Ref.No. Ex/PG/PE/T/1210B/2018

MASTER OF POWER ENGINEERING EXAMINATION, 2018

(1ST Year 2nd Semester)

ENVIRONMENTAL ENGINEERING

Time: Three hours **Full Marks 100**

Use of Turner's Stability Curves Permitted
Use of Log-Log Graph Paper Permitted

(Answer any ***four*** questions) (4X25=100)

No. Of Questions	QUESTIONS	Marks
Q1.	a) *A coal fired thermal power plant burns 6.25 tonnes of coal per hour, and discharges the combustion products through a stack having an effective height of 80 m. The coal has a sulphur content of 5.8%, and the wind velocity at the top of the stack is 8.5 m/sec. Atmospheric conditions are moderately to slightly unstable. Determine the maximum ground level concentration of SO_2 and the distance from the stack at which this maximum concentration prevails.*	4+2
	b) *Write the basic assumptions behind the Gaussian model. Write the basic Gaussian equation clearly stating the meanings of all the parameters. What will be the modified equation for obtaining i) plume centerline concentration, ii) ground level concentration, iii) ground level concentration at a point for downwind distance less than the ground reflection distance and iv) ground level concentration at a point for downwind distance more than the ground reflection distance.*	3+2+2
	c) *Determine the effective stack height with the following given data:* *i) Physical stack height is 190 m with 0.90m inside diameter* *ii) Wind velocity is 2.50 m/sec and air temperature is 20^0C* *iii) Barometric pressure is 1000 mb* *iv) Stack gas velocity is 15.22 m/sec and stack gas temperature is 165^0C*	3

	d) Prove the followings from the basic Gaussian Modeling Equation subject to the following necessary conditions: *i) σ_z=0.47H & ii) σ_z=0.707 H*	7
	e) A rising parcel of dry air has a temperature of 35^{0}C at sea level. Assuming a dry adiabatic lapse rate determine the temperature at 3500 m.	2
Q2.	*a) Derive the expression for atmospheric visibility.*	5
	b) What do you mean by fractional transmittance? On what factors does it depend?	4
	c) Derive an expression for coefficient of haze (Coh).What is its significance?	4
	d) In connection with the determination of Coh value 70% was noted as the light transmittance after air had passed through a filter paper at 0.60 m/sec for 3.5 hrs. Determine the Coh units per 1000 m.	6
	e) If the limit of visibility is defined as the distance when I/I_o reaches 0.02 in value, then determine the percent extinction that occurs in the first (a) 25%, (b) 40%, and (c) 75% of the path length.	6
Q3.	*a) What do you mean by potential temperature? Derive the expression for potential temperature?*	2+6
	b) Derive an expression for the vertical gradient of potential temperature?	6
	c) Explain the significance of potential temperature.	3
	d) What do you mean by atmospheric lapse rate and dry adiabatic lapse rate?	3
	e) Explain atmospheric stability using the concept of potential temperature.	5
Q4.	*a) Estimate the quantity of Carbon (Gt-C) in the atmosphere corresponding to a concentration of 1ppm$_v$ of CO_2. Hence estimate the increase in atmospheric CO_2 that would result from the complete combustion of the world's entire fossil fuel resource which is estimated as 350 Gt-C. Assume that only 65% of carbon burnt in air remains as CO_2 in the atmosphere. Assume suitable data as required*	10

ing	7		b) The following data on air pollutants has been obtained for an industrial belt on a particular day. Based on the Ministry of Environment And Forests Notification, Govt. of India dated 16th November, 2009, prepare the Air Quality Index for the area and comment on the air quality of the area:	8
sea the	2		i) PM_{10} Concentration= 250 $\mu g/m^3$ ii) SO_2 Concentration= 85 $\mu g/m^3$ iii) NO_2 Concentration= 250 $\mu g/m^3$ iv) $PM_{2.5}$ Concentration=250 $\mu g/m^3$ v) 1 hr O_3 Concentration= 900 $\mu g/m^3$ vi) 1 hr CO Concentration=6000 $\mu g/m^3$	
	5			
hat	4		c) A man is working in an abandoned well where the CO concentration is found to be 350 ppmv. Make a rough estimate of the saturation value of HbCO in his blood and also calculate the necessary exposure time required for this to develop. The following informations may be used if required:	7
is	4			
was ugh Coh	6			
hen ent (c)	6		i) Oxygen content of air breathed in =21% by volume ii) M=230 iii) Physical Activity Level=2	
the	2+6			
ial	6	**Q5**	a) A proposed source is to emit 120 gm/sec of NO_2 from a stack of 90 meters height with a diameter of 3.0 meters. The effluent gases are emitted at a temperature of 350^0 F with an exit velocity of 25 m/sec. Plot on log-log paper a graph of maximum GLC as a function of wind speed for stability class B. Determine the critical wind speed Assume that the design atmospheric pressure is 1000 mb and the design ambient temperature is 25^0 C.	20
	3			
dry	3			
of	5		b) What is thermal inversion? Explain its role related to atmospheric pollution.	05
ere nce ult uel 65% re.	10	**Q6**	Write short notes on any five of the followings: a) Environmental Impact Assessment b) Temperature Lapse Rates c) Gaussian Dispersion Model	5x5 =25

