

MIZORAM PUBLIC SERVICE COMMISSION
TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, NOVEMBER, 2015

CIVIL ENGINEERING
PAPER - II

Time Allowed : 3 hours

Full Marks : 200

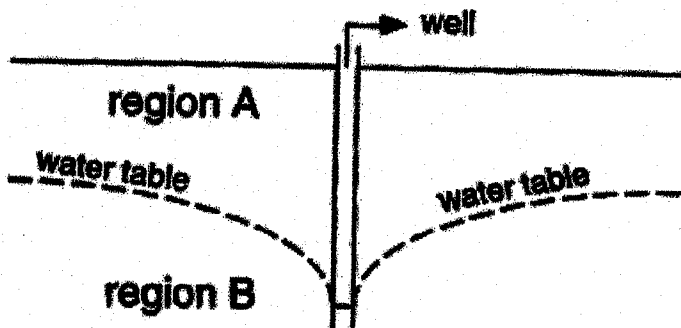
Attempt all questions.

Part A - Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

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

1. The hydraulic flood routing method used is:
 - (a) Equation of motion
 - (b) Energy equation
 - (c) Continuity equation
 - (d) Both (b) & (c)
2. The standard height of a standard rain gauge is
 - (a) 10 cm
 - (b) 20 cm
 - (c) 30 cm
 - (d) 40 cm
3. The runoff of a drainage basin is
 - (a) Initial recharge + ground water accretion + precipitation
 - (b) Precipitation + ground water accretion - initial recharge
 - (c) Precipitation - ground water accretion - initial recharge
 - (d) Precipitation - ground water accretion + initial recharge
- 4.



In the diagram above region A is the

- (a) Discharge zone
- (b) Recharge zone
- (c) Saturated zone
- (d) Unsaturated zone

5. A 12-h unit hydrograph of a catchment is triangular in shape with a base width of 144 hours and a peak discharge value of $23 \text{ m}^3/\text{s}$. This unit hydrograph refers to a catchment of area
- (a) 756 km^2 (b) 596 km^2
(c) 1000 km^2 (d) None of these
6. In pipe lines, a surge tank is provided
- (a) To relieve the pressure due to water hammer
(b) To provide additional water head
(c) To overflow the pipeline when suddenly closed
(d) All of these
7. The following operations are generally employed for tunnelling in hard rock. 1. Removing ground water, 2. Loading holes and firing the explosive 3. Setting up and drilling 4. Grouting and lining 5. Removing muck 6. Ventilation and removing explosion dust.
- The correct sequence is
- (a) 4 1 2 3 6 5 (b) 3 4 6 1 5 2
(c) 5 4 2 1 3 6 (d) 3 2 6 5 1 4
8. A pelton turbine has following specifications.
Shaft power = 9560 kwatt, Head = 350 m , Overall efficiency = 85%, wheel dia = 15.8 cm, Co-eff of velocity = 0.985.
- No of jet is
- (a) 2 (b) 1
(c) 0 (d) 3
9. A single acting reciprocating pump having a 150 mm bore and a 300 mm stroke raises water from a sump. If the pump runs at 40 rpm and it delivers 209 lit per min, then the slip percentage is
- (a) 1.1% (b) 1.2%
(c) 1.3% (d) 1.4%
10. Surge tanks are used
- (a) For storage of water (b) To increase the velocity in pipeline
(c) As overflow valves (d) To guard against water hammer
11. Most satisfactory formula for an estimate of fire demand Q for a city of population P in thousands for Indian conditions, is
- (a) $1115(P/5+20)$ (b) $Q=1640\sqrt{P(1-0.01\sqrt{P})}$
(c) $Q=3180\sqrt{P}$ (d) None of these
12. If the depletion of oxygen is found to be 2.5 mg/lit after incubating 2.5 ml of sewage diluted to 250 ml for 5 days at 20°C , BOD of the sewage is
- (a) 100 mg/l (b) 150 mg/l
(c) 200 mg/l (d) 250 mg/l
13. In slow sand filters, the turbidity of raw water can be removed only up to
- (a) 60 mg/lit (b) 75 mg/lit
(c) 100 mg/lit (d) 150 mg/lit
14. BOD of treated water should be
- (a) 0 ppm (b) 5 ppm
(c) 10 ppm (d) 15 ppm

