Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2018

Program:M.Tech.(Structural Engineering) | **Semester – VI**
Subject (Course): Bridge Engineering | **Max. Marks : 100**
Course Code :CIVL7022 | **Duration : 3 Hrs**
No. of page/s:

Note: Attempt All Questions. Assume suitably any data not given and state clearly.

	Section A		
1.	**While designing a girder bridge, show that the cost of bridge is minimum, when the cost of pier is equal to the cost of girder in one span.**	**[4]**	**CO1**
2.	**Explain how the following parameters effect the design of bridges:** **a. Impact factor** **b. Longitudinal force**	**[4]**	**CO2**
3.	**A solid slab bridge is considered to be uneconomical for spans greater than 6m. Explain and give reasons.**	**[4]**	**CO3**
4.	**The match cast method is preferred over wet cast system for casting of prestressed segments for metro bridges. Explain why.**	**[4]**	**CO4**
5.	**In case of bridges crossing over rivers, explain how does the buoyancy effect the design of substructures.**	**[4]**	**CO5**
	Section B		
6.	**Determine the linear waterway for a bridge across a river having following hydrologic data. Assume rectangular cross section.** **a. Peak flood discharge =Q= 180 cumec** **b. Flood velocity = v=1.5m/s** **c. Width of flow at HFL =L= 62m** **d. Allowable velocity under the bridge from scour considerations= 1.6m/s** **Afflux may be calculated according to Moleworth formula=** **$X = [(v2/17.9) + 0.015][(A2/a2) - 1]$**	**[10]**	**CO1**

	Or **Determine the linear waterway for a bridge across a river having following hydrologic data. Assume triangular cross section.** **a. Peak flood discharge =Q= 220 cumec** **b. Flood velocity = v=1.5m/s** **c. Width of flow at HFL =L= 70m** **d. Allowable velocity under the bridge from scour considerations= 1.8 m/s** **Afflux may be calculated according to Moleworth formula=** **$X = [(v^2/17.9) + 0.015][(A^2/a^2) - 1]$**		
7.	**A two lane prestressed highway bridge of 18m span consists of precast deck slab of span 2.5m and 300 mm thick supported on prestressed beams below . The bridge is required to carry a live load Class 70R tracked vehicle. Show in a figure how the load should be placed on the deck slab in order to obtain maximum load intensity, and also calculate the resulting maximum load intensity.** **Assume tracked vehicle chain dimension as 4.57 x 0.84m and carrying a load of 350KN, wearing coat 100mm thick, K = 3.**	**[10]**	**CO2**
8.	**A simply supported composite girder bridge of 12 m span is constructed on a highway. The cross section of bridge consists of precast webs of size 800x300mm having cast-in-situ RCC flange of thickness 100mm. The initial pre-stress force of 1400kN is applied at a eccentricity of 200mm. If the bridge is made up from M40 concrete and is required to carry a uniformly distributed live load of 35kN/m acting on the beam over full span, calculate the stresses developed in the beam at various stages as given below. Check if the live load can be carried safely. Assume 20% losses and c/c of beams as 2m.** **a. When the beam is prestressed at site** **b. Beam is lifted immediately after prestressing** **c. Losses occur and slab is cast thereafter** **d. Slab is cured and Live load is applied.**	**[10]**	**CO3**
9.	**A two lane bridge is constructed on a highway to cross a river having currant velocity as 1m/s. The pier provided is rectangular in shape with semi circular ends with the size of rectangle at bottom of pier being 3.5x8.4m and 1.5x8.4m at the HFL.** **If the HFL level is 7m high above the bottom of pier, calculate the stresses produced at the base of pier due to water currant. Assume k= 0.66**	**[10]**	**CO5**

	Section C		
10.	**A two track three span precast segmental bridge of balanced cantilever type for metro rail has main central effective span 60m and two end spans 30m each. The bridge is constructed from box type precast segments having 2m length and following dimensions:** **Width of top flange = 7.2m** **Flange outstands from box section= 1.5m each** **Flange thickness varies from 0.2m at end to 0.4m to box junction** **Overall depth of segment = 2.74m** **Box segment thickness = 0.2m** **Use M60 concrete and HTS wires 12mm having UTS of 2200 Mpa.** **a. Design the bridge for erection of cantilever segments** **Or** **b. Design the bridge for erection of all segments in mid span.**	**[20]**	**CO4**
11.	**A bridge is constructed on a highway to carry Class A loading that produces a reaction of 50KN on the pier from one span. Calculate the stresses produced at the base of pier due to live load in (a) single span, (b) both spans.** **The pier provided is rectangular in shape with semi circular ends with the size of rectangle at bottom of pier being 4.5x8.4m and 1x8.4m at the top. Assume the deck slab has a bearing of 300mm on the pier top and impact factor as 1.36**	**[20]**	**CO5**

