

Course title: Wind power generation					
Course code: ENR 113		No. of credits: 3		L-T-P: 25-14-12	
Learning hours: 51					
Pre-requisite course code and title (if any): NA					
Department: Sustainable Engineering					
Course coordinator: Prof. Naqui Anwer			Course instructor: Mr. Ankit Narula		
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Course type: Elective			Course offered in: Semester 3		
Course description The Course is meant to comprehensively provide the student in-depth knowledge on different aspects of wind power project development, its implementation and issues of risks and bankability. After the course, the students will have better and practical insights on developing a wind farm project.					
Course objectives <ul style="list-style-type: none">▪ To present to students with updated and latest trends in wind turbine technology▪ Provide knowledge on methods and approaches of site selection for wind turbines▪ To provide knowledge on aspects of Wind Power Project Planning & Structuring including issues on bank ability and risk-mitigation▪ Project & Asset Management					
Course contents					
Module	Topic	L	T	P	
1	Latest Trends in Wind Turbine Technology, Development of onshore and offshore wind power, Site Selection–Wind climatology, terrain features, surface roughness etc. Micro siting of wind turbines, site identification, wind mast installation. Annual Energy Output estimation. Uncertainties in estimation. Probabilities of estimation.	5	2	0	
2	Wind Power Project Planning & Structuring: Bank ability of Projects: Promoters, Financing, Balance Sheet, Non-Recourse or Project Finance, Leasing, Taxation Issues Electricity Off Take Arrangements & Structures: ü PPA with utility, Captive, Group Captive, Open Access & Merchant Sale Project Contracts, Corporate PPA : ü Wind Turbine Supply Contracts, Works Contracts, E&C Contract, O&M Contract Risk Mitigation Indemnities & Liabilities 4 Power Curve Measurement Project Management: ü Project Implementation Activities, Pert/CPM/MS Projects, Quality Assurance in Project Implementation	5	2	0	
3	Project Works: ü Soil Tests, Excavation, Civil Works, Foundations, Buildings, Roads, Concrete Tests, Erection & Commissioning, On site Sub Assembly, Selection of cranes and crane types, Erection, Commissioning Tests, Internal Electrical Lines, Switch Gear, Grid interconnection, Metering, Sub Station. Operation & Maintenance Management: ü Management of Maintenance, Predictive Maintenance, Preventive Maintenance, Planned Maintenance	4	2	0	
4	Different types of contracts and ways of mitigating risks through contracts. Repowering	3	2	0	
5	Technical Due Diligence in Asset Acquisition. Physical Verification of the Asset and Checklists, WRA of an existing asset, future health and lifetime of the project	2	2	0	

6	This part consists of studying the various cases of wind energy systems, the concept and associated challenges. For this part students may take up papers from peer reviewed journal on wind energy and discuss the new technology, advantages, and challenges. (The students may also design wind farms of various capacities considering the micro siting guideline for each state and arrive at different wind farm layouts.)	2	4	0
7	Discussion Paper: Students will be required to develop a discussion paper on a specific topic to be decided in the class	2	0	4
8	Simulation and Analysis on design of wind farms, lay outs etc.	2	0	8
	Total	22	14	12
Evaluation criteria <ul style="list-style-type: none"> ▪ Assignment/Tutorials: 20% ▪ Test 1 (Written): 15% ▪ Test 2 (Written): 15% ▪ Test 3 (Written): 50% 				
Learning outcomes: <ul style="list-style-type: none"> ▪ The course imparts an ability to contribute to the complex task of wind farm project development. ▪ Sound understanding of the various stages in project development ▪ Sound understanding of the role of contracts in project management, financing and risk management ▪ Quality Assurance in project management ▪ Understanding of various processes involved in project management 				
Pedagogical approach: The course will be delivered through class room lectures and use of presentations, exercises on simulation packages and conduct of seminars				
Materials Textbooks Renewable Energy Engineering and Technology – A Knowledge Compendium, ed. VVN Kishore (TERI Press, 2008). YA Cengel and JM Cimbala, “Fluid Mechanics: Fundamentals and Applications”, Tata McGraw Hill Manwell et. “Wind Energy Explained: Theory Design and Application” Al Wind Energy Handbook by Burton et. Al				
Additional information (if any): NA				
Student responsibilities: The students are expected to submit assignments in time and come prepared with readings when provided.				

Course reviewers

1. Mr. Ashish Swarup Agarwal, Chief Operating Officer, Skeiron Renewable Energy Pvt Ltd