15. What is the important requirement of water for domestic use?
- (a) The taste should be salty (b) It should have good odour
(c) It should be cheap and plentiful (d) All of these
16. At a water treatment plant, 15×10^6 lit of water is treated daily, using alum dosage of 20 ppm. Find the total quantity of alum used in a week.
- (a) 300 kg (b) 1000 kg
(c) 1500 kg (d) 2100 kg
17. In urban air pollution, the most poisonous gas is supposed to be carbon monoxide. It is hazardous because it
- (a) Affects our sense of smell (b) Is carcinogenic in nature
(c) Combines with haemoglobin (d) Causes blindness
18. If the moisture content of a sludge is reduced from 98% to 96%, the volume of sludge will be decreased by
- (a) 2% (b) 20%
(c) 25% (d) 50%
19. According to World Health Organization (WHO), what is the standard permissible limit of pH in water?
- (a) 7-8.5 (b) Less than 6.5
(c) 6.5-9.2 (d) 7
20. After which of the following treatment units is the turbidity maximum?
- (a) Chlorination (b) Primary sedimentation
(c) Flocculation basin (d) Secondary sedimentation
21. An irrotational flow is one in which
- (a) The streamlines of flow are curved and closely spaced
(b) The fluid does not rotate as it moves along
(c) The net rotation of fluid particles about their mass centres remains zero
(d) None of the above
22. The dimensions of dynamic viscosity μ are
- (a) $ML^{-1}T^{-2}$ (b) $ML^{-1}T^{-1}$
(c) ML^2T^{-2} (d) ML^2T^{-1}
23. The continuity equation $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$
- (a) Is not valid for unsteady, incompressible fluids
(b) Is valid for incompressible fluids whether the flow is steady or unsteady
(c) Is valid for steady flow whether flow is compressible or incompressible
(d) Is valid for ideal fluid only
24. If $\psi = 2xy$, the magnitude of the velocity vector at (2, -2) is
- (a) $4\sqrt{2}$ (b) 4
(c) -8 (d) $\sqrt{2}$

25. Dynamic similarity between model and prototype means
- (a) The similarity of forces
 - (b) The similarity of shape
 - (c) The similarity of motion
 - (d) None of these
26. In laminar flow the pressure drop per unit length of pipe ($\Delta p/L$) is given as
- (a) $\frac{32\mu\bar{u}}{D^2}$
 - (b) $\frac{2\mu\bar{u}}{D^2}$
 - (c) $\frac{32\mu\bar{u}}{D^3}$
 - (d) None of these
27. The shear stress between two fixed parallel plates with a laminar flow between them
- (a) Varies directly as distance from the mid-plane
 - (b) Varies inversely as distance from the mid-plane
 - (c) Varies parabolically across the gap
 - (d) Remains constant across the gap
28. A laminar boundary layer has a velocity distribution given by $u/U = y/\delta$. The displacement thickness δ^* for this boundary layer is
- (a) δ
 - (b) $\delta/2$
 - (c) $\delta/4$
 - (d) $\delta/6$
29. For a triangular channel side slopes m horizontal : 1 vertical, the Froude number F is given by
- (a) $\frac{m}{\sqrt{gy}}$
 - (b) $\frac{V}{\sqrt{2gy}}$
 - (c) $\frac{V\sqrt{2}}{\sqrt{gy}}$
 - (d) $\frac{V}{\sqrt{gy}}$
30. In a hydraulic jump occurring in a rectangular channel of 3.0 m width, the discharge is $7.8 \text{ m}^3/\text{s}$ and the depth before the jump is 0.28 m. The energy loss in the jump is
- (a) 2.50 m
 - (b) 1.50 m
 - (c) 2.0 m
 - (d) None of these
31. Available soil moisture is the difference between
- (a) Saturation capacity and field capacity
 - (b) Saturation capacity and permanent wilting point
 - (c) Field capacity and permanent wilting point
 - (d) Saturation capacity and temporary wilting point
32. Crop ratio is defined as the ratio of area irrigated
- (a) In Rabi season to Kharif season
 - (b) In Kharif season to Rabi season
 - (c) Under perennial crop to non-perennial crops
 - (d) Under perennial crop to total area
33. The most commonly adopted method of irrigation for cereal crops is
- (a) Furrow
 - (b) Basin flooding
 - (c) Check flooding
 - (d) Sub-surface irrigation

