

EXTRACT OF SYLLABUS OUTLINE FROM



STANDARDS OF COMPETENCE FOR CATEGORY "A" HYDROGRAPHIC SURVEYORS

**Publication S-5A
First Edition
Version 1.0.2 - June 2018**

Pages 13 to 34 inclusive:

FOUNDATION SCIENCE SUBJECTS

F1: Earth Models

F1.1 Physical geodesy

- F1.1a The gravity field of the Earth
- F1.1b Gravity observations and their reduction
- F1.1c Height systems and height determination
- F1.1d Geopotential and geoidal Modelling

F1.2 Coordinate Systems

- F1.2a Coordinate Systems for Positioning
- F1.2b Datum transformation techniques
- F1.2c Geodetic computations on the ellipsoid
- F1.2d Three-Dimensional Geodetic Modeling

F1.3 Land surveying methods and techniques

- F1.3a Trigonometric surveys
- F1.3b Existing survey control
- F1.3c Establishing survey control
- F1.3d Instrument tests
- F1.3e Historical surveys

F1.4 Levelling

- F1.4a Levelling instruments
- F1.4b Height reduction

F1.5 Map Projections

- F1.5a Map Projections

F1.6 Trigonometry and least-squares

- F1.6a Trigonometry
- F1.6b Theory of observations
- F1.6c Least squares

F2: Oceanography

F2.1 Physical Oceanography and measurements

- F2.1a Water masses and circulation
- F2.1b Physical properties of sea water
- F2.1c Oceanographic measurements
- F2.1d Waves

F3: Geology and geophysics

F3.1 Geology

- F3.1a Earth structure
- F3.1b Geomorphology
- F3.1c Substrates

F3.2 Geophysics

- F3.2a Gravity fields and gravity surveys
- F3.2b Magnetic fields
- F3.2c Seismic surveys

HYDROGRAPHIC SCIENCE SUBJECTS

H1: Positioning

H1.1 Vessel and sensor reference frames

- H1.1a Common reference frames for sensors
- H1.1b Integration of reference frames

H1.2 GNSS positioning

- H1.2a GNSS Signals
- H1.2b GNSS observables
- H1.2c Relative and absolute techniques
- H1.2d Installation and operation
- H1.2e Quality control

H1.3 Inertial navigation systems

- H1.3a Accelerometers and gyroscopes, inclinometers, and compass
- H1.3b Strapdown inertial measurement units
- H1.3c Kalman filtering
- H1.3d Aided inertial navigation

H1.4 Subsea positioning

- H1.4a Acoustic positioning principles
- H1.4b Acoustic positioning systems
- H1.4c Acoustic positioning error analysis
- H1.4d Acoustic positioning applications

H1.5 Line keeping

- H1.5a Track guidance

H2: Underwater Sensors and Data Processing

H2.1 Underwater acoustics

- H2.1a Transducers and generation of acoustic waves
- H2.1b Propagation of acoustic waves
- H2.1c Acoustic noise
- H2.1d Reflection, scattering and system performance
- H2.1e Refraction and ray-tracing

H2.2 Single beam systems

- H2.2a Single beam echo sounders principles
- H2.2b Single beam returns interpretation
- H2.2c Single beam survey system
- H2.2d Processing of single beam data

H2.3 Sonar imagery systems

- H2.3a Side-scan sonar systems
- H2.3b Synthetic Aperture Sonar

H2.4 Swath echo sounder systems

- H2.4a Multi-beam echo sounders
- H2.4b Multi-beam system parameters
- H2.4c Multi-beam systems
- H2.4d Multi-beam data processing
- H2.4e Interferometric Sonar

H2.5 Backscatter

- H2.5a Backscatter from side scan, interferometric swath sonars and multi-beam echo sounders

H3: LiDAR and Remote Sensing

H3.1 LiDAR

- H3.1a Airborne LiDAR systems
- H3.1b Airborne LiDAR data products
- H3.1c Terrestrial LiDAR

H3.2 Remote Sensing

- H3.2a Remotely sensed bathymetry
- H3.2b Satellite altimetry
- H3.2c Optical methods of shoreline delineation

H4: Survey Operations and Applications

H4.1 Hydrographic survey projects

- H4.1a Hydrographic survey requirements
- H4.1b Hydrographic survey project management

H4.2 Hydrographic survey operations

- H4.2a Survey planning
- H4.2b Single Beam operations
- H4.2c Multi-beam and Interferometric operations
- H4.2d Magnetic surveys
- H4.2e Airborne LiDAR surveys
- H4.2f Side scan sonar operations
- H4.2g Side-scan sonar data interpretation

H4.3 Seabed characterization

- H4.3a Classification from acoustic data
- H4.3b Classification from optical data
- H4.3c Seabed sampling
- H4.3d Seabed characterization

H5: Water Levels and Flow

H5.1 Principles of Water Levels

- H5.1a Tide theory
- H5.1b Non-tidal water level variations

H5.2 Water level measurements

- H5.2a Water level gauges
- H5.2b Tidal measurement
- H5.2c Uncertainty in water level

H5.3 Tide modelling

- H5.3a Harmonic analysis
- H5.3b Ocean water level

H5.4 Ellipsoid separation models and vertical datums

- H5.4a Separation models
- H5.4b Vertical Datums
- H5.4c Sounding reduction

H5.5 Currents

- H5.5a Tidally induced currents
- H5.5b Current measurement, portrayal and surveys

