Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Industrial Structures **Semester: I**
Programme: M.Tech. (Structural Engineering) Course Code: **CIVL7004**
Time: 03 hrs. **Max. Marks: 100**
Instructions: : Attempt All Questions. Assume suitably any data not given and state clearly.

SECTION A

S. No.		Marks	CO
Q 1	**The basic wind velocity has been measured as 33m/s in Bangluru city. Using general exponential equation for wind velocity variation, calculate wind velocity at 30m, 40m and 50m height and illustrate its variation in a diagram.**	**[4]**	**CO1**
Q 2	**An industrial roof is made up with steel frames. The frames can be designed as subjected to concentrated wind loads or uniformly distributed wind loads depending on how the purlins are placed. Explain through figure the conditions when this is possible.**	**[4]**	**CO2**
Q 3	**Prove that the compressive stress due to self weight in the steel plates of chimney across a cross section is dependent only on the height of chimney, if the thickness of steel plates is constant above that cross section.**	**[4]**	**CO3**
Q 4	**How does the settling of dust on transmission lines effect the design of transmission towers. What are the parameters that are affected by the settling of dust phenomena. State and explain briefly.**	**[4]**	**CO4**
Q 5	**The columns at the base of cooling tower are so anchored to the foundation such that the net bending stress in the foundation is zero or minimal. Explain in a diagram how this can be achieved. Also explain how the key is provided in the foundation to take care of the shear stress produced due to inclination of the base columns.**	**[4]**	**CO5**

SECTION B

Q 6	**Explain what is drift index. A tall building of 20 storeys has 3.2m height of each storey. In addition it has a ground floor 6m high. If the plan of building is 30x40m, calculate the drift index in worst case and check if it meets the requirement of IS code.**	**[10]**	**CO1**
Q 7	**A steel chimney of 1 m diameter is to be provided in a fertilizer factory, that discharges sulfur fumes in atmosphere . The exhaust velocity has been regulated as 10m/s.**	**[10]**	**CO3**

	(i) estimate the: **a. amount of flue gases maximum discharge that can be done in the atmosphere , and** **b. height of chimney so that these fumes can be discharged into the atmosphere safely.** **or** **(ii) If the velocity of discharge is increases to 15m/s, will the chimney require its height to be increased, if so by how much.** **Assume the CPCB recommendation as follows:** • **For chimney emitting SO_2** **$H = 14\ Q_s^{0.33}$** **Q_s is SO_2 emission in Kg/hour** • **density of sulfur fumes = 2.63kg/m^3**		
Q 8	**Explain why lintels are provided in cooling towers over the columns. Also show in a diagram how reinforcement can be provided in the lintels and at the junction of lintels and base columns in order to ensure safety of the cooling tower against cracking.**	**[10]**	**CO4**
Q 9	**In case of steel towers located at the bank of river, the buoyancy force may affect the design of raft foundations of such towers. Explain its effect and what are the special considerations to be taken into account for designing foundation of such structures.**	**[10]**	**CO5**
	SECTION-C		
Q 10	**An industrial shed is constructed in industrial area at Delhi. The shed has a plan area of 15x60m, with columns 5m high spaced at 4m c/c.** **(a) The roof of shed is made up Fink trusses of 15m span and 3m high, supporting purlins at panel points. Calculate:** **(i) Wind load per frame acting on the walls of the shed and sketch the possible deformed shape of the wall.** **(ii) The wind load per panel acting on the roof and show in a diagram the wind loads to be considered for designing the roof truss.** **<u>or</u>**	**[20]**	**CO2**

	(b) The roof of shed is made up steel frames of 15m span and 3.5m high, with purlins placed on top of steel frame at 2.75m c/c. Calculate and show in a diagram the wind loads to be considered for designing one steel frame. **Assume following data:** **a. Design wind speed = 44m/s.** **b. Shed has normal permeability towards wind.** **c. External pressure coefficients:** **Wall – Wind normal to wall – windward side : 0.7** **- Leeward side : -0.25** **- Wind parallel to wall- windward side : -0.5** **- leeward side : -0.5** **Roof - Wind normal to roof – windward side : -0.33** **- Leeward side : -0.4** **- Wind parallel to roof- windward side : -0.7** **- leeward side : -0.7**		
Q 11	**A thermal power plant requires a cooling tower to be constructed in a space of 140m with total height not exceeding 250m. Assuming suitable dimensions of the cooling tower, calculate the characteristic dimension of the hyperbolic profile and plot the shape of the cooling tower.**	**[20]**	**CO4**

CONFIDENTIAL **Paper II**

Name of Examination (Please tick, symbol is given)	:	**MID**		**END**	☐	**SUPPLE**	
Name of the School (Please tick, symbol is given)	:	**SOE**	☐	**SOCS**		**SOP**	
Programme	:	**M.Tech. (Structural Engineering)**					
Semester	:	**I**					
Name of the Course	:	**Industrial Structures**					
Course Code	:	**CIVL7004**					
Name of Question Paper Setter	:	**Dr Vijay Raj**					
Employee Code	:	**40001380**					
Mobile & Extension	:	**7500212221, 1106**					
Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention "NOT APPLICABLE":							

FOR SRE DEPARTMENT		
Date of Examination	:	
Time of Examination	:	
No. of Copies (for Print)	:	

Note: - Pl. start your question paper from next page

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Time: 03 hrs. **Max. Marks: 100**
Instructions:Attempt all Questions. Assume suitably any data not given and state clearly.

