

**BÜLENT ECEVİT UNIVERSITY**  
**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**  
**DEPARTMENT OF GEODESY AND PHOTOGRAMMETRY ENGINEERING**

**COURSE LIST FOR PROGRAMME CODE: 8102**

**M.Sc. Program**

JDF701 Advanced Surveying (2-2-3) 6 ECTS

Selection of appropriate methods and equipment in measurements applications, to take advantage of modern observation and measuring equipment in surveying, GPS and application areas, GPS measurement and evaluation processes, Sensitive to measure the position and elevation measurements, calibration process for modern measurement instruments.

JDF702 Computer Aided Mapping (3-0-3) 6 ECTS

Basic definitions and concepts. Data design for mapping. Digital mapping procedure. Automatic digitizing, and semi-automatic digitizing. Data collecting methods for Digital mapping.

JDF703 Modern Surveying and Observation Equipments (2-0-2) 6 ECTS

Modern measuring instruments and equipment into the concept and this group and equipments, basic specifications, hardware selection criteria, to determine the underground location and amount of equipments, advantage of tools and equipment areas like Ekstensometer, tiltmeter and inklinometer etc.

JDF704 Subsidence Engineering (3-0-3) 6 ECTS

Subsidence and subject of subsidence engineering, mining subsidence, relationship between subsidence engineering and surveying engineering, Introducing subsidence parameters, The main topics and contents of subsidence engineering, subsidence-time relationship, subsidence estimates and methods, evaluation of Our country's mining for subsidence engineering and its problems.

JDF705 Exceptional Mine Surveying (3-0-3) 6 ECTS

Conception of measurement and measurement errors, determine to equipments and methods for measurements, movements due to mining activities on ground and underground, introduction of equipments and methods about deformation and damage on structure, measurements of Ekstensometer, tiltmeter , inclinometer pnozometer and utilization of these equipments for mining area, measurement and calculations about Underground transport system.

JDF706 Adjustment (3-0-3) 6 ECTS

Introduction and description of adjusment. Type of matrix and calculation. Error theory and adjusment principle. Error propagation rule, weighting and root mean square. Minumum likelyhood method. Adjustment of indirect measurement. Adjustment of direct measurement. Adjustment of conditional measurement.

### JDF707 Transformations (3-0-3) 6 ECTS

Concepts of transformation, coordinate systems, horizon coordinates. Shifting, rotating and reflection. Linear and non linear similarity transformations. Affin transformations. 3D transformations, perspective transformations.

### JDF708 Fundamental of Cadastre (3-0-3) 6 ECTS

Introduction and Cadastral concept. Historical perspectives of cadastre. Property cadastre. Multipurpose cadastre. Updating of cadastre. Cadastre and Land Title relationship, cadastral information systems. Forest cadastre. Characteristic statement of forest cadastre.

### JDF709 Geodetic Computation on Ellipsoid (3-0-3) 6 ECTS

Triangle computations on ellipsoid, Basic coordinate computations. Rectangular coordinate systems on ellipsoid. Power series for geographical and rectangular coordinates. Projecting ellipsoid on plane. Gauss-Krüger coordinate system, distance and direction corrections. Basic coordinate calculations on Gauss-Krüger coordinate system. Computation of Gauss-Krüger coordinates from geographical coordinates and vice-versa. Adjacent zone computations.

### JDF710 Advanced Engineering Surveying (2-2-3) 6 ECTS

Work Steps in land content projects, bid files related to technical regulations and technical assessments, applications of important engineering projects however control and reliability measurements of post engineering applications, modern measuring and methods of identifying the amount about underground engineering structures, related to industrial plants to measure.

### JDF711 Thematic Cartography (3-0-3) 6 ECTS

Introduction and importance of the topic. Definition of thematic maps. Definition of thematic cartography. Creating methods for thematic maps. Classification of thematic maps depends on the topics.