	d) Air Quality Indexing e) Photochemical Smog & PAN f) Photolytic Cycle of NO_X g) Environmental Management Planning	

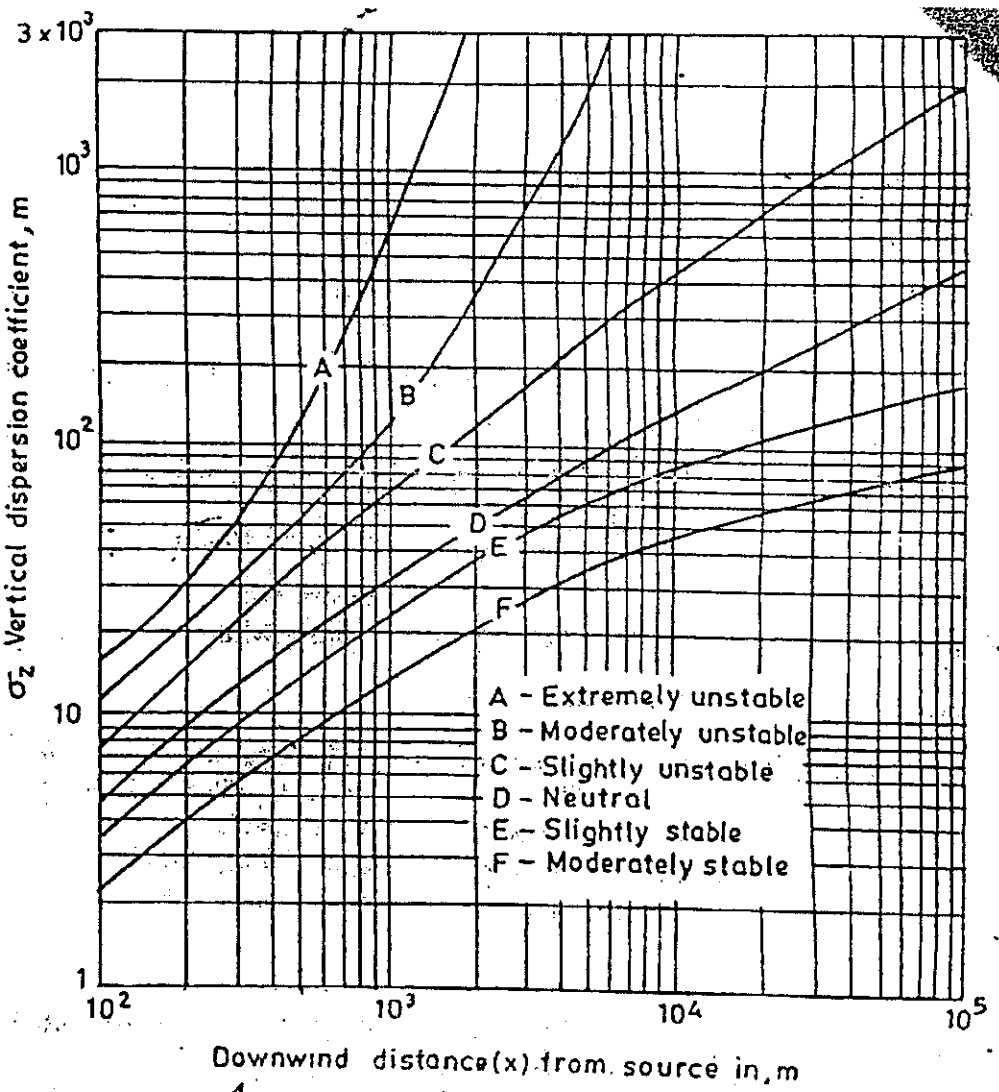

Fig. ~~13.6.~~ 1 σ_z *Vs* x for different atmospheric stabilities.

