B. Tech. Civil Engineering/ GEC3				
Course code: Course Title	**Course Structure.**			**Pre-Requisite**
CE405: Wind Effects on Structures and Wind Energy Systems	**L**	**T**	**P**	**Nil**
	3	**0**	**2**	

Course Objective: To familiarize the students with the atmospheric winds, their effects on structures, and converting them into energy.

S. No	Course Outcomes (CO)
CO1	To understand the atmospheric boundary layer and its characterisation for engineering applications.
CO2	To acquire skills for experimentation using wind tunnel testing.
CO3	To have knowledge and skills for the wind energy conversion system.
CO4	To apply knowledge of the effect of wind for designing structures and demonstrating for wind energy towers.
CO5	Students are able to know the various opportunities in wind energy technology inland and offshore, and apply knowledge to the Indian scenario.

S. No	Contents	Contact Hours
UNIT 1	Introduction, Types of wind – Characteristics of wind – Wind velocity, Method of measurement, atmospheric boundary layer, variation of speed with height, shape factor, aspect ratio, drag effects – Dynamic nature of wind, Pressure and suctions, Spectral studies, Gust factor. Shape factor – Aspect ratio – Drag and lift for common structures exposed to wind.	8
UNIT 2	Wind Tunnel Studies, Types of tunnels, – Prediction of acceleration – Load combination factors – Wind tunnel data analysis – Calculation of Period and damping value for wind design. Design Wind speeds and risk coefficients, Design wind pressure and pressure coefficients.	8
UNIT 3	Wind Energy – Fundamentals and Applications: Introduction, Application and Historical background, Merits and Limitations, Nature and Origin of Wind, Wind Energy Quantum, Variables in Wind Energy Conversion Systems, Wind Power Density, Power in a Wind Stream, Wind Turbine Efficiency, Power of a Wind Turbine, Forces on the Blade of a Propeller. Wind Velocities and Height from Ground, Mean Wind Velocity, Wind Velocity duration curve, Energy	9

	Pattern Factor, Wind Power duration Characteristics.	
UNIT 4	Effect of Wind on Structures: Static effect – Dynamic effect – Interference effects. Rigid and Flexible– Static and dynamic effects on tall buildings, Chimneys, wind energy towers. Design of Structures for wind loading – as per IS codal provisions Industrial Sheds: Types of roofing, steel monopoles, transmission line towers, self-supporting, Guyed, including aero-elasticity.	9
UNIT 5	Wind Turbine- Generator Units: Introduction, Various terms and definitions, Types of Wind Turbine Generator (WTG) Units, Horizontal Axis Propeller type, Wind Turbine Generator. Wind Energy Farm and Energy Conversion System: Wind to Electric Energy Conversion System, Power versus Velocity of WTG, Power Duration Curves, Types of Wind Energy System, Energy Storage Requirements with Wind Energy System, Hybrid wind energy systems, Economics of Wind Energy. Offshore Wind Energy Power: Introduction, offshore wind energy technology, scenario for the future offshore development of wind power, National Offshore Wind Energy Policy of India, developments in India	8
	TOTAL	**42**

REFERENCES

S. No	**Name of Books/Authors/Publishers**	**Year of Publication Reprint**
1	Devenport A.G., "Wind Loads on Structures", - Division of Building Research, Ottawa.	1990
2	Wind Effects on Building Vol. I and II, Lawson T.V., Applied Science Publishers, London.	1980
3	Joshua Earnest and Tore Wizelius, "Wind Power Plants and Project Development", PHI Learning Pvt. Ltd., New Delhi.	2011
4	Wind energy handbook, Burton T, Jenkins N, Sharpe D, Bossanyi E., John Wiley and Sons.	2015
5	Advances in wind energy and conversion technology, Mathew S, Philip GS, Berlin, Springer.	2016
6	Tall Chimneys – Design and Construction, Manohar S.N., Tata McGraw-Hill.	1985
7	Transmission Line Structures, Santhakumar A.R. & Murthy S.S., Tata McGraw-Hill.	1992
8	IS: 875 (3) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Part 3: Wind Loads, BIS.	2016