### JDF712 Special Topics in Bundle Adjustment (3-0-3) 6 ECTS

Introduction and importance of the topic. Adjustment with Gauss- Markoff Model. Adjustment with Gauss- Helmert Model. Free network adjustment. 3D transformations. Affin and Helmert transformation. Collocation. GPS base model of adjustment. Numeric applications.

### JDF713 Digital Elevation Models (3-0-3) 6 ECTS

Concept of Digital elevation models and application areas. Dispersion and density type of data compilation points. roughness parameters of topography. Interpolation methods, linear interpolation, weighted arithmetic average, slippery surface interpolation.

### JDF714 Height Determination Methods using GPS (2-2-3) 6 ECTS

Introduction and importance of the topic. Descriptions of height systems (ellipsoidal, geopotential, dynamic, orthometric and practical heights). GPS observation techniques.

Crucial criteria for GPS measurements for height determination. Mathematical relations between ellipsoidal and orthometric heights. Concept, definition, practical importance of geoid and geoid determination techniques. Principles of geoid determination with combinations of GPS and other leveling techniques. Numerical geoid surface modeling techniques. Numerical examples. Field work.

#### JDF715 Advanced Cadastre (2-2-3) 6 ECTS

Multipurpose cadastre. Digital cadastre and updating cadastral concepts. Cadastral Information Systems. Improving techniques of cadastre.

#### JDF717 Introduction to Global Positioning System (3-0-3) 6 ECTS

Coordinate and time systems used in Satellite geodesy, computing motions and positions of satellites, Satellite signal structure, GPS observations, mathematical models, GPS error sources, GPS measurement techniques, Planning GPS sessions and GPS assessment techniques.

#### JDF720 Coordinate Systems in Geodesy (3 0 3) 6 ECTS

Classifications of coordinate systems in Geodesy. Terrestrial coordinate systems. Celestial coordinate systems. Orbital coordinate systems. Seminar applications.

#### JDF721 Statistical Analysis Techniques (3-0-3) 6 ECTS

Introduction and importance of the topic. Comparison of statistical analysis. Time series, trend, regression, correlation and multi regression. Continuous dispersion and example dispersion. Methods of statistical supervision. Parametric tests. Discordant measurement tests.

#### JDF722 Assessing Real-Estate (3 0 3) 6 ECTS

Real estate, ownership and valuation concepts and importance of land valuation. Valuation legislations and methods. Determining of factors that effects value of land in valuation and unit value calculation. Valuation in privatization. Determining and updating of land valuation indexes . Institutional regulations. Producing and evaluating of land value maps. Using GIS in land valuation

#### JDF724 Designing Geodetic Networks (3-0-3) 6 ECTS

Definition and types of Geodetic Networks, measurement networks according to the type of measurement, balancing the network model, different engineering problems appropriate network design, optimization of geodetic Networks

#### JDF725 Techniques For Determining and Modeling Atmospheric Errors and Integer Ambiguity in GPS (3-0-3) 6 ECTS

Error Sources of GPS, atmospheric errors, ionospheric and tropospheric errors, elimination and modeling these errors, initial ambiguity error in GPS, techniques for resolving initial ambiguities.

### JDF727 Deformation Analysis Using Geodetic Methods (3-0-3) 6 ECTS

Introduction and general definitions, geometric changes, caused of deformation, deformation models, deformation measuring equipments, evaluation of geodetic measurements, three-dimensional coordinate systems, establishment of balancing models, establishment of stochastic models, balancing of geodetic Networks, determination of sensitivity and reliability criteria, Static deformation analysis of geodetic Networks, general deformation model, classical deformation model, robust deformation analysis, static deformation kinematics analysis in geodetic Networks, applications for determining of deformation due to mining, and in major dams and structures, besides applications for determining of deformation on earth surface

### JDF729 Advanced GPS (3-0-3) 6 ECTS

Introduction and importance of the topic. Coordinate systems used in GPS, error sources in GPS, Integer ambiguity resolution techniques, Tropospheric and ionospheric modeling, conversion computations between different datums, Accuracy and precision analysis.

