MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

M.TECH. (CHEMICAL ENGINEERING)

END SEM EXAMINATIONS, APRIL 2019

SUBJECT: AIR POLLUTION MONITORING AND CONTROL [CHE 5231]

REVISED CREDIT SYSTEM DATE: 29/4/2019

Time: 3 Hours

MAX MARKS: 50

Instructions to Candidates:

- ✤ Answer all FIVE questions FULLY.
- ✤ Missing data may be suitable assumed.

1A	(i) Explain the different objectives of monitoring air pollution.(ii) List the air pollution related factors to be considered while selecting a site for an industry?	3 2
1 B	Write short notes on Adiabatic lapse rate, Environmental Lapse rate,	5
	radiation inversion, subsidence inversion and frontal inversion	

2A	With a neat sketch explain any three types of plume behavior in a stack	3
	based on atmospheric conditions.	
2B	A city is located near an airport. The smelter stack is 300 m high and has a	
	plume rise of 100m. It is emitting 10,000 g/s of SO ₂ . Assume stability class	
	is C (Refer chart in next page) and that wind speed is 3 m/s.	
	A flight path for airport is perpendicular to the plume and 5km downwind	
	of the smelter. The airport safety office has determined that it is unsafe for	
	planes if the planes if the plume concentration $> 500 \mu g/m3$. They have also	
	decided that it is unsafe to fly under the plume. Assume Gaussian plume	
	a) What is the minimum altitude the plane can fly safely above the plume,	3
	without considering ground reflection of plume?	
	b) What is the minimum altitude the plane can fly safely above the plume	3
	with considering ground level reflection?	
	b) List steps you would propose to reduce the effect of the air pollution	1
	caused by the industry, if the other contaminant from the plant includes	
	Particulate matter	

3A	Derive the expression for displacement losses for VOCs	2
	Estimate the volume of gasoline vapor emitted as displacement losses per	3
3B	cubic meter of gasoline when gasoline is transferred from petrol station	
	storage tanks to the gasoline tanks of the customers' vehicles at 25°C. The	
	vapor pressure of gasoline is 6 psia and the molecular weight is 60 g/mol.	

	(1 atm = 14.7 psia). Density of gasoline is 740 kg/m ³ . What volume % of	
	gasoline is lost?	
3 C	With a neat diagram explain the sampling train for measurement of SO ₂	5

4 A	With a help of neat charts of temperature, explain the dependence of NOx	5
	formation. Explain thermal NOx, fuel NOx and prompt NOx.	
4B	With a neat diagram explain Forced oxidation Limestone Wet Scrubber for	5
	SO ₂ removal	

5 A	i) With a diagram derive the expression for displacement loss of VOCs	2
	ii) What are the control strategies to reduce VOC pollution?	3
5B	i)Why is NOx more difficult to remove compared to SOx?	1
	ii) With a neat sketch explain NDIR method of measurement of CO ₂	3
	iii) List the methods to reduce carbon dioxide (CO ₂) emissions?	1



Dispersion coefficients for various stability criteria