

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Thermal Engg.	Wind Energy Technology	MET 524	SM+MT+ET 25+25+50
Semester	Credits	L-T-P	Exam
II	3	3-0-0	3 Hours

Unit - I

Introduction: History of wind energy; Current status and future prospects. Basics of Wind Energy Conversion; Power available in the wind spectra; Wind turbine power and torque; Classification of Wind turbines; Characteristics of wind rotors; Aerodynamics of wind turbines; Rotor Design; Rotor Performance. **(07 Hours)**

Unit - II

Analysis of Wind regimes: The wind; Turbulence; Acceleration effect; Time variation; Measurement of Wind; Ecological indicators; Anemometers: Cup anemometer; Propeller anemometer; Pressure plate anemometer; Pressure tube anemometers; Sonic anemometer; Wind direction; Analysis of wind data; Average wind speed; Distribution of wind velocity; Statistical models for wind data analysis; Weibull distribution; Rayleigh distribution; Energy estimation of wind regimes; Weibull based approach; Rayleigh based approach. **(08 Hours)**

Unit - III

Wind Energy Conversion System: Wind electric generators: Tower; Rotor; Gear Box; Power regulation; Safety brakes; Generator; Induction generator; Synchronous generator; Fixed and variable speed operations; Grid integration. Wind Farms; Offshore wind farms. **(07 Hours)**

Unit - IV

Wind pumps: Wind powered piston pumps; Limitations of wind driven piston pumps; The hysteresis effect; Mismatch between the rotor and pump characteristics; Dynamic loading of the pump's lift rod; Double acting pump; Wind driven roto-dynamic pumps; Wind electric pumps. Performance of wind energy conversion systems – Power curve of the wind turbine; Energy generated by the wind turbine; Weibull based approach; Rayleigh based approach; Capacity factor; Matching the turbine with wind regime; Performance of wind powered pumping systems. **(08 Hours)**

Unit - V

Wind energy and Environment: Environmental Benefits of wind energy; Life Cycle analysis; Net energy analysis; Life cycle emission; Environmental problems of wind energy; Avian issues; Noise emission; Visual impact. **(07 Hours)**

Unit - VI

Economics of wind energy: Factors influencing the wind energy economics; Site specific factors; Machine parameters; Energy parameters; Incentives and exemptions; The present worth approach; Cost of wind energy: Initial investment; Operation and maintenance costs; Present value of annual costs; Benefits of wind energy. Yardsticks of economic merits: Net present value; Benefit cost ratio; Payback period; Internal rate of return; Tax deduction due to investment depreciation. **(08 Hours)**

Recommended Books:

1. Wind Energy; Sathyajith Mathew; 1st Edition; Springer; 2006.
2. Advances in Wind Energy Conversion Technology; M. Sathyajith; G. S. Philip; Springer; 2011.
3. Wind Energy; Melissa Higgins; 1st Edition; Innovative Technologies; 2013.
4. Wind Energy: Theory and Practice; Siraj Ahmed; 2nd Edition; PHI Publications; 2011.
5. A Student Guide to Energy; J. F. Mongillo; 1st Edition; ABS-CLIO; 2011.