Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Bridge Engineering **Semester: II**
Program: M. Tech. (Structural Engineering) **Time 03 hrs.**
Course Code: CIVL 7022 **Max. Marks: 100**

Instructions: Attempt all Questions. Assume and state clearly any data considered necessary, but not given.

SECTION A

S. No.		Marks	CO
Q 1	In a girder bridge, explain why the cost of main girder increases as the span of bridge between the piers is increased.	**4**	**CO1**
Q 2	Give reasons why the IRC code prescribes the impact factor to be considered in the design of bridges.	**4**	**CO2**
Q 3	A solid slab bridge of span 'l' is to be designed for Class A loading of IRC code. Illustrate in a figure where should the wheel loads are placed on the slab: a. For calculating maximum bending moment b. For calculating maximum shear force. Also give reason for your answer.	**4**	**CO3**
Q 4	In composite construction, if the deck slab is precast, explain through figure how topping is provided and why is it required.	**4**	**CO4**
Q 5	Sketch a trapezoidal segment and box type segment for use in segmental bridge construction. What is the advantage of using a trapezoidal segment over box type segment , for construction of a metro rail viaduct.	**4**	**CO5**

SECTION B

Q 6	Determine the linear waterway for a bridge across a hilly river having following hydrologic data. Assume rectangular cross section. a. Peak flood discharge =Q= 225 cumec b. Flood velocity = v_n =1.5m/s c. Width of flow at HFL = L_n = 60m d. Allowable velocity under the bridge from scour considerations= 1.8 m/s	**10**	**CO1**

	e. Afflux according to Moleworth formula= x $X = [(v^2/17.9) + 0.015][(A^2/a^2) - 1]$		
Q 7	A two lane solid slab bridge has a span of 5m. Check if the slab is safe in shear for Class A loading as per IRC. Assume: Slab thickness = 350mm Concrete used M20 having permissible shear stress = 0.28 MPa Load intensity due to axles at a distance of 0.6m from support= 32 KN/m width Load intensity due to axles at a distance of 1.8m from support=28KN/m width Impact factor = 1.36	**10**	**CO2**
Q 8	What is the role of shear connectors in composite construction, and explain through figures how different types of shear connectors can be provided in bridges having composite construction. Or What is shored and unshored method of construction of composite bridges. Explain the difference in design of prestressed beams of such bridges.	**10**	**CO3**
Q 9	What is match cast system and wet cast system of jointing the segments in a precast segmental bridge. Which one is superior and why.	**10**	**CO5**
	SECTION-C		
Q 10	A post tensioned precast T girder spaced at 2.5 m c/c is to be provided in a highway bridge having a span of 22m. Suggest a suitable size for the web of the girder and calculate the initial prestress force to be applied. Assume: a. live load intensity on the bridge as 27KN/m width, b. deck thickness as 0.25m having a 50mm topping. c. Losses as 20%. Or If prestressed gap slabs are provided for the deck in between the girders for the above bridge, design the deck slabs using M40 concrete and prestressing wires of 12mm diameter having UTS of 1800 MPa. Sketch all details clearly showing how these can be fitted in gaps in between the T girders.	**20**	**CO4**
Q11	A two line three span precast segmental bridge of balanced cantilever type is to be	**20**	**CO5**

	constructed for metro train. The bridge has main central effective span 70m and two end spans 35m each. The bridge is constructed from trapezoidal type precast segments having following dimensions: a. Width of top flange = 10m b. Flange outstands from box section= 1.5m each c. Flange thickness uniform = 0.35m d. Overall depth of segment = 3.5m e. Box segment thickness = 0.25m f. Angle of inclination of webs from the bottom flange = 60^0 Use M60 concrete and HTS wires 16mm having UTS of 2200 Mpa. Design the bridge for two track metro loading. Tendons are stretched to 70% of UTS in initial stage and 60% of UTS in service stage. Following data may be assumed for loading per metro track for 70m span: EUDL for Bending Moment = 262.5 t EUDL for shear force = 237 t CDA= 0.15 + (8/(6+L))		