#	**Turin Polytechnic University in Tashkent** **Specialty and subject name, Total hours**	**Learning Outcomes**	**Main Content of the Course**	**Topics of Practical Works**	**Topics of Lab Works**
1	**Automatical Managing Systems in Engeneering "** **"Advanced Programming and Algorithms"** The course №3 «Algorithms and Programming" is one of the core courses for students majoring in ICT. The course is taught in the third year of education for the specialty of "Automated control systems in the industry," Bachelor's program TTPU.	Objectives: teach *advanced* computer programming as an instrument for the solution of real problems • Efficiently solve problems by an accurate design of the data structures and algorithms to be implemented • Learn different programming strategies (e.g., modular and recursive programming) • Get the theoretical foundations of "standard" algorithms for "classical" problems	▪ C prerequisites ▪ Elementary problem solving ▪ Pointers ▪ Dynamic memory management ▪ Lists ▪ Complexity theory ▪ discrete mathematics ▪ Introduction to graphs and trees ▪ Recursion ▪ Heaps ▪ Greedy algorithms ▪ Modularity and ADTs (Abstract Data Types - queues, stacks) ▪ symbol tables ▪ BSTs (Binary Search Trees) ▪ Hash tables ▪ Graph algorithms ▪ graph ADT ▪ graph searches ▪ graph search applications ▪ graph shortest paths	The practical exercises are proposed relatively on the topics, with the assistance of teaching staff and the solutions will be developed in classroom.	▪ To develop program: C review ▪ To develop program: Dynamic memory management ▪ To develop program: Lists ▪ To develop program: Complexity theory ▪ To develop program: Introduction to graphs and trees ▪ To develop program: Recursion ▪ To develop program: Heaps ▪ To develop program: Greedy algorithms ▪ To develop program: Modularity and ADTs (queues, stacks) ▪ To develop program: BSTs ▪ To develop program: Hash tables ▪ To develop program: Graph algorithms

	120 hours (12 credits)		*60 hours*		*24 hours*
2	**Fluid Mechanics and Hydraulics**	Tasks of a hydraulic installation: ▪ Hydraulic topics range through some parts of science and most of engineering modules, and cover concepts such as pipe flow, dam design, fluidics, pumps, turbine s, hydropower, computational fluid dynamics, flow measurement, river channel behavior and erosion. The place held by hydraulics in modern automation technology illustrates the wide range of applications for which it can be used. A basic distinction is made between: ▪ Mobile hydraulics ▪ Stationary hydraulics Fluid mechanics is a branch of continuum mechanics Fluids obey the usual laws of Newtonian mechanics, but as a continuum. Fluid mechanics is divided into: ▪ fluid statics, the study of fluids at rest; ▪ fluid kinematics, the study of fluids in motion; fluid dynamics , the study of the effect of forces on fluid motion. ▪ Fluid mechanics provides the theoretical foundation for hydraulics and aerodynamics, which focuses on the engineering uses of fluid properties.	▪ Basic principles of hydraulics. Fundamental physical principles of hydraulics. Tasks of a hydraulic installation. ▪ Hydrostatics. Pressure. Pressure transmission. Power transmission. Basic hydrostatic equation. Pascal's low. ▪ Pressure measurement. ▪ Forces on submerged planar objects. ▪ Forces on submerged boundaries of general shape. Archimedes principle. Buoyancy. Euler fluid statics equations ▪ Fluid Dynamics. Hydrodynamics. Flow rate. Continuity equation. Measurement of flow rate. Euler fluid dynamics equations ▪ Energy and power frictional losses. Bernoulli's equation without losses. Bernoulli's equation with losses. ▪ Cavitation. Formed parts. Minor losses. ▪ Liquid outflows. Orifices. Nozzles. Nozzle aperture. ▪ Hydraulic fluids. Tasks for hydraulic fluids. Types of hydraulic fluid. Characteristics and	▪ Fluid physical properties. ▪ Examples for calculation of liquid physical properties. ▪ Examples for calculation of hydrostatic pressure. ▪ Examples for calculation of pressure transmission. ▪ Examples for calculation of force of pressure on plane wall. ▪ Examples for calculation of force of pressure on curvilinear surface. ▪ Examples for calculation of flow rate. ▪ Examples for calculation of flow rate. ▪ Graphic and circuit symbols of hydraulic systems. ▪ Graphic and circuit symbols of hydraulic systems. ▪ Examples for calculation of flow rate. ▪ Examples for calculation of continuity equation.	▪ Introduction. Notes on safety and operation. ▪ Technology package for fluid mechanics. ▪ Training contents of basic level and advanced level. ▪ Exercise 1. Allocating device. ▪ Exercise 2. Sorting device for metal stampings. ▪ Exercise 3. Separating parcel post. ▪ Exercise 4. Vertical switching point for briquettes. ▪ Exercise 5. Edge folding device. ▪ Exercise 6. Marking machine. ▪ Exercise 7. Separating out plain pins. ▪ FluidSIM-H (Hydraulics) program training. ▪ FluidSIM-P (Pneumatics) program training. ▪ FluidLAB program training.

