

18CC1651

M. Tech. EXAMINATION, 2020

(Third Semester)

(C Scheme) (Main & Re-appear)

(CE(SE))

CES621C

DESIGN AND CONSTRUCTION OF BRIDGE SUB-STRUCTURES

Time : 2½ Hours]

[Maximum Marks : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Four* questions in all. All questions carry equal marks.

1. (a) Write down the limitations of empirical methods in estimation of peak flood flow. Explain with example.
(b) What are the design consideration for scour depth near pier and abutment and how can it be controlled ? Explain in detail.
2. (a) Describe in detail the step involved in computation of flood flow by the slope-area method.
(b) (i) What is the difference between normal and maximum scour depth ?
(ii) Distinguish between alluvial and quasi-alluvial streams.
3. (a) Briefly explain the different types of piers used in High way bridge structures. What are the normal type of materials used for constructing piers ?
(b) Describe the method of checking the stability of a pier. What is the effect of buoyancy during floods on stability of the pier ?

4. (a) What are the various forces to be considered in the design of pier ? How do you evaluate these forces ?
- (b) Verify the adequacy of the dimensions for the pier shown in Fig. The following details are available :

Top width of the pier : 1.6 m

Height of the pier up to springing level : 10 m

c/c of bearing on either side : 1.00 m

Side batter : 1 in 12

Height of flood level : 1 m below the bearing level

Span of the bridge : 16 m

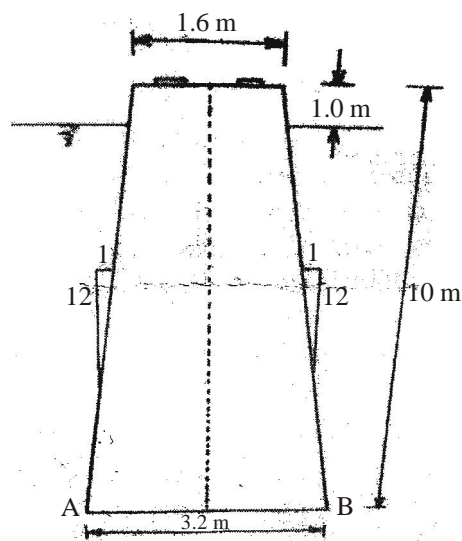
Loading on span : IRC class AA

Road : Two-lane road with 1 m wide footpath on either side

Super structure consists of three longitudinal girder of 1.4 m depth with a deck slab of 200 mm depth.

Rib width of girders = 300 mm

Material of pier : M 25



5. (a) Explain with sketches the different types of wing walls used mentioning the suitability of each type.

- (b) Briefly explain the necessity of using abutments. What materials are generally used for the construction of abutments ?
6. (a) Explain the methods of checking the stability of abutments subjected to dead, live and earth pressure from backfill.
- (b) Verify the stability of the abutment of a bridge with the following details :
- Top width : 1.5 m
- Height : 4 m
- Back batter : 1 in 6
- Front face of the abutment is vertical.
- Material : Stone masonry
- Unit weight of soil : 18 kN/m^3
- Angle of repose : 30°
- Superstructure : T-beam bridge of span 15 m
- Loading : IRC class AA
- Assume suitable dimensions for the components of the superstructure.
7. (a) What are the major classifications of bridge foundations ? Under what situations you would adopt shallow and deep foundations ?
- (b) It is proposed to use 400 mm by 400 mm precast RCC piles for the foundation of the pier of a major bridge. It is estimated that the load on each pile to be 800 kN. Design suitable reinforcement in the pile if the total length of the pile is estimated as 8 m using M 25 grade of concrete and Fe-415 grade HYSD bars.
8. (a) Explain with sketches the reinforcement details of a typical caisson and the method of sinking a pneumatic caisson for a major bridge foundation.
- (b) Design a well foundation for a bridge using the following particulars :
- Diameter of well : 2.75 m
- Depth of the well : 13 m
- Type of soil : Stiff clay
- Material M 20 concrete and Fe 500 steel.

9. (a) How do you estimate the normal scour depth of a quasi-alluvial stream ? Also, write down the respective equations.
- (b) How do hydraulic factors influence the design of bridges ?
- (c) Explain, how braking forces can be calculated in case of live load on pier structure.
- (d) What are the effects of braking forces on the stability of abutment structures ?
- (e) Under what situation you would resort to well foundations for bridge structures ?