

MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO) UNDER PUBLIC WORKS DEPARTMENT, SEPTEMBER, 2018.

CIVIL ENGINEERING PAPER – II

Time Allowed : 3 hours

FM : 100 PM : 40

The figures in the margin indicate full marks for the questions.

(PART-I)

1. Answer the followings (5×3=15)
- (a) During a field visit of the alignment of one of the PMGSY roads in Mizoram, at one of the curves, the length of chord measured is 12.96m and that of the offset from the chord to the centre-line of the alignment is 0.60m. If the design speed is 40 Km/h, calculate the rate of super-elevation. Comment on your result.
 - (b) The alignment of a road passes through a portion of medium rock area where blasting is found necessary. A hole is drilled having a diameter of 25.00mm upto a depth of 1.80m at a spacing of 1.20m centre to centre. The burden is 1.50m. If the blasting ratio 4, what is the quantity of explosive required per hole?
 - (c) Section of the road alignment from a Toposheet/Contour map is proposed to pass through a consecutive points A,B,C,D and E. The targeted gradient to achieve is 1:22. The R.Ls. of the points A,B,C,D and E from the toposheet are 100.00m,102.00m,104.00m,106.00m and 108.00m respectively :-
 - i) What is the total distance length between the point A & E?
 - ii) A grade contour is to be established starting from point E. What should be the staff reading at a point 20.00m away from point E, if the height of instrument at this point is 108.75m?
2. Fill in the blanks (5×1=5)
- (a) In the stability analysis of slope, the Factor of safety with respect to height is the Factor of safety with respect to _____ .
 - (b) In Passive earth pressure condition, the state of stress of the backfill behind Retaining wall is in _____ .
 - (c) The time taken by the run-off from the farthest point on the periphery of the catchment to reach the site of the culvert is called _____ .
 - (d) Structures provided on the up-stream side of the road to reduce the flow of debris which blocks the road are _____ .
 - (e) The maximum spacing of reference pillars in the process of final location survey of road alignment recommended is _____ .
3. Give the difference between the followings (use short, direct and simple sentences) (5×2=10)
- (a) Wing wall and Return wall
 - (b) Catch water drain and Chute
 - (c) Direct method and Indirect method of remedial/preventive techniques of Landslide
 - (d) Small Bridges and Culverts
 - (e) Parapet and Railing pertaining to Roads and Highways

4. What remedial measure / action would you take/suggest in the following situations? (use short, direct and simple sentences) (5×2=10)
- (a) In an area having Translational type of landslide involving Earth slide or Debris slide or Rock slide or a combination of any of them.
 - (b) In a portion of road alignment having a sharp horizontal curves, where the safe overtaking sight distance requirement cannot be fulfilled.
 - (c) At locations in a steep stable rock zone where further cutting into the hill side is not practically feasible to get the required formation width of road.
 - (d) Problem of perpetual seepage of water from the hill side cutting slopes saturating the subgrade of the existing pavement.
 - (e) In built-up areas with houses/shops on either side of the road, the water stagnates on the road surface. Any of the drainage or Sub-surface drainage system cannot be provided
5. Explain the followings by giving technical reasons thereto. (use short, direct and simple sentences) (5×2=10)
- (a) In survey and alignment of hill roads, it is desirable to follow the direct line as far as possible between obligatory points. But this shortest route may have to be sacrificed with a longer road length.
 - (b) Smooth and worn out tyres offer higher skid resistance on dry pavement surface, but on wet pavement surface, new tyres with good treads give higher skid resistance.
 - (c) In Benching of slope, the width of bench to be really effective, should not be less than 8.00 m.
 - (d) Construction of successive Retaining walls one over the other should be avoided in continuity and closely located.
 - (e) The drill hole in a blasting operation should neither be too big nor too small than the actual requirement.

(PART-II)

6. Answer the followings (5×3=15)
- (a) The cost of one Pier and one Super-structure span of a multiple span bridge for various span lengths are as given below. The cost of super-structure is exclusive of the costs of railing and decking. If the economical span is given by the relation $l^2 = p/a$, where 'p' is the average cost of piers and 'a' is the average constant of variation. Assume for the constant of variation that the cost of super-structure varies inversely as the square of the span length. Calculate the Economic span.

Span (m)	3.50	6.00	9.00	12.00
Cost of Super-structure (Rs)	5000.00	8000.00	12000.00	24000.00
Cost of Sub-structure (Rs)	24000.00	26000.00	26500.00	28000.00

- (b) The earth is to be filled in an embankment of 500.00m long, 4.00m high and a side slope of 1:1. The top width of an embankment is 3.00m. The unit weight of excavated earth in undisturbed condition is 18 Kn/m³ with moisture content of 8%. The dry density required to achieve in the embankment is 15 Kn/m³. If the output of an Excavator is 60 m³/hr and hiring charge is Rs 3000/hr. Calculate the cost of hiring the Excavator to finish the work. Dry density and Wet density are given by the relation $\sigma_d = \sigma_t / (1+w)$, using the usual notation.

- (c) If the standard axle load is 80 Kn, calculate the vehicle damage factor (VDF) for the following vehicles :-
- Laden Heavy Commercial Vehicles (HCV) having rear axle load of 10.2 tonnes and a front axle load of 5.00 tonnes.
 - Un-Laden/ Partially loaded Heavy Commercial Vehicles (HCV) having rear axle load of 6.0 tonnes and a front axle load of 3.00 tonnes.

7. Fill in the blanks (5×1=5)

- To prevent decay of the Roadside trees while doing Lopping process to develop a certain shape during its growth, _____ coating is convenient to apply on the cut portion.
- For the purpose of Pavement design, only motorized Commercial vehicles of gross laden weight of _____ tonnes and above are considered.
- The recommended 7-day average compressive strength of DLC as Sub-base is _____ Mpa .
- Portland cement concrete (PCC) overlay constructed on the top of an existing Bituminous pavement is called _____ .
- The primary cause of smooth pavement surface under the traffic is _____ .

8. Give the difference between the followings (use short, direct and simple sentences) (5×2=10)

- Piers and Abutments of Bridge
- Structural and Functional failure of pavement
- Upheaval and Blow-up of pavement surface
- Dowel bars and Tie bars in Rigid pavement
- Scrap value and Salvage value

9. What remedial measure / action would you take/suggest in the following situations? (use short, direct and simple sentences) (5×2=10)

- There is a Hungry surface observed on the surface of the pavement.
- When the pavement surface manifests a symptoms of Ravelling.
- When estimation of traffic is required to carry out for a new road where no road is existing at present.
- When the Contractor starts excavation where erosion or sedimentation is likely to be a problem.
- When the wearing courses in a Bituminous construction is found, upon inspection either high or low than the specifications.

10. Explain the followings by giving technical reasons thereto. (use short, direct and simple sentences) (5×2=10)

- Tri-axial consolidated-quick test for the Sub-grade is justified/appropriate among others for pavement design purpose.
- It is desirable for alignment of Bridge, as far as possible, not to provide a skew alignment.
- The design life to be considered for the purpose of pavement design should neither be too short nor too long.
- Vehicles having axle distance between the front and the rear axle more than the spacing of transverse joints/construction joints are not considered for the Top-down crack criterion in the design of Rigid pavement.
- The deflection of pavement measured using Benkelman Beam Deflection technique during the dry months needs correction for seasonal variation.