ME825 Advanced Wind Turbine Technology
(Credits: 3)

COURSE OUTCOME

- Handle qualitative and quantitative knowledge regarding wind resources, technical and environmental aspects.
- Concretize and apply some specific tools to identify, analyze and formulate complex problems.
- Suggest methods and solutions in order to promote a sustainable and efficient. Planning, development and management of wind power projects.
- Ability to perform decision analysis and evaluations in project management and research considering scientific, social and ethical aspects.

SYLLABUS

Description

1. **Fundamentals:** Basics of turbomachines, history of wind turbines, modern wind turbines, types, nomenclature.

2. **Wind turbine aerodynamics:** One-dimensional Momentum Theory and the Betz Limit-Ideal Horizontal Axis Wind Turbine with Wake Rotation- Blade Design for Modern Wind Turbines - Momentum Theory and Blade Element Theory -Blade Shape for Ideal Rotor without Wake Rotation -General Rotor Blade Shape Performance Prediction -lade Shape for Optimum Rotor with Wake Rotation. Numerical.

3. **Cascade Aerodynamics:** Types of cascade, flow and performance of characteristics, effects of geometry and dynamic parameters, experimental investigation – fluid flow measurements - multi-hole probes, hot-wire anemometry, calculation of lift and drag forces, coefficients, wind tunnel techniques. Numerical.

4. **Blade flow characteristics:** Geometry details lift and drag calculation, pressure and velocity measurements, formation of boundary layer - von-Karman integral equation – solutions, causes, effects, separation, controlling techniques. Numerical.

5. **Wind turbine design:** Sub-systems and components, supporting structure. Performance analysis of airfoils and blades Numerical.

Reference Books:

1. Rae, W.H. and Pope, A., Low Speed Wind Tunnel Testing, John Wiley Publications, 1984.
2. Schlichting, H., Boundary layer theory, McGraw-Hill, 1968.
3. Wood, D., Small Wind Turbines Analysis, Design, and Application, Springer, 2011.
4. Manwell, J.F., McGowan J.G., and Rogers A.L., Wind Energy Explained: Theory, Design and Application (Second Edition), Wiley, New York, 2010.
5. Gostelow, J. P., Cascade Aerodynamics, Pergamon Press, Elmsford, NY, 1984.