MODULE HANDBOOK DESCRIPTION

Module designation	Distributed Generation (DG)	
Code	FBA0003	
Semester(s) in which the module is taught	6/third year	
Person responsible for the module	Sabar Nababan, S.T., M.T.	
Language	Indonesian	
Relation to curriculum	Compulsory for electrical power systems students	
Teaching methods	Lecture, small group discussion, case base method.	
Workload (incl. contact hours, self-study hours)	Contact minutes every week, each week of the 16 weeks/semester : • Lectures: 2 x 50 minutes • Exercises and Assignments: 2 x 60 minutes • Private study: 2 x 60 minutes. Total study hours = 5 hours 40 minutes/week	
Credit points	*2 (~ 3,2 ECTS)*	
Required and recommended prerequisites for joining the module	- Electrical Circuit I (FBS1213) - Electrical Circuit II (FBS2122) - Power System Analysis (FBA3101) - Power System Protection	
Module objectives/intended learning outcomes	Introduction 1.1 Defenition of DG 1.2 DG, Distribution System, dan Centralled Generation 1.3.Technical effect of generation on the distribution system 1.3.1 Voltage change in network 1.3.3 Power Quality 1.3.4 Protection 1.3.5 Stability 1.4. DG's economic influence on the distribution system 1.5. The influence of DG on the transmission system	PLO3

	1.6. The influence of DG on centralized generators	
	2. DG Plant 2.1. Combined heat and power plants 2.2. Renewable energy generation 2.2.1 Small-scale hydro generation 2.2.2 Wind power generation 2.2.3 Photovoltaics Generation	PLO3 and PLO4
	Distributed Generation and its relation with the system: 3.1. Synchronous generators 3.2. induction generator 3.2. Doubly Fed Induction *generator* 3.3. Full power converter connected to generator	PLO3, PLO4
	System studies: 4.1. Power flow in a simple radial network 4.2. Symmetry disorder study 4.3. Unbalanced studies	PLO 5
	Fault Current and Electrical Protection 5.1. Fault current from Distributed generators 5.2. Fault current limiter 5.3. DG protection 5.4. The effect of DG on the existing distribution protection system	PLO 5
	6. Pricing of distribution network with DG	PLO 5
	7. Microgrids	PLO 5

Content	The conventional topology of the electric power system includes generation, transmission, distribution and load centers. However, long distribution systems, for example in rural areas, can result in imbalances and under voltages. The new topology of the power system can install small distributed generators (DG) in the distribution system i.e. near the load. These small generators can be in the form of wind power plants, photovoltaics, micro hydro and combined heat and power. The presence of this small generator can improve voltage stability and reduce losses in the distribution system. However, the presence of DG can also cause new problems in the protection system in the power distribution system.
Examination forms	- Essay Test - Presentation case study.
Study and examination requirements	The final grade in the module is composed of: a. Per-meeting score = 5 % x 16 meeting = 80% b. Exercise Report/ Homework/Portfolio = 20% Students must have a final grade of 65% or higher to pass
Reading list	**1. Distributed Generation** by N.Jenkins, J.B. Ekanayake, and G Strbac**,** 2010 2. **Embedded Generation,** by N.Jenkins, Ron Allan, Daniel Krischen, and Goran Strbac, 2008 **3. Protection of Power Systems with Distributed Generation: State of the Art** by Geidl, Martin, July 2005 4. **Distributed Generation** from paper journal.