

MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATION FOR JUNIOR GRADE OF M.E.S. (AE/SDO) UNDER IRRIGATION & WATER RESOURCES DEPARTMENT, GOVERNMENT OF MIZORAM, DECEMBER, 2024.

ENGINEERING PAPER – I (Common for Civil and Agricultural Engineers)

Time Allowed : 3 hours

FM : 100 PM : 40

Marks for each question is indicated against it.

Attempt all questions.

PART – A (50 MARKS)

1. Choose the correct answer:

(20×1=20)

- (a) Irrigation canals are generally aligned along-
 - (i) Ridgeline
 - (ii) Contour line
 - (iii) Valley line
 - (iv) Straight line
- (b) Available water in a soil refers to the water that is-
 - (i) Drained
 - (ii) Conserved
 - (iii) Used by plants
 - (iv) Lost due to percolation
- (c) An irrigation project is classified as a major project when the CCA involved in the project is more than _____.
 - (i) 2500 hectares
 - (ii) 10000 hectares
 - (iii) 2000 hectares
 - (iv) 5000 hectares
- (d) Centrifugal pumps are used for pumping water when-
 - (i) Both head and discharge are high
 - (ii) Discharge is high and head is low
 - (iii) Both discharge and head are low
 - (iv) Discharge is low and head is high
- (e) Which shape of weir provides a smooth flow transition and minimal turbulence?
 - (i) Broad-crested
 - (ii) Sharp-crested
 - (iii) Ogee
 - (iv) V-notch
- (f) What is the time interval between the sowing and harvesting of crops?
 - (i) Base period
 - (ii) Kor period
 - (iii) Crop period
 - (iv) Season period
- (g) A lysimeter is used to measure-
 - (i) Infiltration
 - (ii) Evaporation
 - (iii) Evapotranspiration
 - (iv) Vapour pressure
- (h) Which one of the following is true for the most economical trapezoidal section?
 - (i) Half of the base width = one of the sloping side
 - (ii) Half of the sloping side = total base width
 - (iii) Half of top width = One of the sloping sides
 - (iv) Total top width = one of the sloping sides
- (i) The useful soil moisture for plant growth is _____.
 - (i) capillary water
 - (ii) gravitational water
 - (iii) hygroscopic water
 - (iv) permanent wilting point

- (j) Darcy's law is valid under the condition of-
- (i) Flow is laminar
 - (ii) Flow is turbulent
 - (iii) Flow is transitional
 - (iv) Flow has Reynold's number > 4000
- (k) The sheet of water which overflows a weir is called-
- (i) Head
 - (ii) Static head
 - (iii) End contraction
 - (iv) Nappe
- (l) Which of the following factors influences the hydraulic performance of an irrigation well?
- (i) Soil type at the surface
 - (ii) Well screen colour
 - (iii) Pumping rate
 - (iv) Temperature of the well casing
- (m) The duty of irrigation water for a given crop is maximum-
- (i) On the field
 - (ii) At the head of the main canal
 - (iii) At the head of the water-course
 - (iv) At the tail end
- (n) When an irrigation canal is taken over a drainage channel, the crossing is called-
- (i) An aqueduct
 - (ii) Super passage
 - (iii) Level crossing
 - (iv) Canal Siphon
- (o) Recommended safe limits of land slopes for sandy loam to sandy soil is-
- (i) 0.25% to 0.60%
 - (ii) 0.20% to 0.40%
 - (iii) 0.05% to 0.20%
 - (iv) 0.10% to 0.20%
- (p) Bored tube-wells in rocky consolidated formations are usually drilled by-
- (i) Rotary drill rigs
 - (ii) Percussion drill rigs
 - (iii) Down the hole (DTH) hammer rigs
 - (iv) Impact drill rigs
- (q) The growing of two or more crops on the same piece of land within one calendar year is known as-
- (i) Multiple cropping
 - (ii) Inter-cropping
 - (iii) Mono-cropping
 - (iv) Sequential
- (r) An aquifer is a geological formation that-
- (i) Contains water but does not transmit
 - (ii) Does not contain water
 - (iii) Contain water and also transmit
 - (iv) Is a rock
- (s) For a circulatory watershed, the circulatory ratio is-
- (i) 0
 - (ii) 25
 - (iii) 30
 - (iv) 400
- (t) Calculate the hydraulic radius for a channel having a cross-sectional area of 20 m^2 and a wetted perimeter of 50 m.
- (i) 0.4 m
 - (ii) 0.8 m
 - (iii) 2.5 m
 - (iv) 0.6 m