### JDF730 Robust Statistic Techniques (3-0-3) 6 ECTS

Introduction, general terms, robust estimation aspect, principles of robust estimation, functions used for robust estimation, breaking point aspect, outliers, sources of outliers and their effect on the least square estimations, the weighted-least square estimator, organized least square estimator, M estimator, median estimator, L1-norm method and its use for determining outliers, L1-norm solution and statistical tests, use of robust statistics in different applications, robust regression method, two and three dimensional transformation techniques by robust estimation, deformation analysis by robust estimation, robust estimation in geodetic networks, robust estimation in surface modelling.

### JDF731 Project Planning and Management (3-0-3) 6 ECTS

Project description, type and design stages and budget estimate issues, legal and administrative regulations, about project design and applications, project planning and management issues, Geodesy and Photogrammetry Engineering of applications related to project planning and management related applications.

### JDF736 Advanced Geographical Information Systems (GIS) 6 ECTS

History of GIS. Information Systems. Non-Spatial information systems. Spatial information systems. Data model of GIS. Data acquisition methods for GIS. Data quality. Spatial analysis. Network analysis. Grid analysis. Statistical analysis. GIS software's information.

### JDF737 Advanced Database Management Systems 6 ECTS

Description of database and applications areas. Database Management Systems (DBMS). Conceptual data models. Entity-relationship data model. Network data model. Hierarchical data model. Relational data model. Temporal databases. Database management and organization. SQL (Standard Query Language).

### JDF738 Image Sensing Techniques (3-0-3) 6 ECTS

Active and passive sensing. Optical, microwave, thermal and laser sensing techniques. Geometric, spectral and radiometric characteristics of images. Effect of imaging geometry to position information. Types of carrier platforms. Choosing receiver, proper to image usage. Applications on sample images.

### JDF739 Advanced Techniques of Signal and Image Processing (3-0-3) 6 ECTS

Introduction. Terms of analog and digital signal/image. Application areas. Relationship between signal and image. Terms and formats of panchromatic and multispectral images. Transformations and filtering systems. Noise-term. Radiometric-spectral distortions and corrections. Pre-processing of signal and image. Repairing and reconstruction of image. Image enhancement techniques. Image compressing techniques.

### JDF740 Image Interpretation Techniques (3-0-3) 6 ECTS

Introduction. Application fields. Concepts of mono-stereo images. Techniques of pixel-based and object-based image analysis. Concepts of classification. Supervised and unsupervised classification. Semi-automatic and automatic classification. Visual interpretation. Concepts and types of information contents of images. Innovation on optic, microwave and laser image interpretation. Information and data generation based on spatial analysis. Topographic mapping. DTM/DEM generation. Applications of change detection. Overview of non-spatial applications. Sample applications.

### JDF741 Advanced Digital Photogrammetry (3-0-3) 6 ECTS

Terms of digital photogrammetry. Analog/digital sensors and images. Analog/digital converters. Raster and vector scanning techniques. Resolution standards of digital image. Digital image matching techniques. Digital photogrammetric hardware and software. Orientation with GPS/INS. Generation of digital ortho-image. Semi- and fully automatic feature extraction and vectorisation techniques. Generation of digital surface/elevation model. 3D model generation. Sample applications.

### JDF742 Special Applications of Photogrammetry (3-0-3) 6 ECTS

Introduction, concepts and basis of photogrammetry. Special application field of photogrammetry. Close-range photogrammetry. Industrial photogrammetry. Architectural photogrammetry. Medical photogrammetry. Oblique photogrammetry. Special photogrammetric applications at small areas. Photogrammetric applications with UAV

### JDF743 3D Modeling in Terrestrial Photogrammetry (3-0-3) 6 ECTS

Terms of 2D, 2.5D and 3D. Data sources in 3D modeling. Optical, laser and geodetic data formats. 3D hardware and software. 3D modeling of different sourced data. Principles of digital mobile mapping. Sample applications.

#### JDF744 Geometric Analysis of Remote Sensing Images (3-0-3) 6 ECTS

Term of geometric analysis. Image and imaging geometry. Transformation between image and ground coordinate systems. Sensor dependent and independent models. Importance of ground control points. Figure condition analysis. Bundle adjustment.

