

MIZORAM PUBLIC SERVICE COMMISSION
DEPARTMENTAL EXAMINATION FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT,
GOVERNMENT OF MIZORAM, DECEMBER-2024.

ENGINEERING PAPER – II
CIVIL ENGINEERS

Time Allowed : 3 hours

FM : 100 PM : 40

Marks for each question is indicated against it.

PARTS -A (50 MARKS)

1. Choose the correct answer in the following :

(5×1=5)

(a) For stones Mohs scale is used to determine-

- | | |
|---------------------|-----------------|
| (i) Toughness | (ii) Hardness |
| (v) Flakiness index | (iv) Durability |

(b) Hydration of which compound is responsible for increase in strength of cement in later age?

- | | |
|---------------------------|------------------------------------|
| (i) Tri-calcium Aluminate | (ii) Tri-calcium Silicate |
| (iii) Di-calcium Silicate | (iv) Tetra-calcium Alumino-ferrite |

(c) Considering the following data for concrete with mild exposer:

Water cement ratio = 0.5, Water = 191.6 litres

The required cement content will be.

- | | |
|-----------------------------|----------------------------|
| (i) 560 kg/m ³ | (ii) 470 kg/m ³ |
| (iii) 295 kg/m ³ | (iv) 383 kg/m ³ |

(d) The volume of water below the minimum pool level in a reservoir is known as-

- | | |
|--------------------|------------------------|
| (i) Useful storage | (ii) Surcharge storage |
| (iii) Dead storage | (iv) Bank storage |

(e) With the same water cement ratio, the lower the maximum size of aggregate the strength of concrete.

- | | |
|-------------------|----------------|
| (i) Increases | (ii) Decreases |
| (iii) Remain same | (iv) Bending |

2. Match List-I with List-II of the following:

(2×2=4)

(a)

List- I (Type of cement)	List - II (Uses)
(1) Rapid hardening	(i) Refractory concrete in industries
(2) Quick setting	(ii) Dams
(3) High alumina	(iii) Concrete under water
(4) Low heat	(iv) Repairs of bridges

(b)

List- I	List - II
(1) Smith test	(i) Frost
(2) Brard test	(ii) Durability
(3) Hardness test	(iii) Devil's
(4) Attrition test	(iv) Mohs scale

3. Fill in the blanks :

(5×1=5)

- (a) The thickness of mortar in brick work should not exceed _____.
- (b) Steel becomes harder and more brittle with higher content of _____.
- (c) The removal of unwanted chlorine in water by chemical or physical treatment is known as _____.
- (d) The major loss of energy, as a fluid flows through a pipe, is caused by _____.
- (e) A _____ is a portion of the foundation of a structure that transmits loads directly to the soil.

4. Answer any three (3) of the following questions.

(3×2=6)

- (a) What are the purposes of making frog in bricks during moulding?
- (b) What do you mean by dilution in the water treatment process?
- (c) What is Thixotropy?
- (d) What do you mean by bleeding in cement concrete?

5. What are light weight bricks ? Where are they commonly used?

(5)

6. What is creep of concrete ? Explain in detail.

(5)

OR

What are the main constituents in cement that give cementing properties?

7. Briefly explain the purpose and procedure for Attrition test on stone?

(5)

8. What do you mean by most economical section of a channel. Explain most economical of Trapezoidal section ?.

(5)

OR

What do you mean by parallel pipes in water supply system. Why pipes are connected in parallel?

