UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M.Tech.(Structural Engineering) — **Semester – I**
Subject (Course): Industrial Structures — **Max. Marks : 100**
Course Code :CIVL7004 — **Duration : 3 Hrs**
No. of page/s:

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

	Section A		
1.	**With reference to wind loading on tall structures, explain what is gradient height and illustrate in a diagram how does it vary for different terrain categories.**	**[4]**	**CO1**
2.	**Tubular steel sections are considered to have advantage over other structural steel sections for construction of industrial roof trusses. Give reasons why. What are the problems associated in making joints in tubular sections.**	**[4]**	**CO2**
3.	**A self supporting steel chimney is to be constructed in suburban area of a city for a height of 60m. Suggest suitable dimensions for the chimney and show them in a neat sketch. Explain why chimney is flared at the base.**	**[4]**	**CO3**
4.	**The solidity ratio for a tower panel may vary from 0.1 to 0.3. Explain with examples, the cases of tower where different values of solidity ratio can be assumed.**	**[4]**	**CO4**
5.	**Anchor bolts are provided in the foundation of industrial structures. Sketch a typical truncated cone concrete raft foundation for the chimney and show how anchor bolts can be provided in them. Explain why weight of lining is not considered in the design of anchor bolts.**	**[4]**	**CO5**
	SECTION B		
6.	**A chimney is discharging Sulphur dioxide fumes from a fertilizer factory at a height of30m from the ground. Calculate the maximum discharge possible and the diameter of the chimney required if the discharge velocity not to exceed 30m/s. Assume Density of SO_2 = 1.46 g/cc**	**[10]**	**CO1**
7.	**(a) A hyperbolic cooling tower of 162m height is to be designed according to the salient dimensions as given below. Generate the governing equations for the top and bottom portions of the cooling tower from the throat , and plot the profile of the cooling tower.** **a. Throat diameter = 65.3m**	**[10]**	**CO3**

	b. Top diameter = 68m **c. Height of cooling tower from throat to top = 37m** **d. Bottom diameter = 117m** **Or** **(b) A cornice is usually provided at the top of the shell of cooling tower. Sketch a typical configurations of the cornice and explain why it is provided.**		
8.	**A gantry girder whose details are as follows is to be provided in a warehouse. Design the gantry girder.** **Capacity of crane: 50kN** **Longitudinal spacing of column : 6m** **Center to Center distance of gantry girder: 12m** **Wheel spacing: 3m** **Edge distance: 1m** **Weight of crane: 40kN** **Weight of trolley car: 10kN**	**[10]**	**CO3**
9.	**A steel transmission tower 60m high is divided into ten segments of 6 m height each is to be designed for a line in Dehradun. The tower is resting on pile foundations. Assuming wind force acting on each panel point in KN from top is as follows:** **F_1 (top of tower) 13.2** **F_2 18.3** **F_3 13.1** **F_4 13.8** **F_5 15.0** **F_6 16.2** **F_7 16.3** **F_8 16.8** **F_9 16.5** **F_{10} 17.2** **F_{11} (base of tower) 8.9** **Calculate:** **a. The moment due to wind load at the base of tower.** **b. Base shear.** **c. Self weight of tower (assume k = 0.35 in Ryles formula)** **d. The maximum compressive compressive and tensile reactions for which the pile foundation should be designed under each leg.**	**[10]**	**CO5**

	SECTION C		
10.	**Design side walls of a rectangular bunker of sufficient capacity to store 330KN of coal. Unit weight of coal is 9kN/m^3. Angle of repose is 30^0. Use M 25 concrete and Fe415 steel.** **OR** **Design a cylindrical silo to store wheat. Density of wheat is 8kN/m^3. The Angle of repose is 23^0. The diameter of cylindrical portion is 4.2m. Take the height of hopper bottom as 4m. Use M20 concrete and Fe415 steel.**	**[20]**	**CO2**
11.	**A 400 KV transmission line constructed to transmit power from main power station Dakpathar to city sub station at Dehradun consists of transmission towers spaced 100m apart. The 'Moose' cable is used to construct the transmission line. During transmission, a layer of dust 15mm thick collects on the cable.** **Calculate the increase in sag of the cable.** **If the height of transmission line is 11m, check if it is still within the safe limits as per CEA regulations.** **Assume density of dust as 500kg/m^3.**	**[20]**	**CO4**

Following data may be used.