#### JDF745 Mapping from Remote Sensing Images (3-0-3) 6 ECTS

Historical development of topographic mapping from remote sensing images. Importance at today and application fields. Presented potentials and limitations. Processes of mapping from images. Concepts and selection of GCPs. Orthophoto generation using DEMs. Vectorization from ortho-images. 3D solid modelling using ortho-images and DEMs. Sample applications.

#### JDF746 Image Based DEM Generation (3-0-3) 6 ECTS

Digital surface/elevation/terrain model concept. Optical, microwave and laser sensing techniques. Image matching techniques in optical images and DEM production. DEM production of microwave sensing by Side Looking Radar. DEM production by Laser point cloud processing. Accuracy analyses of DEMs and comparison. Sample applications.

#### JDF797 M.Sc. Seminar (0-2-0) 6 ECTS

Based on a specific topic to more than one source to make a review, the spelling rules, and an audience into a written text and presented as a community, acquired habit of discussion and mutual information transmission in the presentation

#### JDF798 M.Sc. Field of Specialization (2-0-0) 15 ECTS

This is a theoretical course offered in semester, semester break and summer terms followed by appointment of the advisor for M.Sc. students. It provides M.Sc. students to obtain scientific ethic and discipline.

#### JDF799 M.Sc. Thesis Research (0-1-0) 15 ECTS

This is a practical course offered in year, semester, semester break and summer terms followed by appointment of the advisor for M.Sc. students.

### **Ph.D Program**

#### JDF801 Advanced Industrial Surveys (3-0-3) 6 ECTS

Introduction, industrial measurement in industry, industrial measurement equipments, Control of quality measurement, methods of integrated measurement for engineering, numerical applications of the lesson.

#### JDF802 Advanced Engineering Surveys II (3-0-3) 6 ECTS

Special sensors and applications in Engineering Geodesy, specific methods for measuring direction and application of hydrostatic leveling, engineering projects and geodynamic effects, course-related applications.

### JDF803 Mathematical Cartography (3-0-3) 6 ECTS

Shape and size of the World. Specific characteristics of ellipsoid which is stable for World. Ellipsoid parameters. The description of Map projection. Projection surfaces. Conform projections and mathematical correlation. Area protection projection and mathematical correlation. Projection for atlas maps. Applications of map projections.

### JDF806 Spatio-Temporal GIS (3-0-3) 6 ECTS

Introduction and importance of the topic. Temporal GIS and problems. Data models of Temporal GIS. Raster and vector data in Temporal GIS. Design and development of Temporal GIS. Spatial analysis. Temporal analysis, spatio-temporal analysis.

### JDF807 Applied Geostatistical Predictions (3-0-3) 6 ECTS

Introduction and importance of the topic. Forecasting. Linear Combination. Global and local forecast. Root mean square. Ranges. Point and block forecasting. Functional model of point forecast and its applications. Ordinary and Kriging applications, Universal Kriging applications.

### JDF808 Artificial Neural Networks and Geodetic Applications (3-0-3) 6 ECTS

Introduction and overview, structure and fundamentals of artificial neural networks, learning by multilayer perceptron yapay as neural network model, yapay sinir ağı modeli olarak LVQ modeli ile destekleyici öğrenme, unsupervised learning for neural network model, learning by backpropagation, use of neural Networks and developing applications.

### JDF809 Kalman Filtering Techniques (3-0-3) 6 ECTS

Importance of the subject and introduction, the dynamic movements of modeling techniques, linear and nonlinear dynamic models measurability, control and error analysis, the kinematic positioning of linear filtering, softening and filtering to Kalman, Kalman for the navigation of the filter, the satellite-based positioning to Kalman in the filtering, kinematic model of the Kalman filtering for tectonic movements, Kalman filtering estimation for object deformation according as to time

### JDF810 Deformation of Solids (3-0-3) 6 ECTS

Materials atomic and crystal structures, lattice errors and dislocation movements, elastic, plastic and viscoelastic form changes and fractures, and mechanical properties between mikroyapı links.

