MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, GOVERNMENT OF MIZORAM, DECEMBER, 2023.

ENGINEERING PAPER – I

(Common for Civil, Electrical and Mechanical Engineers)

Time Allowed : 3 hours FM : 100 PM : 40

Marks for each question is indicated against it.
Attempt all questions.

Directions (Question Nos. 1 - 40) : Choose the correct Answers. **(40×1=40)**

1. How many methods of rainwater harvesting are there?
(a) One (b) Two
(c) Three (d) Four

2. How does induce emf in DC motor react to supply voltage
(a) It will aid the supply voltage (b) It will be double the supply voltage
(c) It will oppose the supply voltage (d) It will be half of the supply voltage

3. What is called for an area surrounding a body of water in which that body of water is subject to?
(a) Rainwater harvesting (b) Watershed
(c) Water pumping (d) Water cycle

4. Which of the following method is used to forecast the population of old and very large city?
(a) Arithmetical increase method (b) Geometric progression method
(c) Graphical method (d) Logistic curve method

5. Centrifugal pump works by imparting
(a) Potential energy (b) Kinetic energy
(c) Heat energy (d) Electrical energy

6. Which of the following tests is performed to detect the leakage of rain water pipe in the testing of house sewers?
(a) Water test (b) Smoke test
(c) Temperature test (d) Air test

7. Surge tanks are used
(a) for storage water (b) to increase the velocity in a pipeline
(c) as overflow valves (d) to guard against water hammer

8. As per IS 10500 : 2012, for drinking water in the absence of alternate source of water, the permissible limits for chloride and sulphate, in mg/ L, respectively are
(a) 250 and 200 (b) 1000 and 400
(c) 200 and 250 (d) 500 and 1000

9. Which part of centrifugal well pumps prevents the back flow through the pump?
   (a) Delivery pipe
   (b) Foot valve
   (c) Strainer
   (d) Check valve

10. Wastewater from different sources like bathrooms, kitchens and wash basins is called
   (a) Sewage
   (b) Garbage
   (c) Sullage
   (d) Discharge

11. The efficiency of the DC motor at maximum power is
   (a) 90%
   (b) 100%
   (c) Around 80%
   (d) Less than 50%

12 Critical time for developing a water hammer, is the time required for
   (a) Closing the valve
   (b) The wave to travel from valve to the reservoir
   (c) The wave to travel from the valve to the reservoir and back
   (d) Water column separation

13. Which of these diseases can happen from drinking contaminated water?
   (a) Dengue
   (b) B. Small pox
   (c) C. Malaria
   (d) D. Cholera

14. In pumping stations, the type of joint generally used, is
   (a) Socket and spigot joint
   (b) Flanged joint
   (c) Expansion joint
   (d) Dresser coupling joint

15. Which process is used to remove dirt and sand from wastewater?
   (a) Aeration
   (b) Chlorination
   (c) Sedimentation
   (d) Flocculation

16. How does a pit toilet or latrine work?
   (a) by separating sludge and scum from the liquid wastewater.
   (b) by holding feaces' and urine in a pit or tank until it can be removed for further treatment
   (c) by allowing feaces and urine to flow directly to a drain field for bacteria to continue their work.
   (d) by mixing in air to speed up the breakdown of liquid wastewater.

17. Which is the fastest method of drilling and especially useful in unconsolidated formations?
   (a) Cable tool method
   (b) Water-jet boring method
   (c) Hydraulic Rotary method
   (d) Reverse Rotary method

18. The impeller is mounted on a
   (a) Draft tube
   (b) Throttle bush
   (c) Stuffing box
   (d) Shaft

19. In DOL fuses are provided to protect against
   (a) Short circuit protection
   (b) Over voltage
   (c) Over current
   (d) Over load

20. The point at which the centrifugal pump operates at maximum efficiency is called
   (a) Duty point
   (b) Flow point
   (c) Static point
   (d) Operating point

21. The maximum pressure to which a pipe is subjected to during its operation, is known

(a) Working pressure
(b) Design pressure
(c) Test pressure
(d) Pipe pressure

22. A multistage centrifugal pump produces a pressure of

(a) 10 Pa
(b) 100Pa
(c) 21 Pa
(d) 150Pa

23. Which one of the following gases plays a decisive role in affecting the climate of earth?

(a) Oxygen
(b) Nitrogen
(c) Carbon dioxide
(d) Hydrogen

24. The Mizoram Water Supply (Control) Rules was recently approved by the Council of Minister meeting held on 18th May 2023 is

(a) The Mizoram Water Supply (Control) Rules Amendment 2023
(b) The Mizoram Water Supply (Control) Rules Repeal 2023
(c) The Mizoram Water Supply (Control) Rules 2023
(d) The Mizoram Water Supply (Control) Rules & Water Tariff 2023

25. The specific speed of the pump is 8000. What is the type of pump?

(a) Reciprocating pump
(b) Centrifugal pump
(c) Mixed flow pump
(d) Axial flow pump

26. The most commonly used chemical for dechlorination of water, is

(a) sodium thiosulphate
(b) sodium bisulphate
(c) sodium sulphite
(d) sulphur-dioxide

