University of Mumbai
Examination Summer 2022

Program: Civil Engineering
Curriculum Scheme: Rev2019
Examination: BE Semester: VIII
Course Code: CE-DLO8034 and Course Name: Bridge Engineering and Design
Time: 2-hour 30 minutes Max. Marks: 80

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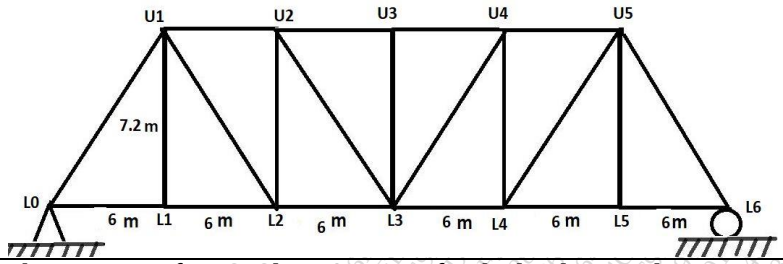
Note: IRC 6-2017, IRC 112-2011 and IS 1343-2012 are permitted in examination.

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks. (2 x 10)**
1.	Which of the following theories is not suitable for load analysis on a longitudinal girder of a bridge?
Option A:	Wester guard's theory
Option B:	Grid slab theory
Option C:	Henery Jaeger theory
Option D:	Courbon's theory
2.	A tilt of ….. and a shift of …. shall be considered in the design of well foundation.
Option A:	1 in 150, 80 mm
Option B:	1 in 100, 100 mm
Option C:	1 in 80, 150 mm
Option D:	1 in 10, 10 mm
3.	Micro piles are most suitable for which loads?
Option A:	both tension and compression
Option B:	tension only
Option C:	compression only
Option D:	tension, compression and lateral
4.	In case of multi-lane bridges, each …… loading shall be considered to occupy two lanes and no other vehicle shall be allowed in these two lanes.
Option A:	IRC Class 70R or IRC Class B
Option B:	IRC 70R or IRC Class AA
Option C:	IRC Class A
Option D:	IRC Class B
5.	The span length of bridge for which the cost of the superstructure is equal to cost of substructure is called …….
Option A:	Effective span
Option B:	Economical span
Option C:	True span
Option D:	Clear span
6.	The balanced cantilever method of construction of bridge is easily adaptable to …
Option A:	irregular and long span lengths
Option B:	regular and long span lengths
Option C:	irregular and medium span lengths
Option D:	regular and medium span lengths
7.	Which of the following is incorrect?
Option A:	Poisson's ratio for concrete used in bridges is considered as 0.2.
Option B:	Service life of normal bridge, designed in India shall be 100 years.

Option C:	Minimum clear distance between outer of wheels of two passing or crossing IRC Class A vehicles must be 1.2 m for bridge of carriageway width 6.1 m and more.
Option D:	From durability requirements, minimum clear cover to the reinforcement bars must be 50 mm when bridge is constructed at a place having sever environmental conditions of exposure.
8.	What will be intensity of live load per m width of RC deck slab bridge, accounting effect of Impact Factor, if effective span of bridge is 6 m and dispersion of load due to IRC Class 70R tracked vehicle is on a patch of 5.55 m (along the span) x 7.45 m (along the carriageway width)?
Option A:	16.93 kN/m
Option B:	20.53 kN/m
Option C:	33.3 kN/m
Option D:	45.76 kN/m
9.	Which of the following statements about IRC Class B train of vehicles are incorrect? 1. Total load of vehicle is 332 kN. 2. Maximum load transferred by an axle is 114 kN. 3. Distance between front most and rear most axle of a vehicle is 18.8 m. 4. Distance between tail of leading vehicle and nose of succeeding vehicle shall not be less than 30 m. 5. There are in all 7 axles in a vehicle.
Option A:	2, 4 & 5
Option B:	1 & 3
Option C:	3 & 4
Option D:	2 & 5
10.	A 50 m long lattice girder bridge has to carry Modified Broad Gauge -1987 Loading. Coefficient of dynamic augment shall be ….
Option A:	0.293
Option B:	0.445
Option C:	0.111
Option D:	0.701
Q2.	**Attempt any Four out of Six. (5 x 4)**
A	What is a well foundation? What are various shapes of well foundations? Also sketch components of well foundation.
B	Enlist the various method of launching of a girder. Explain any one in detail.
C	How the bridges are classified on the basis of load transfer mechanism, material, lanes and flood level?
D	A PSC girder bridge has 200 mm thick RC interior slab panel. The ultimate bending moment acting per meter width of slab along shorter span is 30.5 kN-m. Verify the depth of slab in flexure and design reinforcement. Use 12 mm ϕ-Fe 415 bars and M30 concrete.
E	What are different factors influences to decide the span of a bridge? What do you mean by economical span of a bridge? Develop equation for the same.
F	Determine bending moment on a longitudinal girder of 30 m span bridge due to IRC Class AA tracked vehicle. Clear carriage width is 7.5 m. Consider longitudinal girders at 2.5 m c/c and cross girders at 4.5 m c/c.
Q3.	**Attempt any Two Questions out of Three. (10 x 2)**
A	Calculate the LLBM for the RCC slab culvert for the National highway to suit the following requirements: • Carriageway: 7.5 m • Footpath: 1 m on either side • Effective span: 6 m • Live load: IRC class A wheeled vehicle • Wearing coat: 80 mm thick and deck slab: 500 mm thick