### JDF811 Real Time GPS Positioning (3-0-3) 6 ECTS

Essence of real time kinematic (RTK) positioning, single-base RTK positioning and its components, Positioning with RTK Network and its components, designing and establishing reference stations and GPS cabinets, computation and transferring correction data.

### JDF812 Advanced Programming For Engineering Applications (3-0-3) 6 ECTS

The base component of the C++ programming. Control mechanism. Function for client which is dependent on interface. Class of objects. Strings and codes. Input and output devices.

### JDF813 Sensor Materials (3-0-3) 6 ECTS

Characteristics of physical and electric for sensors and working principle. Production methods of sensor materials, sensor materials and production methods, working principles of sensor and transducer for determining of temperature, pressure, light, strain, chemical composition, fracture and chemical environment, quantum theory of atoms, molecules and solids and using in electronic and sensor materials, applications, evaluation of the signals from sensors, errors in analysis and separation power sensors, selection and design of sensor for specific problems

### JDF815 Genetic Optimization (3-0-3) 6 ECTS

Introduction to genetic algorithms, mathematical foundations, programming of genetic algorithms, some optimization applications, advanced operators and techniques, introduction to genetic-based machine learning.

### JDF816 Web Geographical Information Systems (GIS) and Applications (3-0-3) 6 ECTS

Determination of Web and application areas of Web. Description of Web Services, Web Services software's and applications. Design and development of Web via GIS techniques.

### JDF819 Advanced Programming Techniques with Microsoft Visual Basic. (2-2-3) 6 ECTS

Advanced programme techniques and application areas. Application via using advanced programme techniques for programmes. Using advanced programme in Database and GIS. Using advanced programme in WEB.

### JDF820 Digital Mobile Mapping and 3D Modeling (3-0-3) 6 ECTS

3D modeling concept and importance. Optical and laser receivers and GPS/INS systems, usage in common. Possibilities and restrictions of mobile mapping. Territory study. Arrangement, enrichment and management of images. Combination of optical/laser images. Analysis of accuracy of position. Association with geographic information systems. Sample applications.

### JDF821 Feature Extraction from Remote Sensing Images (3-0-3) 6 ECTS

Characteristics of remote sensing images. Geometric, spectral and radiometric characteristics of images. Panchromatic and multiband images. Georectification and enhancement of images. Information contents of images. Feature extraction methods and algorithms of buildings, roads and vegetation. Edge detection operators. Vectorization. Segmentations and classifications of images. Pixel-based and object-based image classification. Evaluation of data and accuracy analysis. Integration to GIS. Feature extraction applications of urban, rural and forested fields. Sample applications.



#### JDF822 Sensor Orientation (3-0-3) 6 ECTS

Term of orientation. Sensor-dependent and –independent orientation models. Coordinate systems used. Field studies for collection of ground control point. Orientation models for various image geometries. Digital elevation model usage. Georeferencing accuracy analysis. Georeferencing accuracy assessment via figure condition. Sample applications.

#### JDF823 Synthetic Aperture Radar (SAR)Technology (3-0-3) 6 ECTS

Radar concept. Definition of Synthetic Aperture Radar. Historical development. Place and importance of Synthetic Aperture Radar in other radar types. Systematic differences, advantages and disadvantages of Synthetic Aperture Radar. Quality evaluation of gained data and usage in professional applications.

#### JDF824 Airborne Laser Scanning (3-0-3) 6 ECTS

Laser scanning concept. Definition, history and development of air-borne laser scanning. System components, geometry and data acquisition methodology of the technique. Application areas, sample applications and advantages. Quality evaluation of data gained and comparison with other data acquisition methods born of air and space.

#### JDF897 Ph.D Seminar (0-2-0) 6 ECTS

Based on a specific topic to more than one source to make a review, the spelling rules, and an audience into a written text and presented as a community, acquired habit of discussion and mutual information transmission in the presentation

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