Roll No: ----------

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2018

Program:M.Tech.(Structural Engineering) | **Semester – VI**
Subject (Course): Bridge Engineering | **Max. Marks : 100**
Course Code :CIVL7022 | **Duration : 3 Hrs**
No. of page/s:

Note: Attempt All Questions. Assume suitably any data not given and state clearly.

	Section A		
1.	**What is economic span of a highway bridge. Derive and explain the condition for economic span of bridge.**	**[4]**	**CO1**
2.	**Explain how the following parameters effect the design of bridge substructure;** **c. Braking force** **d. Water current force**	**[4]**	**CO2**
3.	**In case of a composite bridge deck, explain through figure how the precast beam web can be connected to cast in situ deck slab.**	**[4]**	**CO3**
4.	**For a long span segmental bridge , explain through figure how the prestressing strands are provided in precast concrete segments for erection and for carrying live load.**	**[4]**	**CO4**
5.	**In case of bridges having several spans, explain how the stresses are produced in a pier when live load acts only on one span.**	**[4]**	**CO5**
	Section B		
6.	**A two lane prestressed highway bridge of 20m span consists of precast deck slab of span 2m and 250 mm thick supported on prestressed beams below . The bridge is required to carry a live load Class 70R tracked vehicle. Show in a figure how the load should be placed on the deck slab in order to obtain maximum load intensity, and also calculate the resulting maximum load intensity.** **Assume tracked vehicle chain dimension as 4.57 x 0.84m and carrying a load of 350KN, wearing coat 100mm thick, K = 3.**	**[10]**	**CO2**

7.	**A simply supported composite girder bridge of 15 m span is constructed on a highway. The cross section of bridge consists of precast webs of size 800x325mm having cast-in-situ RCC flange of thickness 125mm. The initial pre-stress force of 1600kN is applied at a eccentricity of 200mm. If the bridge is made up from M45 concrete check if it can carry safelya uniformly distributed live load of 38kN/m acting on the beam over full span.Assume 20% losses and c/c of beams as 2.2m.**	**[10]**	**CO3**
8.	**Explain the balanced cantilever method of construction of segmental bridges. Why is the end span in such bridges kept nearly half of the central span in this method.** **Or** **Explain the span by span method of construction of segmental bridges. How does it differ from the balanced cantilever method.**	**[10]**	**CO4**
9.	**A two lane bridge is constructed on a highway to cross a river having currant velocity as 1.5m/s. The pier provided is rectangular in shape with semi circular ends with the size of rectangle at bottom of pier being 3.5x8.4m and 1.5x8.4m at the HFL.** **If the HFL level is 6m high above the bottom of pier, calculate the stresses produced at the base of pier due to water currant. Assume k= 0.66**	**[10]**	**CO5**
	Section C		
10.	**A three span metro rail precast segmental bridge of balanced cantilever type has main central effective span 60m and two end spans 30m each. The bridge is constructed from box type precast segments having following dimensions:** **a. Width of top flange = 7.2m** **b. Flange outstands from box section= 1.5m each** **c. Flange thickness varies from 0.2m at end to 0.4m to box junction** **d. Overall depth of segment = 2.74m** **e. Box segment thickness = 0.2m** **f. Use M60 concrete and HTS wires 12mm having UTS of 2200 Mpa.** **a. Calculate the prestressing force and the eccentricity at which it should be applied for erection of cantilever segments, and show it in a figure.** **Or** **b. If all the segments are to be erected using closure segment, calculate the prestressing force and the eccentricity at which it should be applied. Show the details in a neat sketch.**	**[20]**	**CO4**

11.	**A bridge is constructed on a highway to carry Class AA loading that produces a reaction of 70KN on the pier. Calculate the stresses produced at the base of pier due to live load in (a) single span, (b) both spans.** **The pier provided is rectangular in shape with semi circular ends with the size of rectangle at bottom of pier being 5x8.4m and 1.2x8.4m at the top. Assume the deck slab has a bearing of 350mm on the pier top and impact factor as 1.35**	**[20]**	**CO5**