H6: Hydrographic Data Acquisition and Processing

H6.1 Real-time data acquisition and control

- H6.1a Hydrographic Data acquisition
- H6.1b Real-time data monitoring
- E6.1c Survey data storage and transfer

H6.2 Bathymetric data filtering and estimation

- H6.2a Filtering and estimation of single beam data
- H6.2b Filtering and estimation of multi-beam data
- H6.2c Spatial data quality control
- H6.2d Spatial data interpolation
- H6.2e Spatial data representation

H7: Management of Hydrographic Data

H7.1 Data organization and presentation

- H7.1a Databases
- H7.1b Marine GIS basics

H7.2 Marine data sources and dissemination

- H7.2a MSDI
- H7.2b Open access marine data

H7.3 Spatial data integration and deliverables

- H7.3a Spatial data integration
- H7.3b Spatial data visualisation
- H7.3c Deliverables

H8: Legal Aspects

H8.1 Product liability

- H8.1a Responsibilities of the hydrographic surveyor
- H8.1b Contracts

H8.2 Maritime zones

- H8.2a Delimitations
- E8.2b Impact of surveys

EXTRACT OF SYLLABUS OUTLINE FROM



STANDARDS OF COMPETENCE FOR CATEGORY "B" HYDROGRAPHIC SURVEYORS

**Publication S-5B
First Edition
Version 1.0.1 - June 2017**

Pages 12 to 24 inclusive:

ESSENTIAL SUBJECTS

E1: Underwater Acoustics

E1.1 Acoustic Theory

- E1.1a Generation of acoustic waves
- E1.1b Propagation of acoustic waves
- E1.1c Reflection, scattering and system performance
- E1.1d Reception of acoustic waves

E1.2 Single Beam Systems & Side Scan Sonar

- E1.2a Single beam echo sounders
- E1.2b Single beam echo sounder data recording
- E1.2c Range uncertainty
- E1.2d Side scan sonar

E1.3 Swath Systems

- E1.3a Beam characteristics
- E1.3b Backscatter and water column returns
- E1.3c Bottom spatial coverage
- E1.3d Installation and configuration
- E1.3e Range and angle uncertainty
- E1.3f Operation

E2: Remote Sensing

E2.1 LiDAR

- E2.1a Airborne LiDAR systems
- E2.1b Airborne LiDAR data products
- E2.1c Terrestrial LiDAR

E2.2 Remote Sensing

- E2.2a Remotely sensed bathymetry
- E2.2b Shoreline delineation

E3: Water Levels and Flow

E3.1 Principles of Water Levels

- E3.1a Tidal fundamentals
- E3.1b Tidal information
- E3.1c Non-tidal water level variations

E3.2 Water Level Measurement

- E3.2a Water level gauges
- E3.2b Tidal measurement
- E3.2c Water level datums
- E3.2d Uncertainty in water level

E3.3 Water Level Reduction

- E3.3a Water level reduction of soundings
- E3.3b Reduction of soundings using GNSS observations

E3.4 Currents

- E3.4a Tidal streams and currents
- E3.4b Current measurement and portrayal

E4: Positioning

E4.1 Geodesy

- E4.1a Introduction to Geodesy
- E4.1b Coordinate systems, frames and datums
- E4.1c Geodetic transformations and associated computations
- E4.1d Ellipsoidal computations

E4.2 Principles of Cartography

- E4.2 Map projections

E4.3 Positioning Measurements, Methods and Techniques

- E4.3a Positioning fundamentals
- E4.3b Satellite positioning
- E4.3c Positioning systems
- E4.3d Historical surveys
- E4.3e Survey control

E4.4 Vertical Positioning

- E4.4a Height systems
- E4.4b Elevation measurements and computation

E4.5 Acoustic Positioning

- E4.5a Acoustic positioning concepts
- E4.5b Acoustic positioning systems

E4.6 Inertial Navigation

- E4.6a Inertial Measurement Units
- E4.6b Inertial Navigation Systems

E4.7 Uncertainty in Positioning

- E4.7 Sources of uncertainty

E5: Hydrographic Practice

E5.1 Hydrographic Survey Projects

- E5.1a Hydrographic survey purposes
- E5.1b Hydrographic survey execution requirements
- E5.1c Hydrographic survey project organization

E5.2 Hydrographic Survey Operations

- E5.2a Operational survey data transfer
- E5.2b Survey systems
- E5.2c Calibration and corrections
- E5.2d Line planning
- E5.2e Line keeping
- E5.2f Survey operations
- E5.2 Quality control

E5.3 Hydrographic Survey Documentation

- E5.3a Documentation

E5.4 Legal Aspects

- E5.4a Liability of the hydrographic surveyor
- E5.4b Delimitations

E6: Hydrographic Data Management

E6.1 Real-Time Data Acquisition and Control

- E6.1a Hydrographic Data acquisition
- E6.1b Real-time data monitoring
- E6.1c Data transfer and storage

E6.2 Data Processing and Analysis

- E6.2a Spatial data cleaning
- E6.2b Spatial data quality control
- E6.2c Spatial data representation

E6.3 Data Organization and Presentation

- E6.3a Databases
- E6.3b Marine GIS basics
- E6.3c Visualization and presentation
- E6.3d Deliverables

E7: Environment

E7.1 Oceanography

- E7.1a Physical properties of sea water
- E7.1b Oceanographic measurements
- E7.1c Waves

E7.2 Marine Geology and Geophysics

- E7.2a Seabed characteristics
- E7.2b Magnetic surveys
- E7.2c Seismic surveys

E7.3 Environmental impact

- E7.3a Impact of surveys