B Determine the force in the member U_2L_3 of lattice girder bridge due to total imposed load acting per track as under. Consider CDA = $[0.15 + \frac{8}{6+L}]$

Span (m)	12	13	14	15	16	17	18
Total load (kN)	1377	1475	1558	1631	1695	1751	1820

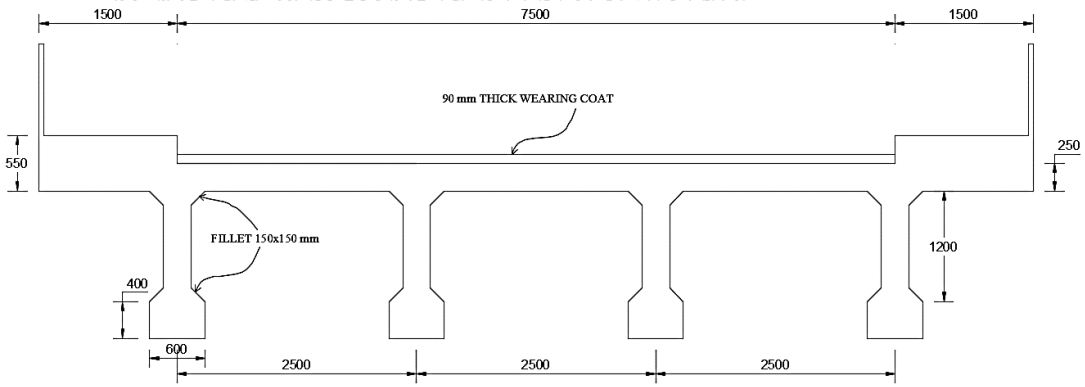


C Locate the position of IRC Class A train of vehicle along and across a 13 m long and 8 m wide carriageway deck slab bridge to produce maximum flexural effect in it.

Q4 A **Attempt any One Question out of Two.** **(10 x 2)**

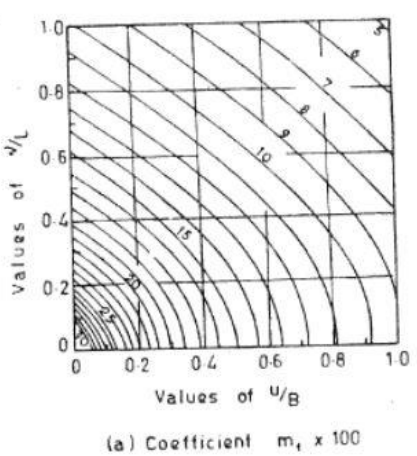
I A simply supported prestressed concrete deck slab bridge has to carry LLBM and DLBM of 170 kN-m and 300 kN-m respectively per meter width of carriage way. Take thickness of wearing coat 100 mm and deck slab 500 mm. Check suitability of section in limit state of serviceability cracking and maximum compression. Also determine prestressing force and eccentricity at mid span. Use M60 concrete and steel with f_p 1700 MPa. Consider $f_{ci} = f_{ck}$, losses 20% and type-1 element.

II Determine bending moment on a longitudinal girder of 27 m span due to self-weight of bridge superstructure. Cross girders are provided at 4.5 m c/c. Area of cross girder is 70% of area of longitudinal girder.

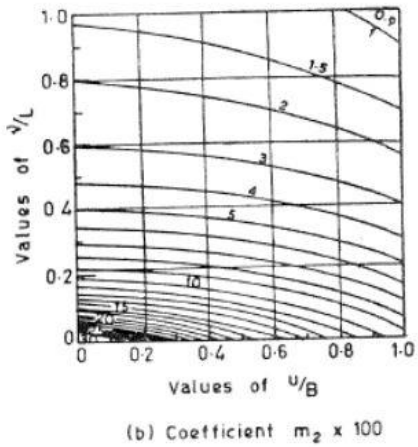


B **Attempt any Two Questions out of Three.** **(5 x 2)**

I Calculate BM in an interior slab panel of a girder bridge due to IRC Class AA tracked vehicle. Longitudinal girders and cross girders are provided at 2.5 m c/c and 5 m c/c respectively. Thickness of RCC slab is 250 mm and thickness of wearing coat is 100 mm.



(a) Coefficient m_1 x 100



(b) Coefficient m_2 x 100

II	How environmental exposer conditions for a bridge construction be identified? How does it effect on the following? Grade of concrete, Nominal cover, Maximum water cement ratio, Minimum cement content per meter cube of concrete
III	What is different between fixed and expansion type of bearing? Explain components and functioning of elastomeric bearing.