		In hydraulics a distinction is made between hydrostatics and hydrodynamics ▪ Hydrostatics is the study of fluids at rest. ▪ Hydrodynamics is the study of fluids in motion.	requirements. Viscosity. ▪ Components of a hydraulic system. Power supply section. Drives. Pumps and motors. ▪ Reservoirs. Filtering of the flow. Filters. Filtration principles. Coolers and heaters. ▪ Valves. Nominal sizes. Design. Poppet valves. Spool valves. Piston overlap. Control edges. ▪ Pressure valves. Pressure relief valves. Pressure regulators. Flow control valves. Restrictors and orifice valves. ▪ Hydraulic cylinders. Single-acting cylinder. Double-acting cylinder. End position cushioning. Seals. Types of mounting. Venting. Characteristics. Buckling resistance. Selecting a cylinder. ▪ Pipeline types. Simple and complicated pipelines. Flexible hoses.	▪ Examples for calculation of Bernoulli's equation without losses. ▪ Examples for calculation of Bernoulli's equation with losses. ▪ Examples for calculation of flow regimes. ▪ Examples for calculation of simple pipelines parameters.	
	90 hours (6 credits)		***32 hours***	***32 hours***	***26 hours***
3	**«Applied mechanics»**	Applied Mechanics provides the students with the necessary knowledge to properly address and solve engineering problems relevant to the mechanics of rigid bodies. The syllabus of the course will	**Kinematics**: particle kinematics, vectorial analysis, rectangular and local coordinates, Time derivative of unit vector. **Polar coordinates:** Rigid	The practical exercises are proposed relatively on the topics, with the assistance of teaching staff and the solutions will be developed in	Experimental measures of efficiency of speed reducers and belt transmissions. Each team of students will prepare a final report of the results to

		include: - Description of the mechanics of rigid bodies and of the forces acting upon them. - Presentation of the main characteristics of mechanical drives and of their individual components, such as Hooke's joints, belt drives, gears and gear trains, power screws, clutches, brakes, bearings. - Outline of the basics of mechanical systems dynamics with particular emphasis to the mechanical vibrations.	Body, connection of rigid bodies, translatory motion and rotation about a fixed axis, fundamental law of kinematics, Rivals Theorem. Instantaneous center of zero velocity. **Dynamics:** operations on forces and moments, types of forces, constraint forces. Cardinal equations of dynamics, free body diagrams, examples. Work and energy, power and efficiency. Energy conservation law. **Rotor dynamics:** Central reference system, Static and dynamic balancing, flexural critical speed. **Friction:** static and dynamic friction, start of a vehicle, dry journal bearing, rolling friction. **Brakes and Clutches:** types of brake. Pad brakes: pivoted and not pivoted pad. Drum brakes: pivoted and not pivoted drum. Band brake and disc brake. Clutches: plane discs, conic discs. Examples of realizations. **Transmission of the motion:** Rigid and elastic couplings, mobile couplings, universal joints, Cardan joint. Homocinetic joints. Spur gears,	classroom.	deliver at the teachers before the exam.