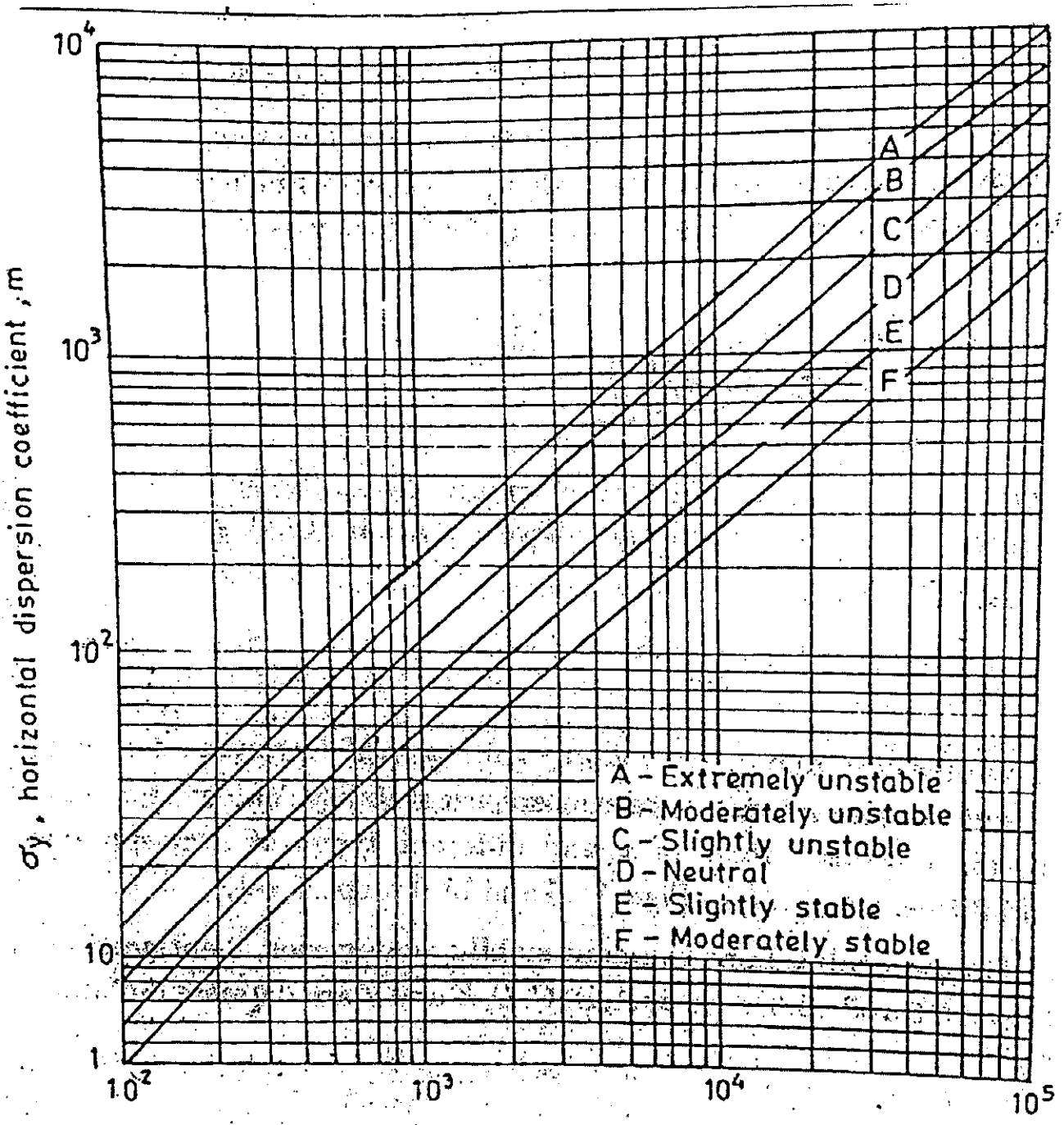

Fig. ~~18.5~~ 2.5. σ_y *Vs* x for different atmospheric stabilities.