Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course:	**Design of Formwork**	**Semester:**	**VI**
Program:	**B. Tech Civil Engineering**	**No. of Pages:**	**4**
Time:	**03 hrs.**	**Max. Marks:**	**100**

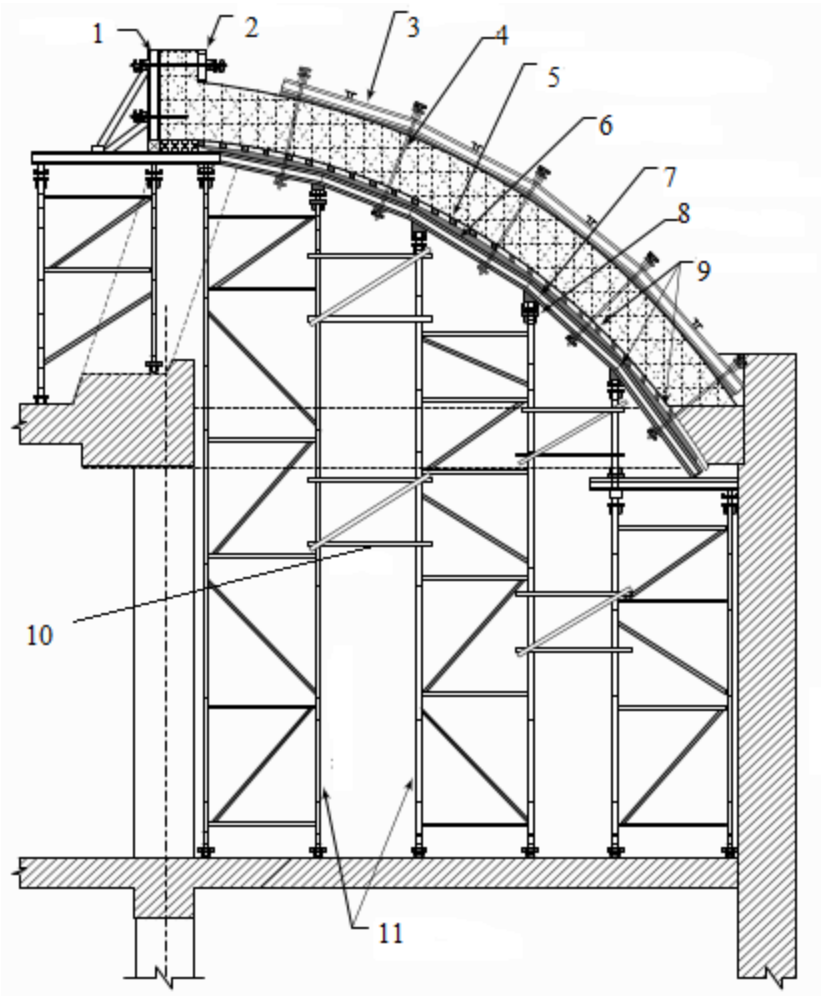
Instructions: **1. Answer all questions of Section A, B & C**
2. Internal choice is given in Section C
3. Useful formulae and tables are given for some questions
(Assume all the necessary data if necessary)
NOTE: IS 800 should be Allowed/Provided

SECTION A

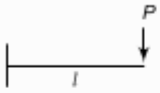
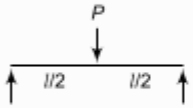
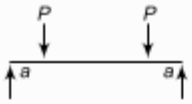
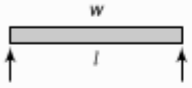
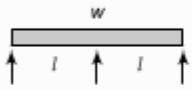
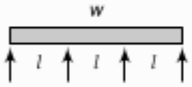
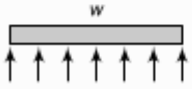
S. No.		Marks	CO
Q 1	True or False explain with reasoning: 1. Slipform construction is similar to the extrusion process in which the wet concrete is extruded rather than retained in forms until it is hardened. 2. The term flying formwork is used because forms are flown from one story to another story with the help of crane. 3. Caissons are hollow structures sunk to vey high depth below ground or the river bottom. 4. Three broad parts of caissons are cutting edge, curb and wall. 5. Some of the special structures are shells, domes, folded plates, natural draft cooling towers, nuclear reactors, tunnels, lift shafts etc. 6. The main components of a slab and beam formwork are sheathing, joist, stringers, shores and bracings. 7. Various factors in achieving economy in column formwork are location, orientation, shape, varying percentage of steel. 8. The three variants of ACS are: ACS-R, ACS-P and ACS-G. 9. In sheathing design span is based upon bending, shear and deflection criteria. 10. Form is part of formwork from sheathing to support system.	**2X 10 = 20**	**CO 1, CO 2, CO 3, CO 4**

