



## FACULTY OF ENGINEERING & TECHNOLOGY

### First Year Master of Technology

#### Semester II

**Course Code: 102450203**

**Course Title: WIND ENERGY SYSTEMS**

**Type of Course: Core Course V**

**Course Objectives:** To impart knowledge on wind energy systems, components and able to design systems for wind energy conversion.

#### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30/15	20/10	70/35	30/15	150/75

\* J: Jury; V: Viva; P: Practical

#### Detailed Syllabus:

Sr.	Contents	Hours
1	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 Pattern Factor, Wind Power duration Characteristics	10
2	Wind Turbine- Generator Units: Introduction, Various terms and definitions, Types of Wind Turbine Generator(WTG) Units, Planning of a Wind Farm, Horizontal Axis Propeller type Wind Turbine Generator, Three Blade Horizontal Axis Wind Turbine(HAWT), Dimensioning of Horizontal Axis Wind Turbine, Vertical Axis Wind Turbine, Vertical Axis Darrieus Rotor Wind Turbine, Vertical Axis Wind Turbine with H-Rotor, Wind Turbine Rotor Speed, Practical PV Characteristics, Power Coefficients Versus Tip Speed Ratio, Operation and Control of a HAWT, Economic Consideration	10



3	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, Wind to Electrical Energy Conversion Alternatives, Grid Connection, Energy Storage Requirements with Wind Energy System, Hybrid wind energy systems, Economics of wind Energy-fundamental of economics, Initial cost of wind energy project-cost of turbine-installation-transportation-grid connection-legal and other cost, Operating cost-running cost-maintenance cost, Comparison with other energy sources, Cost per unit-case study.	10
4	Offshore Wind Energy power Introduction, offshore wind energy technology, future technological development, scenario for the future offshore development of wind power, new offshore concepts, National Offshore Wind Energy Policy of India-development in India, maritime zones-challenges-objectives-geographical coverage-essential components of development offshore wind energy.	9

### Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
15	20	30	15	10	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

1	Wind turbines: fundamentals, technologies, application, economics, Hau E, von Renouard H, Springer.
2	Wind energy handbook, Burton T, Jenkins N, Sharpe D, Bossanyi E., John Wiley and Sons.
3	Advances in wind energy and conversion technology, Mathew S, Philip GS, Berlin, Springer.
4	Wind energy systems, Johnson GL., Englewood Cliffs (NJ): Prentice-Hall.
5	Aerodynamics of wind turbines, Hansen MO, Routledge.

### Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To know the wind energy conversion system.	26%
CO-2	Students able to know and demonstrate the wind turbine system.	26%
CO-3	Students able to design of aerofoil blade for wind systems.	26%
CO-4	Students able to know the offshore wind energy technology.	22%

### List of Practicals / Tutorials:

1	Study of Fundamentals of wind energy
2	To Study Energy and power in the wind
3	Study of Horizontal Axis Wind Turbine
4	Study of Vertical Axis Wind Turbine
5	To Study Wind Energy Farm
6	Study of Energy Storage Requirements



<b>7</b>	To study Offshore wind energy farm
<b>8</b>	Measurement of power of installed wind mill
<b>9</b>	Case study: Site survey of wind energy and turbine matching
<b>10</b>	Design of 100 W wind mill

### Supplementary learning Material:

### Curriculum Revision:

Version:	<b>1</b>
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22