			involute profile, transmission ratio, geometrical dimensions, minimum number of teeth, Pinion and Rack, gear force analysis, manufacturing process. Helical gears, geometry and forces analysis. Bevel gears, geometry and forces analysis. **Flexible elements:** belts, ropes, chains, stiffness of flexible, block and tackle. Power screws. **Transient motion in mechanical systems:** motor torque characteristics, direct coupling motor-user, coupling by means of clutch. **Vibrations:** Damped free vibrations, logarithmic decrement, forced vibrations, accelerometer and seismograph. **Lubrication:** rolling and lubricated bearings, viscosity, one dimensional Reynolds equation, velocities profiles, types of bearings, hydrodynamic and hydrostatic pad.		
	108 hours		***60 hours***	***45 hours***	***3 hours***
4	**ICT"** **(Preparatory level)**	Objectives: ▪ Get general overview on computers and commonly used applications.	▪ Introduction to IT ▪ Hardware Devices ▪ Application & System Software.	▪ Data representation: binary system. ▪ Converting from binary to other numbering	▪ Managing spreadsheets. ▪ Creating presentations ▪ Databases ▪ Web browsing

		▪ Study of elements of binary arithmetic and logics. ▪ Give introduction to structured programming	▪ Word processing. Managing spreadsheets. Creating presentations ▪ Files, Databases, and E-commerce. ▪ Networking. ▪ The Internet & WWW. Web browsing and mail services ▪ Information Systems. ▪ The Binary system: representation of integer (unsigned) data, additions and subtractions ▪ Boolean logic: Boolean variables, operators, Boolean expressions and Truth Tables ▪ The concept of algorithm: sequential execution, conditional branches, iterations ▪ Flow charts ▪ Pseudo-codes ▪ The visual basic environment embedded in the Excel application	systems ▪ Operation in binary system. ▪ Real valued numbers. ▪ Boolean logic. Constructing Boolean expressions. Logical operations. ▪ Constructing Truth tables. ▪ Developing algorithms. Constructing flow-charts. ▪ Using pseudo-codes. ▪ Constructing Linear algorithms. ▪ Constructing Conditional algorithms. ▪ Establishing loops. ▪ Using algorithms in applications.	▪ Programming linear algorithms. ▪ Programming conditional algorithms. ▪ Programming algorithms with loops.
	90 hours(10 credits)		***45 hours***	***30 hours***	***15 hours***
5	**"Computer Science"** "**Computer Science**" course is a fundamental general educational course for	Objectives: • Teach computer programming as an instrument for the solution of real problems • Obtain the logical-mathematical basics of computer science • Get the forma mentis necessary to deal with «problem solving» • Learn a programming language and apply it to solve simple problems	▪ Overview on computer systems ▪ Data representation ▪ Boolean logic ▪ Introduction to computer programming ▪ The C language: - C fundamentals (types, variables, operators, ...) - Conditional statements	▪ Data representation. Boolean logic ▪ Programming in C. High-level computer languages and compilers. Programming Mechanics: ▪ source code, object code files, executable files, libraries	▪ To develop programs: Conditional Operator ▪ To develop programs: Loops. Nested loops ▪ To develop programs: Arrays. ▪ To develop programs: Function and pointers ▪ To develop programs: String. ▪ To develop programs:

	engineering students. The course is taught in the first year for all engineering specialties of TTPU.		- Loop statements - Arrays (mono and multi-dimensional) - Functions and pointers - Strings - Files - Structures - Dynamic memory allocation - Lists	▪ Editing, Compiling, Linking, Executing, Debugging ▪ Preprocessing Directives, Defining the main() Function, Comments, Keywords and Functions with Arguments ▪ Memory in Computer, Variable and Constants ▪ Basic C Data Types: int and char, Fundamental Operators ▪ Unsigned Integer Types and Specifying Integer Constants. ▪ Floating-Point Variables, Controlling the Number of Decimal Places Designing a Program: ▪ The Problem, The Analysis, The Solution ▪ The Basic if & if-else Statement, Involving Relational Operators. Nested if Statements, Logical Operators, Conditional Operator ▪ Loops. Nested loops ▪ Arrays. Function and pointers ▪ String. Files ▪ Structures. Dynamic memory allocation ▪ Lists	Files ▪ To develop programs: Structures. Lists.