<u>CPCB recommendations</u>

(a) For chimney emitting particulate matter

$$H = 74\ Q_p^{0.27}$$

Where H is height of chimney in m
Q_p is particulate matter emission (tonnes/hour)

(b) For chimney emitting SO_2

$$H = 14\ Q_s^{0.33}$$

Q_s is SO_2 emission in Kg/hour

<u>Details of ACSR Conductor for transmission lines "Moose" 400 KV and "Zebra"220 KV</u>

	Weight (kg/km)	overall Dia(mm)	Area (mm^2)	Area of Al (mm^2)	UTS (Kg)	MPa
400 KV line	**1998**	**31.77**	**597**	**528.5**	**16224**	**2368**
220 KV line	**1621**	**28.62**	**484.59**	**428.9**	**13000**	**2334**

Minimum ground clearance from power conductor (mm)

400 KV 8840mm

220 KV 7050 mm

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

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	Section A		
1.	**Wind can be considered to have a mean component and a short duration gust. Plot a diagram of wind velocity over time indicating the mean and gust component and the 3 second time interval that can be used for averaging.**	**[4]**	**CO1**
2.	**HSFG bolts are considered to have advantage over other structural steel fasteners for construction of industrial buildings. Give reasons why.**	**[4]**	**CO2**
3.	**A cooling tower is generally made of hyperbolic shape. What are the advantages of making such a shape.**	**[4]**	**CO3**
4.	**Dust may settle down on conductor cables in transmission lines. What is the effect of dust on sag of conductor cables. Explain.**	**[4]**	**CO4**
5.	**An annular slab base foundation consisting of lug angles and base plate is provided for a steel chimney. Show in a figure the critical section for bending of base plate and explain how the thickness of base plate can be calculated.**	**[4]**	**CO5**
	SECTION B		
6.	**A chimney is discharging smoke from coal furnace at a height of 50m from the ground. Calculate the maximum discharge possible and the diameter of the chimney required if the discharge velocity not to exceed 20m/s. Assume Density of particulate matter = 1.4 g/cc.**	**[10]**	**CO1**
7.	**(a)) A hyperbolic cooling tower of 200m height is to be designed according to the salient dimensions as given below. Generate the governing equations for the top and bottom portions of the cooling tower from the throat , and plot the profile of the cooling tower.** **a. Throat diameter = 86.1m**	**[10]**	**CO3**

	b. Top diameter = 89m **c. Height of cooling tower from throat to top = 60m** **d. Bottom diameter = 136.2m** **or** **(b) Why are ring Stiffeners provided in the cooling tower shell body. Sketch a typical cooling tower and show where it is necessary to provide such stiffeners.**		
8.	**Design a gantry girder whose details are as follows:** **Capacity of crane: 60kN** **Longitudinal spacing of column : 68m** **Center to Center distance of gantry girder: 12m** **Wheel spacing: 3m** **Edge distance: 1m** **Weight of crane: 40kN** **Weight of trolley car: 15kN**	**[10]**	**CO3**
9.	**The foundation of a steel chimney is made up of an annular concrete raft having a truncated cone cross section. The top and bottom width of cone is 5m and 11m respectively with the height of 3.5m. If the wind load moment acting at the base of chimney is 8800KNm, calculate the :** **a. Maximum and minimum pressure at the base of foundation.** **b. Factor of safety against overturning** **Assume the following data :** **Weight of steel chimney = 780KN** **Weight of lining = 1500KN** **Density of concrete = 24KN/m^3**	**[10]**	**CO5**
	SECTION C		
10.	**Design side walls of a rectangular bunker of sufficient capacity to store 300KN of coal. Unit weight of coal is 9kN/m^3. Angle of repose is 30^0. Use M 25 concrete and Fe415 steel.**	**[20]**	**CO2**

	OR **Design a cylindrical silo to store wheat. Density of wheat is 8kN/m^3. The Angle of repose is 23^0. The diameter of cylindrical portion is 4.0m. Take the height of hopper bottom as 3.5m. Use M20 concrete and Fe415 steel.**		
11.	**A 220 KV transmission line constructed to transmit power from electric sub station to a village located in hills located 100m away in plan. If the difference in elevation is 1m between two transmission towers, calculate the sag in the cable as measured from the tower at lower elevation and higher elevation. The 'Zebra' cable is used to construct the transmission line.**	**[20]**	**CO4**

Following data may be used:

<u>CPCB recommendations</u>

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