SECTION B

Q 2	Provide checks for bending, shear and deflection for the **sheathing layer** as per IS800 of wall formwork made of all steel for casting walls of 5.5 m height and 0.8 m thickness. Assume the maximum concrete pressure on the formwork is 60 kN/m^2. Following materials are available- mild steel plate of 4 mm thickness and mild steel flats of 50 mm x 6 mm ad 60 mm x 6 mm are available.	**10**	**CO 4**
Q 3	Write short notes on Slip formwork and Flying formwork. Also at list two differences between them regarding basic difference and their uses.	**5+5**	**CO 1**

Q 4	List the reasons of failure on the following case studies: a. Failure of prefabricated segment in Hyderabad flyover b. Toppling of girders in an under construction viaduct bridge of Faizabad.	**5+5**	**CO 2**
Q 5	Write the names of components of special structure of concrete dome shown in figure.  	**10**	**CO 4**
	SECTION-C		
Q 6	Design the formwork for a column of cross section 400 mm X 400 mm, Height of 3 m. A plywood of 12 mm thickness is available. Permissible bending stress for plywood is 14 N/mm^2, permissible bending moment is 0.21 kNm/m permissible shear force 6.3 kN and permissible deflection is span / 360. Timber of cross section 50 mm X 100 mm, 100 mm X 100 mm, 100 mm X 150 mm and 150 mm X 150 mm are available. Permissible bending stress for timber 7 N/mm^2, permissible shear stress 1.0 N/mm^2, E = 10000 N/mm^2. Tie rods of mild steel diameter 20 mm are used. Dead weight of fresh concrete is 26 kN/m^3.	**20**	**CO 3**

Q 7	Design the formwork for the slab for the given data: Slab thickness = 150 mm, Live load = 4kN/m^2 with 15 % additional load for impact. The room size is 4m by 4m and dead weight of the fresh concrete is 26.5 kN/m^3. Height of ceiling roof is 4 m. A 19 mm thick plywood is used as sheathing and the allowable stresses for plywood in bending = 12 N/mm^2, shear = 0.5 N/mm^2 and E = 10000 N/mm^2. For joist, stringer and shores suitable timber section may be chosen among the following 75 mm X 100 mm, 100 mm X 100 mm, 100 mm X 150 mm and 150 mm X 150 mm. The allowable stresses for timber in bending 8 N/mm^2, in shear 0.5 N/mm^2 and E = 10000 N/mm^2. Permissible deflection for sheathing is 1.5 m and total formwork is 5 mm. **OR** Design the formwork for the slab for the given data: Slab thickness = 120 mm, Live load = 4kN/m^2 with 25 % additional load for impact. The room size is 4m by 4m and dead weight of the fresh concrete is 26.5 kN/m^3. Height of ceiling roof is 4 m. A 19 mm thick plywood is used as sheathing and the allowable stresses for plywood in bending = 12 N/mm^2, shear = 0.5 N/mm^2 and E = 10000 N/mm^2. For joist, stringer and shores suitable timber section may be chosen among the following 75 mm X 100 mm, 100 mm X 100 mm, 100 mm X 150 mm and 150 mm X 150 mm. The allowable stresses for timber in bending 8 N/mm^2, in shear 0.5 N/mm^2 and E = 10000 N/mm^2. Permissible deflection for sheathing is 1.5 m and total formwork is 5 mm.	**20**	**CO 3**

Sl. No.	Loading condition	Bending Moment	Shear Force	Deflection
1.		$M = Pl$	$V = P$	$\delta = \frac{Pl^3}{3EI}$
2.	 For simply supported beam with concentrated load P at its centre	$M = \frac{Pl}{4}$	$V = \frac{P}{2}$	$\delta = \frac{Pl^3}{48EI}$
3.	 Span = $l = a + b$	$M = \frac{Pab}{l}$	$V = \frac{Pa}{l}$	$\delta = \frac{Pb}{EI} \times \left(\frac{l^2}{16} - \frac{b^2}{12}\right)$
4.	 Two point loads of magnitude P each. Span = l	$M = Pa$	$V = P$	$\delta = \frac{Pa}{6EI} \times \left(\frac{3l^2}{4} - a^2\right)$
5.	 For simply supported beam with U.D.L. Span of length l	$M = \frac{wl^2}{8}$	$V = \frac{wl}{2}$	$\delta = \frac{5wl^4}{384EI}$
6.	 Two span uniformly supported beam with U.D.L. Equal span of length l	$M = \frac{wl^2}{8}$	$V = \frac{5wl}{8}$	$\delta = \frac{wl^4}{185EI}$
7.	 For continuous beam with U.D.L. over its full length. Equal span of length l.	$M = \frac{wl^2}{10}$	$V = \frac{5wl}{8}$	$\delta = \frac{wl^4}{145EI}$
8.	 Continuous beam more than 3 spans with U.D.L. over its full length. Span of length l.	$M = \frac{wl^2}{10}$	$V = \frac{5wl}{8}$	$\delta = \frac{wL^4}{145EI}$

As can be noted from above, the expression remains the same for more than three equally spaced supports.