. Explain how you would find the resultant pressure on curved surfaces.

54. Prove that the discharge through an orifice meter is given by the relation

$$Q = C_d \frac{a_o a_1}{\sqrt{a_1^2 - a_0^2}} \times \sqrt{2gh}$$

Where a_1 is the area of pipe in which orifice meter is fitted, a_0 is the area of orifice.

55. Show that the ratio of inertia force to viscous force gives the Reynolds's number.

56. Explain the procedure for checking a rainfall data for consistency.

57. What is a unit hydrograph? List the assumptions involved in the unit hydrograph theory.

58. The populations of a town in three consecutive years are 6000, 8000 and 9000 respectively. Determine the population of the town in the fourth consecutive year according to geometrical increase method.

59. State the principles of pipe layout for water supply in a house.

60. Describe the function of the air vessel for reciprocating pumps.

61. Write the different forces that act on a gravity dam.

62. Obtain an expression for the boundary shear stress in a fluid in terms of momentum thickness.

63. A storm with a 15.0 cm precipitation produced a direct run-off of 8.7 cms. The time distribution of storm is as follows:

Time from start (hr)	1	2	3	4	5	6	7	8
Incremental rainfall in each hour (cm)	0.6	1.35	2.25	0.45	2.70	2.40	1.5	0.75

Estimate the ϕ index of the storm.

64. Sketch a conventional sequence of various unit operations in a complete municipal sewage treatment plant.

65. Design a septic tank for 100 users.

66. Define sludge volume index. What is its significance?

67. Show the different zones of storage in a reservoir by a neat sketch.

68. Show the different important components of a high head peak load power plant by a neat sketch.

69. Draw a neat sketch of a siphon aqueduct.

70. With the help of a neat diagram, show various parts of a diversion head works.

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