ECTS catalog with learning outcomes
University of Montenegro

Faculty of Mechanical Engineering / MECHATRONICS /

Course:				
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
13879	Mandatory	4	6	2+0+2
Programs	MECHATRONICS			
Prerequisites	No prerequisites for course enrolment and attending			
Aims	Understanding spatial shape of machine parts and basic principles of geometric modeling. Using of computers in geometric modeling of machine parts and assemblies.			
Learning outcomes	Upon successful completion of this subject the student will be able to: 1. Explain mathematical basis of geometric modeling of curves and surfaces 2. Explain basic principles of method for generating of geometric model of machine parts 3. Explain use of features and parametric modeling for geometric modeling of machine parts 4. Use a CAD software to model machine parts and assemblies 5. Draw engineering drawings of machine parts based on its 3D geometric models 6. Use databases of 3D geometric models of machine parts			
Lecturer / Teaching assistant	Prof.dr Janko Jovanović, Mirjana Šoškić			
Methodology	Lectures, exercises, homeworks, tests, consultations.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Introduction. Role of CAD systems in product design.			
I week exercises	Introduction. Role of CAD systems in product design.			
II week lectures	Chronology of development of CAD systems.			
II week exercises	Chronology of development of CAD systems.			
III week lectures	Basics of computer graphics: Gemetric transformations. Homogenous coordinates. Projection and views transformations. Windows and viewports. Transformations of coordination systems.			
III week exercises	Basics of computer graphics: Gemetric transformations. Homogenous coordinates. Projection and views transformations. Windows and viewports. Transformations of coordination systems.			
IV week lectures	Mathematical basis of geometric modeling of curves: Hermite curve, Bezier curve, Spline, B-spline, NURBS curve.			
IV week exercises	Mathematical basis of geometric modeling of curves: Hermite curve, Bezier curve, Spline, B-spline, NURBS curve.			
V week lectures	Mathematical basis of geometric modeling of surface: Bicubic polinomial surface, Ferguson surface, Bezier surface, Coons surface, B-spline surface. B-spline rational form of some specific surfaces.			
V week exercises	Mathematical basis of geometric modeling of surface: Bicubic polinomial surface, Ferguson surface, Bezier surface, Coons surface, B-spline surface. B-spline rational form of some specific surfaces.			
VI week lectures	Standards in computer graphics: Graphical libraries (OpenGL, DirectX). Graphical kernel of CAD software (ACIS, paraSolid, Shape Manager, Granite). Standards for data exchange between CAD software (IGES, STEP, DXF).			
VI week exercises	Standards in computer graphics: Graphical libraries (OpenGL, DirectX). Graphical kernel of CAD software (ACIS, paraSolid, Shape Manager, Granite). Standards for data exchange between CAD software (IGES, STEP, DXF).			
VII week lectures	1st test			
VII week exercises	1st test			
VIII week lectures	Solid modeling (wireframe, surface and solid representation of solid body). Boundary representation. Euler operators and operations with Euler operators			
VIII week exercises	Solid modeling (wireframe, surface and solid representation of solid body). Boundary representation. Euler operators and operations with Euler operators			
IX week lectures	Constructive geometry of body. Half-space and elements of half-spaces. Regularized Boolian operations. Decomposition of body.			
IX week exercises	Constructive geometry of body. Half-space and elements of half-spaces. Regularized Boolian operations. Decomposition of body.			

X week lectures	Parametric modeling. Parametric definition of shapes of chosen machine elements (gears, bearings, threaded parts...). Direct modeling. Synchronous modeling. Web oriented modeling.
X week exercises	Parametric modeling. Parametric definition of shapes of chosen machine elements (gears, bearings, threaded parts...). Direct modeling. Synchronous modeling. Web oriented modeling.
XI week lectures	Assembly modeling (Sceleton modeling, Bottom Up and Top Down modeling). Engineering drawings based on 3D geometric models of machine parts.
XI week exercises	Assembly modeling (Sceleton modeling, Bottom Up and Top Down modeling). Engineering drawings based on 3D geometric models of machine parts.
XII week lectures	Rapid prototyping. 3D printing technologies (FDM, SLA, SLS,...). Materials for FDM and SLA 3D printing.
XII week exercises	Rapid prototyping. 3D printing technologies (FDM, SLA, SLS,...). Materials for FDM and SLA 3D printing.
XIII week lectures	From 3D model to 3D printed machine parts: STL format for 3D model exchange between CAD software and 3D printer software. Preparation of 3D model for 3D printing.
XIII week exercises	From 3D model to 3D printed machine parts: STL format for 3D model exchange between CAD software and 3D printer software. Preparation of 3D model for 3D printing.
XIV week lectures	2nd test
XIV week exercises	2nd test
XV week lectures	Presentation of student projects.
XV week exercises	Presentation of student projects.
Student workload	Peer week 6 credits x 40/30 = 8 hours Structure: Lectures: 2 hours of lectures Exercises: 2 hour of exercises Individual work including consultation: 4 hours Per semester Classes and final exam: 8 hours x 16 weeks = 128 hours Necessary preparations before the semester start (administration, enrolment, verification): 8 hours x 2 weeks = 16 hours Total load for the subject: 6 x 30 = 180 hours Remedial classes for the corrective term, including the corrective exam: 180 hours – (128 hours + 16 hours) = 36 hours Load structure: 128 hours (Classes) + 16 hours (Preparation) + 36 hours (Remedial classes)

Per week	**Per semester**
6 credits x 40/30=8 hours and 0 minuts 2 sat(a) theoretical classes 2 sat(a) practical classes 0 excercises **4 hour(s) i 0 minuts** of independent work, including consultations	Classes and final exam: **8 hour(s) i 0 minuts x 16 =128 hour(s) i 0 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **8 hour(s) i 0 minuts x 2 =16 hour(s) i 0 minuts** Total workload for the subject: **6 x 30=180 hour(s)** Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) **36 hour(s) i 0 minuts** Workload structure: **128 hour(s) i 0 minuts (cources), 16 hour(s) i 0 minuts (preparation), 36 hour(s) i 0 minuts (additional work)**
Student obligations	Students are required to attend lectures and execises and to finish homeworks and colloquiums.
Consultations	2 times per week
Literature	[1] M.Jovanović, J.Jovanović: CAD/FEA Praktikum za projektovanje u mašinstvu, Univerzitet Crne Gore, Podgorica, 2000 [2] J.Jovanović: Konstruisanje podržano računarom, Univerzitet Crne Gore – Mašinski fakultet, Podgorica, 2013 [3] K.Lee: Principles of CAD/CAM/CAE systems, Addison-Wesley, 1999 [4] K.H.Chang: e-Design – Computer Aided Engineering Design, Academic Press, 2016.
Examination methods	2 homeworks 2x5 = 10 points project 15 points 2 tests 2x15 = 30 points Final exam 45 points Passing mark is awarded if the student collects at least 50 points
Special remarks	
Comment	

Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points