	120 hours (12 credits)		***60 hours***	***45 hours***	***15 hours***
6	**"Applied Electronics and Measurements"** "**Applied Electronics and Measurements**" course is special course of IT students. The course is taught in the third year of IT specialists of TTPU.	Objectives: Achieve knowledge and understanding of digital circuits and systems. Ability to evaluate the requirements from the specifications. Select the most appropriate implementation technology. Identify the required development tools. Develop design skills at the system level, functional characteristics, external behavior of modules, interface among modules, internal structure of modules, error analysis Laboratory: Instrumentation, measurements, glossary (precision vs. accuracy…)	• Sequential Circuit Design • FSM design • Digital Systems: Counters Frequency limits • Digital Systems: Combinational Function implementation • Implementing Digital Systems • Microprocessors • Memories • Microprocessors: extended overview • Oscilloscope • Data acquisition and conversion • Microcontrollers • Power Electronics • Switching Power Supplies • SSD technology and architecture • Noise and Electromagnetic Compatibility	In this course each week the students will be self-evaluated. They usually have Tests related previous lectures. Moreover, they should solve exercise problems related previous topics of the lecture. Thus in order to evaluate if the students are following the course.	1. Introduction to Arduino Uno board 2. Arduino UNO reading Analog Signals 3. Digital thermometer with LM35
	56 hours (5 credits)		***40 hours***		***16 hours***
7	**"Electronics Systems and Technologies"** "**Electronics Systems and Technologies**" is one of the main special courses of IT students. The course is taught in	Objectives: To have a good general knowledge of electronics: Devices Circuits To understand application requirements of a project. Analog and digital basic principles.	• Control and feedback • Operational Amplifiers: general review • Operational Amplifiers: real OpAmp circuits • Semiconductors and diodes • Diode applications • Field effect transistors • Field effect transistors:	In this course each week the students will be self-evaluated. They usually have Tests related previous lectures. Moreover, they should solve exercise problems related previous topics of the lecture. Thus in order	1. Visual Analyzer instruction 2. Low pass passive filter 3. High pass passive filter 4. Active circuits: Operational Amplifiers

	the second year of IT specialists of TTPU.	Laboratory: Instrumentation, measurements, glossary (precision vs. accuracy…)	models and circuits • Field effect transistors: application circuits • Oscilloscope • Bipolar Junction transistors • Bipolar Junction transistors circuits • Digital basic elements • CMOS inverters • CMOS: parameters • CMOS power • Digital devices	to evaluate if the students are following the course.	
	56 hours (5 credits)		***40 hours***		***16 hours***
8	**«Machine design»**	The course-module aims at preparing mechanical design engineers/analysts with particular reference to the field of machines. The intended learning outcomes are developed with the intent to develop the competences normally required in a working context. - Designing structural and mechanical components of machines, and the systems which these components are part of (bolted connections, transmissions, bearings, shafts, couplings, springs etc.). - Analyses an existing machine component or design modification to meet given requirements. - Produce new designs for machine components or systems to meet specified requirements. They choose the	1. Design against fatigue (lessons 12 hrs.): - History and overview of fatigue problems - Stress-life fatigue: basic material properties, specimen testing - Stress-life fatigue: component fatigue 2. Bolted connections (Lessons 12 hrs): - Prestressed single bolt connections (non-gasketed) - Refinements and special problems - Elements of gasketed bolted connections - Rolling bearings: static loading - Rolling bearings: fatigue	1. Application to the design of gearbox shafts (tutorials 8 hrs) 2. Application to an hydraulic piston or to a tie-rod connection (tutorials 8 hrs) 3. Application to loading and stresses in a high speed bearing (tutorials 8 hrs) 4. Numerical calculation of elastic and plastic stresses in a rotating disc, strength assessment (tutorials 8 hrs) 5. Sizing of a set of gears in a gearbox (tutorials 8 hrs)	