27. At each stage the fluid is directed

(a) Towards the centre
(b) Away the centre
(c) Towards the surface
(d) Away from the centre

28. Priming is the process by which

(a) The suction pipe, delivery pipe, up to the delivery valve is filled with liquid after starting the motor from an outside source
(b) The suction pipe, delivery pipe, up to the delivery valve is filled with liquid before starting the motor.
(c) Only the suction pipe is filled with liquid before starting the motor from an outside source.
(d) Only the delivery pipe, up to the delivery valve, is filled with liquid before starting the motor from an outside source

29. If an extra resistance is connected in the rotor circuit of slip ring induction motor, then

(a) Starting current and torque decreases
(b) Starting current increases and torque decreases
(c) Starting current decreases and torque increases
(d) Starting current and torque increases

30. In which of the following applications DC series motor is used?

(a) Centrifugal Pump
(b) Motor Operation in DC and AC
(c) Water pump drive
(d) Starter for car

31. A pressure conduit laid underground, may not be subjected to
    (a) Internal pressure of water
    (b) Pressure due to external load
    (c) Longitudinal temperature stress
    (d) Longitudinal stresses due to unbalanced pressure to bends

32. Which of the following will happen in a transformer when the number of secondary turns is less than the number of primary turns?
    (a) The voltage gets stepped up
    (b) The voltage gets stepped down
    (c) The power gets stepped up
    (d) The power gets stepped down

33. Which of the following is correct about direct current?
    (a) Magnitude is constant
    (b) Frequency is zero
    (c) Can be transported to larger distances with less loss in power
    (d) Flows in one direction

34. Which of the following motor is used where an extensive range of control is required
    (a) AC Motor
    (b) DC Motors
    (c) Synchronous Motor
    (d) Induction Motor

35. What is tapped into when digging a well looking for water in the water cycle?
    (a) An underground aquifer
    (b) An underground river
    (c) A sulfur spring
    (d) An irrigation ditch

36. Justify why the DC ammeter cannot measure an alternating current
    (a) AC is virtual
    (b) AC cannot pass via DC ammeter
    (c) The average value of complete cycle is zero
    (d) AC switches its direction

37. The chemical formula of alum is
    (a) $K_2 SO_4 . Al_2 (SO_4)_3 . 20H_2O$
    (b) $KNO_3 . Al_2 (SO_4)_3 . 24 H_2O$
    (c) $K_2 SO_4 . Al_2 (SO_4)_3 . 24 H_2O$
    (d) $K_2 SO_4 . Al_2 (SO_4)_3 . 21 H_2O$

38. In reverse osmosis (RO) the flow of solvent is due to
    (a) Potential gradient
    (b) Vapour pressure gradient
    (c) Concentration gradient
    (d) Osmosis solvent

39. If we connect a DC motor across AC supply, then the motor will be
    (a) It will not work
    (b) Damages
    (c) Speed will be reduced
    (d) Works efficiently

40. The organic impurities from sewage are removed by
    (a) Preliminary treatment
    (b) Primary treatment
    (c) Secondary treatment
    (d) Tertiary treatment

Direction (Questions No.41-45) : Short Answers (Answer ANY FOUR) **(4×5= 20)**

41. What is COD and BOD ?

42. What are the factors governs the location of a pumping station ? Explain factors affecting the selection of a particular type of pump?

43. What is motor starter ? Describe the advantages of soft starter in comparison to other starter.

44. What are sources of liquid waste? Explain in brief the methods of safe disposal of liquid waste.

45. What do you mean by source sustainability ? How do you suggest the most suitable system to be adopted for source sustainability in Mizoram ?

Directions (Question Nos. 46 - 50) : Short Answers (Answer ANY FOUR) **(4×10= 40)**

46. What are the disadvantages of waste dumping? Explain the difference between twin pit and septic tank in all aspects.

47. What is AC and DC electric current ? Explain the differences between the two types of current AC and DC.

48. What are the appurtenances for prevention of water hammer ? Explain in brief the effectiveness of appurtenances for prevention of water hammer.

49. What do you mean by plastic waste management unit ? Give your comment on reuse and recycle of plastic waste with appropriate final disposal of plastic waste.

50. In a water supply scheme to be designed for serving a population of 4 lakhs, the storage reservoir is situated at 8 km away from the city and the loss of head from source to city is 16 m . Calculate the size of the supply main by using Hazen-William's formula. Assume a maximum daily demand of 200 lpcd and half of the daily supply to be pumped in 8 hours. Coefficient of friction (C) = 130. Use the nearest standard available diameter of pipe for the design size of the supply main.

OR

Water has to be supplied to a town with one lakh population at the rate of 150 litres per capita per day from a river 2000 m away. The difference in elevation between the lowest water level in the sump and the reservoir is 36m. If the demand has to be supplied in 8 hours, determine the size of the main and the brake horse power of the pumps required. Assume maximum demand as 1.5 times the average demand. Assume f = 0.0075, velocity in the pipe 2.4 m/sec and efficiency of pump 80 percent.

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