9. Design a most economical trapezoidal canal section for carrying discharge of 45 cumecs and side slope of $1\frac{1}{2} : 1$ at a velocity of 0.9 m/sec. Assume value of $n = 0.022$ (n =Manning coefficient). (10)

OR

The data of material for making a cement concrete mix may be assumed as follows:

Sl.no	Material	Specific gravity	Bulk density kg/m ³	Proportion in mix by dry volume
1	Cement	3.2	1500	1 part
2	Fine aggregate	2.6	1600	1.3 part
3	Aggregate of 20mm size	2.7	1550	3 part

Determine the following for cement concrete :

- (a) Cement content per cubic metre of concrete. (5)
(b) Quantity of materials to make one cubic metre of concrete. (5)

PARTS-B (50 MARKS)

10. Choose the correct answer in the following: (5×1=5)
- (a) As per IS-456:2000, cracking of concrete in tension zone cannot be avoided but can be limited by-
- (i) Adhering to codal requirements of minimum steel area
 - (ii) Proper and prolonged curing of concrete
 - (iii) Increasing water cement ratio to increase workability
 - (iv) Increasing cement content
- (b) In solid waste management , waste utilization is achieved by-
- (i) Recover, Reclamation and Reproduce
 - (ii) Re-use, Reclamation and Re-cycling
 - (iii) Recover, Recycling and Reproduce
 - (iv) Re-use, Reproduce and Re-cycling
- (c) Which one of the following gases is the principal by-product of an aerobic decomposition of the organic content in waste water?
- (i) Carbon monoxide
 - (ii) Ammonia
 - (iii) Hydrogen sulphide
 - (iv) Methane Gas
- (d) As per IS-456:2000, the value of maximum compression strain in concrete in axial compression for limit state of collapse is-
- (i) 0.001
 - (ii) 0.002
 - (iii) 0.003
 - (iv) 0.004
- (e) The disposal of sewage into natural water sources such as streams, rivers, sea & lakes is known as-
- (i) Pollution
 - (ii) Dilution
 - (iii) Oxidation
 - (iv) Sedimentation

11. Fill in the Blanks: (5×1=5)
- (a) The unit wt. as specified by IS-456-2000 for PCC & RCC are _____ and _____.
 - (b) Sewerage treatment plant is normally designed to meet the requirements of _____ period after completion.
 - (c) Increase in waste quantity per capita is known to occur in India at the rate of _____ per year.
 - (d) Tests of BOD are usually made at a temperature of _____ and for a period of _____.
 - (e) _____ is a composite of human excreta and urine.

12. Define the terms – sewage, sewer and sewerage? (5)

OR

What are advantages and disadvantages of combined system of sewerage?

13. What do you meant by Primary and Secondary treatment of sewage? Name their units. (5)

14. With the help of data given below ,estimate the per capita solid waste generate per day in a colony with 20000 houses. (5)

Volume of waste/ 407 truck load = 4 m³

Volume of waste/ pick-up load = 2 m³

Volume of waste/ tractor load = 3 m³

No. of 407 truck loads = 3/day

No. of pick- up loads = 2/day

No. of tractor loads = 1/day

Average people / house = 5

Specific weight of waste in kg/m³ = 150 for 407 truck, 50 for pick-up and 40 for tractor.

OR

A town with population of 3.0 lakh produces solid waste at a rate of 2.5 kg/capita/day. If the waste is compacted to a density of 1500 kg/m³, how much volume of landfill site is needed in a year? Assuming that the ratio of solid waste cover is 4:1, what volume of cover soil is needed in a year?

15. Give reasons why ? (2×2½=5)

- (a) The sewer line may be laid near the centre line of the road.
- (b) Sewer gases should be carefully disposed off in the atmosphere.

16. A waste water sample was diluted 10% with tap water for conducting BOD test. The DO content in waste water sample was 1.2 mg/l and water was 6 mg/l. After 5 days incubation at 20° C the DO of the sample was 0.5 mg/l . Calculate. (5+5 = 10)

- (a) 5 day BOD of waste water.
- (b) Ultimate BOD. Assume $K_{20} = 0.12/\text{day}$.

OR

What do you understand by aerobic digestion ? . What are its advantages and disadvantages?

17. A rectangular sewer with width twice its depth is hydraulically equivalent to a circular sewer. Find the relation between the width of the rectangular sewer and the diameter of the circular sewer assuming that sewer is running completely full. (10)

OR

Explain in detail how landfills are environmentally safe over open dumps. Explaining landfill operations, state the problems associated with landfills.