

# MIZORAM PUBLIC SERVICE COMMISSION

## DEPARTMENTAL EXAMINATIONS FOR AE/SDO (CIVIL) UNDER PUBLIC WORKS DEPARTMENT. FEBRUARY, 2016.

### CIVIL ENGINEERING PAPER – II

Time Allowed : 3 hours

FM : 100 PM : 40

*Marks for each question is indicated against it.*

#### PART I

1. Answer the following (5×5=25)
- (a) Find out the value of superelevation to be provided in rural road for design speed of 20kmph and radius of curvature of 20m
    - (i) If the road is constructed in hilly area (not snow bound), can the calculated value above be adopted? Give reason.
    - (ii) Is super elevation of a road necessary if the traffic volume is very less? Why?
    - (iii) Under what condition of the road is super elevation not necessary?
  - (b) Using Dicken's empirical formula, calculate the peak run-off from a catchment area of 12.5 sq. km. Take the value of the constant in the empirical formula as 0.75
  - (c) For assessing the radius of curvature of an existing road, the inner chord distance measured is 15.25 m and the offset is 2.25 m. Find out the inner radius of curvature of the existing road. Does it satisfy the minimum required inner radius of curvature for a rural road in steep terrain?
  - (d) Write down the expression for base width of retaining wall for i) heights upto 6m and ii) height greater than 6m as laid down in IRC SP:48-1998 – Hill Roads Manual. Mention the sizes of parapet walls also.
  - (e) The blasting ratio of an explosive is 4cu.m per kg. 10 jack hammer holes are expected to break 20 cu.m of medium hard rock. Calculate the charge required in each hole.
2. Choose the correct answer (10×1=10)
- (a) The minimum design speed of hair-pin bend is
    - (i) 15 km/hr
    - (ii) 20 km/hr
    - (iii) 25km/hr
    - (iv) 30 km/hr
  - (b) If there will be numerous small jobs in different locations, the most suitable power shovel would be
    - (i) Crawler-mounted
    - (ii) Smooth wheel-mounted
    - (iii) Rubber tire-mounted
    - (iv) All of the above
  - (c) The size of bulldozer is indicated by
    - (i) Length and height of blade
    - (ii) Type of mounting
    - (iii) Horse power of engine
    - (iv) Kind of control, whether cable or hydraulic

- (d) The actual horse power input required by an air compressor is
- (i) Load factor
  - (ii) Capacity
  - (iii) Brake horse power
  - (iv) Theoretical horse power
- (e) For small diameter shallow blast holes, especially on rough surfaces, the most suitable drilling equipment is
- (i) Piston drills
  - (ii) Jack hammers
  - (iii) Rotary drills
  - (iv) Shot drills
- (f) If the existing formation level at a point 'A' to be established is 100.00m and the height of instrument is 102.00m. If the required formation level at point 'A' is 99.00 m, the top of the stake should be fixed at a height above the ground of
- (i) 1.00 m
  - (ii) 1.20 m
  - (iii) 2.00 m
  - (iv) 2.20 m
- (g) 'Lead' considered for removal of materials in measurement of civil works shall be
- (i) the route actually taken
  - (ii) the longest practical route
  - (iii) the shortest practical route
  - (iv) the average distance
- (h) Stability of hill slope depends upon
- (i) Nature of Slope
  - (ii) Angle of Slope
  - (iii) Geological conditions
  - (iv) Ground Water Conditions
- (i) Minimum thickness for rigid pavement is
- (i) 150mm
  - (ii) 125mm
  - (iii) 175mm
  - (iv) 165mm
- (j) The width of shoulder for a 2-lane National Highway on each side is
- (i) 0.90m
  - (ii) 1.0m
  - (iii) 1.25m
  - (iv) 0.75m

3. Differentiate any 5 (five) of the following.

(5×3=15)

- (a) Road land width and Roadway width
- (b) Limiting Gradient and Exceptional Gradient
- (c) Retaining wall and Breast Wall
- (d) Subway and Causeway
- (e) Ordinary kmstone and 5<sup>th</sup> kmstone
- (f) Single Lane and Intermediate Lane
- (g) Benching and Vision Berm