2. Define 'Duty of water' in irrigation. What is its unit of measurement? (3)
3. State the advantages and disadvantages of tube-well irrigation over canal irrigation. (3)
4. Write short notes on Minor, Medium and Major Irrigation Project. (3)
5. Define the terms (a) Hygroscopic water (b) Capillary Water. (3)
6. Give an expression for Discharge over a rectangular notch or weir indicating the meaning of all the terms involved in the expression. (3)
7. Indicate the various components of a diversion headwork and briefly explain the function of each component. (5)

8. What are the characteristics of the Most Economical Section of a Channel? List out the characteristics of the most economical trapezoidal channel. (5)
9. Design a concrete lined trapezoidal channel to carry a discharge of 200 cumecs at a slope of 1 in 5000. The side slopes of the channel are 1:1 and manning's coefficient of rugosity may be taken as 0.014. Assume the limiting velocity in the channel as 2 m per second. (5)

PART B (50 MARKS)

10. Choose the correct answer: (20×1=20)

- (a) In doubly reinforced rectangular beam, the allowable stress in compression steel is the permissible stress in tension in steel-
- (i) Equal to (ii) greater than
(iii) Less than (iv) None of the above
- (b) As the elastic limit reaches, tensile strain _____.
- (i) Increases more rapidly (ii) Decreases more rapidly
(iii) Increases in proportion to the stress (iv) Decreases in proportion to the stress
- (c) According to ISI method of measurement, the order of the sequence is-
- (i) Length, breadth, height (ii) Breadth, length, height
(iii) Height, length, breadth (iv) None of these
- (d) Each standard cement bag has a volume of-
- (i) 0.32 cu m (ii) 0.35 cu m
(iii) 0.36 cu m (iv) 0.38 cu m
- (e) What is the recommended size of a brick?
- (i) 20x10x10cm (ii) 20x9x9cm
(iii) 19x9x9cm (iv) 19x8x8cm
- (f) What is the size of fine aggregates?
- (i) 4.75mm (ii) <4.75mm
(iii) >4.75mm (iv) 12mm
- (g) A first-class brick should have a minimum crushing strength of-
- (i) 7MN/m² (ii) 105 MN/m²
(iii) 125 MN/m² (iv) 14 MN/m²
- (h) What is the ratio of the components in grade M20 concrete?
- (i) 1:3:6 (ii) 1:1.5:3
(iii) 1:1:2 (iv) 1:2:4
- (i) The ultimate strength of cement is provided by-
- (i) Silica (ii) tri-calcium silicate
(iii) di-calcium silicate (iv) tri-calcium aluminate
- (j) What is the maximum percentage of silt allowed in sand to be used in concrete?
- (i) 5% (ii) 10%
(iii) 8% (iv) 2%
- (k) Slump test for concrete is carried out to determine-
- (i) Durability (ii) Workability
(iii) Strength (iv) Water content

- (l) Workability of concrete can be improved by _____.
(i) More sand (ii) More cement
(iii) More fine aggregates (iv) Fineness of coarse aggregate
- (m) In deep litter system, how many birds can 2.4 x 2.4 m accommodate-
(i) 12 (ii) 14
(iii) 16 (iv) 18
- (n) In which type of barn, the cows are housed and milked in the same building-
(i) Loose housing barn (ii) Stanchion barn
(iii) Open-air barn (iv) All of the above
- (o) What is the most accurate method of estimation from the following-
(i) Building cost index estimate (ii) Detailed estimate
(iii) Plinth area estimate (iv) Cube rate estimate
- (p) Pick up the item of work not included in the plinth area estimate from the following-
(i) Wall thickness (ii) Verandah area
(iii) Room area (iv) Courtyard area
- (q) Using plinth area method, estimate the construction cost of a building having plinth area of 15m², if the plinth area rate is Rs. 2000/- per m²
(i) Rs. 25,000.00 (ii) Rs. 20,000.00
(iii) Rs. 30,000.00 (iv) Rs. 15,000.00
- (r) Which of the following estimates mostly resembles a detailed estimate?
(i) Item rate estimate (ii) Rough estimate
(iii) Annual maintenance estimate (iv) Quantity estimate
- (s) The rate of an item of work depends on-
(i) Specification of works (ii) Specification of items
(iii) Proportion of mortar (iv) All of the above
- (t) The volume is measured correctly to the nearest-
(i) 0.001 cum (ii) 0.01 cum
(iii) 0.05 cum (iv) 0.1 cum
11. What are the factors to be considered for site selection of a farmstead? (3)
12. Write short notes on curing of concrete. (3)
13. What are the various characteristics of first-class brick? (3)
14. Differentiate between singly reinforced beam and double reinforced beam. (3)
15. What are the different types of natural aggregates? (3)
16. What is Estimate? What are the different types of estimates? (5)
17. Explain briefly the steps for preparation of Detailed Project Report of Minor Irrigation Project. (5)
18. Find the volume of earth work in embankment of length 12m. Top width is 5.5m and depth is 2.5m the side slopes are 1½:1. (5)