SECTION A

S. No.		Marks	CO
Q 1	**Illustrate through a diagram, the variation of external coefficient of pressure for wind for an industrial shed with low pitch and high pitch and explain the difference between them.**	**[4]**	**CO1**
Q 2	**Illustrate industrial sheds made up of steel frame and steel truss highlighting the difference between them. Also explain why industrial roofs with trusses are designed on panel basis, while that with frames can be designed both on panel basis as well as frame basis depending on location of purlins.**	**[4]**	**CO2**
Q 3	**Prove that the compressive stress due to weight of lining in the steel plates of chimney across a cross section is dependent only on the ratio height/plate thickness of chimney, if the thickness of steel plates is constant at that cross section.**	**[4]**	**CO3**
Q 4	**Explain why is it necessary to provide some sag in lines of transmission towers. What parameter is affected by sag in the design of transmission towers.**	**[4]**	**CO4**
Q 5	**Piles or raft slab are commonly provided in industrial towers as foundations. What are the site conditions that decide the selection of appropriate foundation for such towers.**	**[4]**	**CO5**

SECTION B

Q 6	**Raking forces are often produced in structures subjected to wind load. What is its effect on industrial sheds Explain through figures how a fully enclosed structure and a partially enclosed structure can deform as a result of raking forces.**	**[10]**	**CO1**
Q 7	**A steel chimney in a power plant is to be constructed for diameter of 2m, for discharging flue gases containing particulate matter in atmosphere . If the maximum permissible exhaust velocity for that site is 15m/s:** **(iii) Check if a 100m high chimney is safe so that these fumes can be discharged into the atmosphere safely, if not how many such chimneys would be required.** **Or**	**[10]**	**CO3**

	(iv) If the management of power plant decides to increase the diameter of chimney to 3m, what will be the effect on the height of chimney. **Assume the CPCB recommendation as follows:** • **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)** • **Assume density of particulate matter as 1.43 kg/m^3**		
Q 8	**A 220 KV transmission line is used for power supply houses in a city. The transmission towers in the line are provided at a spacing of 125m . A layer of dust 20mm thick settles on the collects on the cable. How will the design get modified.** **Also check if the sag is within the safe limits, as per CEA regulations for a tower of 10m. Assume density of dust as 500kg/m^3.**	**[10]**	**CO4**
Q 9	**Sketch a flat ring and a ring beam foundation for a cooling tower. Explain the difference in their structural behavior highlighting why a thicker foundation is necessary for flat ring as compared to ring beam.**		**CO5**
	SECTION-C		
Q 10	**An industrial shed is constructed in industrial area at Chandigarh. The shed has a plan area of 15x48m, with columns 6m high spaced at 4m c/c. The roof of shed is made up of steel frames of 15m span and 3m high, with purlins at 2.7m c/c. Calculate:** **(iii) Wind load per frame acting on the walls of the shed and sketch the possible deformed shape of the wall.** **(iv) The wind load per frame acting on the roof.** **(v) Show in a diagram the wind loads to be considered for designing the full industrial frame.** **Assume following data:** **d. Design wind speed = 37m/s.** **e. Shed has normal permeability towards wind.** **f. External pressure coefficients:** **Wall – Wind normal to wall – windward side : 0.7** **- Leeward side : -0.25** **- Wind parallel to wall- windward side : -0.5**	**[20]**	**CO2**

	- leeward side : -0.5 **Roof - Wind normal to roof – windward side : -0.33** **- Leeward side : -0.4** **- Wind parallel to roof- windward side : -0.7** **- leeward side : -0.7**		
Q 11	**An industrial tower having 4 legs spaced at 10m at base is 50m high to be designed for providing light in an industrial unit. The tower is divided into five segments of 10 m height each is Assuming wind force acting on each panel point in KN from top is as follows:** **What will be the base shear and reactions in the tower base for which the foundations should be designed.** **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.** **Or** **A transmission line is subjected to dust/ice and wind forces simultaneously. Explain through figures the effect of these forces on sag of the line cable. How can the design sag be calculated in such a situation.**	**[20]**	**CO5**

P_1 (top of tower)	P_2	P_3	P_4	P_4	P_5	P_6(Tower base)
15	22	24	25	27	28	14

Following data may be used:

Details of ACSR Conductor for transmission lines "Moose" 400 KV and "Zebra"220 KV

	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