		appropriate analytical or numerical methods and use them under their own responsibility.	- Design of bearing arrangements 3. Gears (lessons 12 hrs): - Summary of motion transmission, tooth shape - Spur and helical gears with parallel axes: kinematics, geometry, forces - Cutting techniques and profile displacement - Criteria for strength assessment of gears: fatigue, hertz contact, wear, scuffing 4. Rotating discs (lessons 12 hrs): - Summary of plane elastic fields and elastic stresses in discs and thick-walled tubes - Plastic stresses in thick-walled tubes		
	96 hours		***48 hours***	***48 hours***	
9	**"Manufacturing process"**	The purpose of this course is to develop students applied and engineering knowledge of basic manufacturing process. The main goals is to study: - manufacturing process bases, producing of industrial products; - manufacturing methods; - calculation machines and parts parameters and attributes; - programming CNC and numeric	1. Casting and Foundry processes 2. Machining processes 3. Stamping and molding 4. Manufacturing lines design 5. Painting processes 6. Automation and robotics 7. Coordinate measuring machines and other measuring machines 8. Assembly and testing	1. Describe manufacturing steps for given product 2. Calculate and design production lines by incoming data. 3. Create soft (G code) for simple machining part. 4. Create differential movement equation (tracking) for spindle with cutting tool.	1. Produce sample of part using created program for machining operations 2. Create simple program for CNC machine for spindle with cutting tool using differential movement equation.

		controllers; - manufacturing standards and systems, optimization and lean manufacturing and etc.	10. Storage, transportation, parts and product internal layout and movement 11. Deformation 12. International technical standards in manufacturing process	5. Calculate time of standard assembly operations using incoming data.	
	124 hours		***74 hours***	***26 hours***	***24 hours***
10	**"Quality control"** **"Statistical control of processes, process capabilities, design of experiment, dimensional and geometric tolerancing, degrees of freedom"**	The target of the course for master students is to generate skills of application of statistical methods to assess pre- and post- measuring tools, products; evaluation of process capabilities; analysis of dimensional and geometric tolerances in order to obey quality requirements. In the long run, to shape the knowledge of significance of quality control during the whole life cycle of the product. The task of the course is to teach master students to: - the fundaments of statistical tools application to analyze measuring systems, products and process capabilities; - in accordance with the results of products analysis (samples), to gain skills on corrective actions concerning dimensional and geometric tolerancing; - degrees of freedom at dimensional measurement problems; - reference system alignment and	1. Introduction. Basic terms and concepts. 2. Statistical methods for engineers. 3. Measuring system analysis, analysis of production. 4. Process capability evaluation. 5. Dimensional and geometric tolerancing. 6. Degrees of freedom of measuring system and samples (specimen). 7. Coordinate systems and alignments. 8. Coordinate measuring machines. 9. Programming of measurement. 10. Optimization of programming for measuring process.	1. Calculation of statistical methods: measuring system analysis. 2. Calculation of statistical methods: analysis of products and production. 3. Calculation of process capabilities. 4. Calculations on dimensional and geometric tolerancing. 5. Analysis of reference system construction, degrees of freedom. Fixators. 6. Construction of algorithms for programming of automatic measuring process. 7. Statistical data analysis.	**1.** Degrees of freedom. Coordinate measuring machines and samples for measurement. 2. Quality control in the event of dimensional tolerancing of during life cycle and at the final test. 3. Algorithm of programming and the significance of fixing. 4. Types of reference systems and depending on the specimen kind.

		fixators; - quality control of the product during whole life cycle.			