34. In an attracting groyne, the axis of the groyne (w.r.t the river flow direction) makes _____ with the bank
- (a) An acute angle (b) An obtuse angle
(c) A right angle (d) An angle of 180°
35. Canals which are excavated directly from the rivers with or without head regulator are called
- (a) Natural canals (b) Ditch canals
(c) Seasonal canals (d) Inundation canals
36. Which of the following is not a component of the diversion headwork?
- (a) Fish ladder (b) Divide wall
(c) Head regulator (d) Spillway
37. In a homogenous earth dam without d/s horizontal filter, portion of the d/s face through which seepage flow comes out is
- (a) Stream line (b) Equipotential line
(c) Neither a stream line nor an equipotential line (d) Both (a) and (b)
38. As per Lacey's theory, the silt factor is
- (a) Directly proportional to average particle size
(b) Directly proportional to square root of average particle size
(c) Inversely proportional to average particle size
(d) Not related to average particle size
39. For effective control of silt entry into the canal, the sill of the head regulator should be
- (a) Below the sill of the under sluices (b) Above the sill of the under sluices
(c) At the same level as the sill of under sluices (d) At the maximum flood level
40. The foundation of a weir consists of a horizontal floor of length 30m, a u/s pile of depth 8m and a d/s pile of depth 12m. the creep length according to Bligh's theory is
- (a) 50 m (b) 70 m
(c) 90 m (d) 110 m
41. Water logging is the state of the soil where
- (a) The water table is brought very near to the ground surface
(b) The water table is at deep depth
(c) The moisture in soil is beyond the reach of plant roots
(d) None of the above
42. The purpose of the end sill in the silting basin of a hydraulic jump type energy dissipater is
- (a) To increase the tail water depth
(b) To reduce the length of the jump and control scour
(c) To counteract the uplift on the floor
(d) To dissipate the energy by impact action
43. According to Khosla's theory, the undermining of the floor starts from the
- (a) Tail end (b) Starting end
(c) Intermediate point (d) Foundation bed

44. Cotton is grown in medium textured soil with available soil water of 100 mm/m depth of soil. Given that the rooting depth is 1.5 m, the fraction of water available is 0.65 and the application efficiency is 0.65, then the required depth of water delivered to the field will be equal to
- (a) 150 mm (b) 200 mm
(c) 165 mm (d) 250 mm
45. As per the middle third rule, for concrete gravity dams with base width b , eccentricity e should be less than or equal to $(b/6)$ for
- (a) No sliding to occur (b) No overturning to occur
(c) No tension to develop (d) None of these
46. A crop requires 900 mm of water for a base period of 120 days. The duty of the water is
- (a) 1152 hectares/cumec (b) 1125 hectares/cumec
(c) 648 hectares/cumec (d) None of these
47. In a homogenous embankment type of earth dam, the phreatic line is kept well within the body of the dam by
- (a) Providing proper u/s slope protection
(b) Providing proper d/s slope protection
(c) Suitably increasing the top width
(d) Providing horizontal drainage filter at the d/s face
48. The critical shear stress τ , at which incipient motion of sediment takes place, is proportional to grain size d as
- (a) \sqrt{d} (b) d
(c) d^2 (d) $d^{3/2}$
49. Bligh's creep theory assumes that
- (a) The percolation water creep is along the contact of the base profile of the apron with the subsoil
(b) The percolation water creep is in a straight path under the floor
(c) The percolation water creep is in a straight path under the foundation
(d) None of the above
50. Cross drainage works are not required when the canal is completely
- (a) A ridge canal (b) A contour canal
(c) Side slope canal (d) Carrier canal

Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

This Part should be answered only on the Answer Booklet provided.

1. What is dimensional analysis and model analysis? State the differences.
2. What is pitot tube? What is the basic principle used in pitot tube?
3. Starting from specific energy concept, define subcritical and supercritical flow condition.
4. Write an expression for momentum equation for compressible flow.
5. Differentiate between infiltration and percolation.

6. Distinguish between Recurrence interval and Probability.
7. Explain the terms : sanitary landfill and composting.
8. Explain the process of removal of iron from raw water.
9. Differentiate between impulse and reaction turbine.
10. What is the role of coagulants added to raw water?
11. What is surge tank? Write the role of surge tank in a hydropower plant.
12. Write short note on canal head regulator.
13. Classify the river training works as anti erosion works and bank protection works.
14. Write the parameters that affect the choice of a particular type of turbine in a hydropower plant.
15. Enumerate the design considerations of inundation canal.
16. Write a note on seepage control methods of earth dam.
17. Differentiate between Aqueduct and siphon aqueduct.
18. What are the different methods of determination of normal depth?
19. Describe the functions of air vessels in reciprocation pumps.
20. Derive the expression for critical depth in rectangular channel.

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