## PART II

4. Answer the following

(5×5=25)

- (a) Calculate the Design Traffic in MSA based on the following data for a double lane road.
- (i) Initial traffic in the design lane = 750 CV/day
  - (ii) Growth Rate = 7.5%
  - (iii) Design Life = 10 years
  - (iv) Vehicle Damage Factor = 1.25

- (b) The following are the sieve analysis result of 20mm and 10mm aggregates. Find out the approximate ratio the two sizes of aggregates must be mixed in order to get the desired all-in-aggregates .

S/No	IS Sieve Size	Cumulative % passing by weight		Range required for all-in -aggregate grading
		20mm	100mm	
1.	26.5mm	100	100	100
2.	19mm	60	90	90-100
3.	13.2mm	52	60	56-88
4.	4.75mm	40	53	16-36
5.	2.36mm	10	20	Apr-19
6.	0.30mm	5	7	02-Oct
7.	0.075mm	1	0	0 - 5

- (c) For WBM Base course, is there any difference in the maximum values of AIV and Flakiness Index for National Highways and Rural Roads? Give the maximum values of AIV and Flakiness Index of WBM Base Course for National Highways and Rural Roads.
- (d) What is afflux? How is it to be considered while designing bridge?
- (e) What do you mean by the economical span of a bridge? What is the condition for the total cost of bridge to be minimum?

5. Choose the correct answers.

(10×1=10)

- (a) Temporary enclosure built to exclude water from working area is
- (i) Caisson (ii) Bund  
(iii) Cofferdam (iv) Sheet Pile
- (b) The length of abutment at the top is normally equal to
- (i) Road Width (ii) Carriageway  
(iii) Formation Width (iv) Land Width
- (c) For small drainage crossings, \_\_\_\_\_ culverts are often found to be most economical in practice
- (i) Concrete (ii) Masonry  
(iii) Pipe (iv) Steel
- (d) The required camber of a pavement depends on
- (i) Class of road (ii) Geological condition of soil  
(iii) Type of pavement surface (iv) All of the above
- (e) In a rigid pavement, arrangements given for tying two slabs together but without transferring the pavement load are
- (i) Wire meshes (ii) Tie bars  
(iii) Dowel bars (iv) Bar mat
- (f) Maximum stress due to application of load in a rigid pavement occurs at
- (i) the edges (ii) the interior  
(iii) the bottom surface (iv) the top surface
- (g) The traffic forecast period considered in India in highway design is
- (i) 10 years (ii) 12 years  
(iii) 15 years (iv) 20 years

- (h) The effect of altitude on capacity of air compressor is :-
- (i) reduced compression ratio resulting reduced capacity
  - (ii) increased compression ratio resulting increased capacity
  - (iii) reduced compression ratio resulting increased capacity
  - (iv) increased compression ratio resulting reduced capacity
- (i) Choose one of the advantages of crawler mounted over wheel mounted Bulldozers from the following
- (i) Less operator fatigue
  - (ii) Higher travel speed
  - (iii) Greater floatation
  - (iv) Greater output
- (j) Primary factor to be considered in selecting the size of a Power shovel would be
- (i) concentration of work to be performed
  - (ii) costs per Cum of material excavated
  - (iii) soil condition of the project site
  - (iv) topography of the project site

6. Answer **any three (3)** of the following: **(3×5=15)**

- (a) Describe the factors to be considered while selecting location for bridge site.
- (b) Describe the method of construction of Bituminous Concrete as laid out in “Specifications for Road and Bridge Works” indicating the technical specifications clearly.
- (c) Describe the method of testing the field density of Granular Sub Base using Sand Replacement Method.
- (d) Describe the method of construction of Rigid Pavement and Cell filled Cement Concrete Road stating the main difference.
- (e) On what basis will you decide the use of Hume Pipe Culvert or RCC Slab Culvert?

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