	Subject:	**NAVIGATION AUTOMATION**			
Maritime University of Szczecin Faculty of Navigation					
Field of study		NAVIGATION			
Mode of study		part-time			
GENERAL SCHEDULE					
Year	Weeks in year	Hours in year			ECTS
		A	C	L	
I	11	18E		18	5
II	11				

Objectives
Upon completion of their studies, the graduating student should:

Know → various kinds of algorithms, data structures and representations, models and phases of data delivery, algorithmization of basic navigational tasks, methods of estimation of position coordinates and movement of ship in different reference systems, evaluation of accuracy of estimated parameters, principles of integration of navigational parameters.

Be able to → make an algorithm, prepare data for algorithmic processing, prepare phases of models delivery, perform the estimation of basic navigational parameters, evaluate the accuracy of estimation.

Syllabus

YEAR I	NAVIGATION AUTOMATION	LECTURES	18 HOURS

- Presentation of algorithms and data structures.
- Sources of navigational information.
- Algorithmic processing of navigational information.
- Algorithmic determination of ship's position coordinates.
- Algorithms of the transformation and shifting of coordinates.
- Algorithmic dead reckoning.
- Integration of ship's movement parameters.
- Areas of automation in navigation.
- Computational algorithms.
- Methods of navigational situation analysis.
- Models, their kinds and phases of creation.
- Model of ship's movement dynamics.
- Automation of ship control (autopilot).
- Methods of determining anti-collision maneuvers.

YEAR I	NAVIGATION AUTOMATION	LABORATORY	18 HOURS

- Preparation of navigational data.
- Preparation of algorithmic input and output data.
- Brief introduction to basic types of algorithms.
- Preparation of different algorithm representations.
- Calculation of position parameters.
- Practical transformation and shifting of coordinates.
- Practical algorithmic dead reckoning.
- Problems of movement parameters estimation.
- Evaluation of estimation accuracy.
- Examples of the integration of navigational parameters.
- designing a ship's dynamic movement model.
- Problems of situation identification - approach parameters: CPA and TCPA.
- Control of ship's movement:

  - conventional autopilot (PID),
  - fuzzy autopilot.
- Determination of anti-collision maneuvers:
  - analytical methods,
  - optimization of preventive maneuver.

Basic literature

1. Crassidis J L, Junkins J.L, Optimal Estimation of Dynamic Systems, CRC press 2004.
2. Rogers R.: *Applied Mathematics in Integrated Navigational Systems*, 2nd Ed., AIAA, Reston, 2003.
3. *Using MATLAB Version 7.0*. The Math Works Inc.

Additional literature

1. Bowditch N., The American Practical Navigator, U.S. Navy Hydrographic Office publication, 1995.
2. Wolper J.S, Understanding mathematics for aircraft navigation, McGraw-Hill Company, 2001.